NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT

JACK R. LOUSMA
INTERVIEWED BY CAROL L. BUTLER
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BUTLER: Today is March 7, 2001. This oral history with Jack Lousma is being conducted for the Johnson Space Center Oral History Project in the studio at JSC in Houston, Texas. Carol Butler is the interviewer.

Thank you very much for joining us today.

LOUSMA: I'm glad I could be a part of this history. It was a long time ago we began, and we have a long way to go yet, but I think it's an important job.

BUTLER: A very important job, and I'm glad that you can be here to share it with us. I'm looking forward to it.

LOUSMA: I hope I can tell you something you don't know already.

BUTLER: I'm sure you can. I'm sure you can. There's a lot still to learn about it and a lot to learn from the history to apply to the programs of today.

LOUSMA: I think when we piece everybody's history together, we'll all see something new that we didn't realize before, and we'll say, "Gee, I didn't realize that happened because of this," and we'll probably put together a whole lot of other things that we have been curious about for a long time.

BUTLER: Absolutely. And everyone always has a different perspective on the same situation.

LOUSMA: Kind of like a jigsaw puzzle. Finally we'll have the whole picture.

BUTLER: And it's a big picture, so many different parts that come in to make it all happen. One of those parts, to begin with, if you could tell us how you got interested in aviation and then moving into the space program.

LOUSMA: When I was a kid, I always enjoyed airplanes. I'd make model airplanes and so forth. I remember being at my grandfather and grandmother's farm in Michigan, just four or five years old, and I had a cousin who was in the Army Air Corps and he flew fighters. I don't know how he got to do it, but he flew them wherever he wanted to, I guess. But I remember they said, "Your cousin Gordon is going to fly over the farm in a little while," and sure enough he did. He just came so low between the barn and the windmill, just like this, and I could almost see his eyeballs. I said, "Wow!" And perhaps that had something to do with it.

I had another cousin whose brother, as a matter of fact, was a Navy pilot and a captain for Eastern Airlines until he retired. So aviation kind of runs in the family a little bit. But I was always interested in airplanes as a youngster, but I'd never really flown. My father took me to the airport around Ann Arbor [Michigan] frequently, just a grass strip out in the country, and we'd watch airplanes land and take off, just fun to do.

But as I went through high school, my plan was to be a businessman, so I studied those kinds of courses, and when I went to the University of Michigan [Ann Arbor, Michigan], that's where I started. I couldn't remember all the things I had to read, the textbooks full of psychology and history and all the facts and figures and so forth. I was a very slow reader, still am, so I thought I'd better get into something that I can figure out, and maybe business isn't the way to go.

So I got into engineering. I thought, well, as long as I'm going to get into engineering—this was in my sophomore year—I really like airplanes and they've got a great aeronautical engineering department at the University of Michigan, so that's what I signed up for. The deeper I got into it, the more I liked it.

I had intended to go to a defense plant after college. In those days we had the draft, and if they called, why, you left and went and served, but you could get a deferment for being in college, and you could also be deferred by going to work in a defense industry somewhere. So the natural thing was to go to work with Boeing [Co.] or Rockwell [International Corp.] or McDonnell Douglas [Corp.] as an engineer.

But while I was studying engineering, these people from industry would come in and put on seminars, and they would show movies of their fast flying airplanes and jets. I said, "Wow! That really looks like fun. I think the best master's degree for an aeronautical engineer is to learn how to fly these airplanes." I said aeronautical engineer, not aerospace, because in those days the word "aerospace" had not even been invented yet, and the word "astronaut" was not out on the street until maybe [19]'58 or so. I was in school in the Dark Ages. That was a long time ago, the mid-fifties.

So I thought to myself, "I think instead of taking a master's degree, what I'll do is learn how to fly airplanes and get in the military service." So I went around and asked the various services if I could fly their airplanes, and it turns out that my wife and I were married between my sophomore and junior year, and she was nurse and put me through school, really. So we were around a long time. She'd never expected to be involved with aviation or marry a pilot. But I went and asked the Air Force and I asked the Navy if I could fly their airplanes, and they said, "Well, our air cadet program requires only two years of college, but you can't be married." So I thought I was out of luck.

I was too late at that time to sign up in the ROTC [Reserve Officer Training Corps] program. So I just put it on a shelf until one day going through school I saw some Marines in one of the campus buildings all dressed up with their red stripes and turtlenecks, you know, and they had pictures of tanks and rifles and all the things Marines had, but also airplanes. I said, "You guys don't have airplanes, do you?"

They said, "Yes, we do."

I said, "Well, can I fly them?"

They said, "Well, probably."

I said, "But I'm married."

They said, "Doesn't matter. We have a program that will take married people, and we'd be glad to have you."

I said, "How do I get in this program?"

They said, "Well, you take this test."

Of course, you know, you always pass those tests. I went home that night, and I asked my wife, I said, "How'd you like to be in the Marines?" [Laughter] Maybe she wouldn't tell it that way, but that's the way I remember it.

She said, "Well, you know, we've lived in Ann Arbor a long time. This is our hometown. Our parents are here. It's time to hit the road and go somewhere else. Maybe that would be all right."

I said, "Well, I signed up to be a Marine aviator."

So all I had to do was to go to boot camp in the summertime, two six-week courses of Marine boot camp. I mean, it was just like Parris Island [South Carolina]. It was a screening course. It was not the summer campus that they advertise it to be. I had to keep my grades up, but I didn't have to do anything during the school year, no drills, no classes of a Marine aviation nature.

When I graduated, I was commissioned Second Lieutenant, and I went to flying school at Pensacola, Florida, and then I took my advanced training in Beeville, Texas, for six months. So I was right near [here (Houston)].

I went to a jet squadron, and I really loved flying airplanes, and rather than getting out in four years like I was planning to do, I decided I'd make a career out of this. So I went overseas and went to Naval Postgraduate School and got an advanced degree in aeronautical engineering and went back to a reconnaissance squadron.

I was looking for new challenges, really, and that was about the time that NASA was looking for new astronauts, in 1965. I always tell people I answered an ad in the newspaper, because I'd been there about eight or nine months, and I read the base newspaper that came out on Friday afternoon every week, and right on the front page there was this advertisement or article that was saying "NASA's looking for new astronauts. If you're a Marine pilot and you fill all these qualifications, you can apply and you'll go through a screening process in the Marine Corps." I thought up until this time this was a "Don't call us, we'll call you" kind of a program, that I really wouldn't have a chance unless somebody from higher up tapped me on the shoulder. I thought, "Well, this is unique in terms of what I had thought. I know I'll never make this, but if I don't apply when I have the chance, I'll just kick myself forever." So I applied for the NASA program.

In those days it was required to be not more than thirty-six years old. There's no age requirement anymore because of legislation, I guess. I was only twenty-nine. You had to have an engineering degree. You had to be a U.S. citizen. You couldn't be more than six feet tall. If you met those qualifications, you sent in an application. So I did. I filled it out, sent it in, thought I'd never hear from it again, but the Marines came back and said, "We're interested in your application, but you're too tall. You are 6'1". So therefore we can't submit your name."

I said, "Well, I am not 6'1". I'm not an inch over six feet. I have never been taller than six feet. I know that must be an error."

They said, "It was on your last flight physical."

I said, "Well, they must have done it incorrectly, because I'm not over six feet."

About that same time I was being deployed from Cherry Point, North Carolina, down to Puerto Rico and Cuba for a couple of months while we were doing some extra duty, so I knew nothing was going to happen on this until I got back, but while I was there, I realized that, in standing next to the door jam every morning and every night, that by nightfall I was about half an inch or more shorter than normally I would be. So I practiced standing, standing all day, and I found that if I hunkered down just right, I could come under six feet. So they must have been right, but I wasn't willing to admit it.

They said, "What we'll do is we'll give you a special measurement. Your flight surgeon will make this measurement, and then we'll decide whether or not you're too tall."

So I got back to the States, went through the measurement, and found out that I was 5'11" and seven-eighths. I was really 5'13", but I didn't tell anybody!

Then I went through that part of the process. In those days, the Marines were screening applications, and they screened it down to six Marines and sent us out to the NASA set of wickets to go through, one of which, of course, was six days at Brooks Air Force Base [San Antonio, Texas] for four days medical and two days psychological testing. That was very interesting, and some memorable tests, I guess you might say.

After that, also, we then came back to be interviewed by NASA, which was done in the Rice Hotel. Is the Rice Hotel still down there, or is it something different? It may have been torn down. But it was a secret place. We didn't come out to the [space] center here, we just went there, so that the newspaper people wouldn't pick it up.

There were about sixty of us. All six Marines and all the Air Force guys and the Navy guys and the civilian guys ended up there being interviewed and taking Blue Book examinations, tests. It was a very disappointing time during the Gemini Program, because we were taking our tests one day, I remember, in the Rice Hotel, and someone came in and said, "Charlie [Charles A.] Bassett [II] and Elliot [M.] See [Jr.] have had an airplane accident at St. Louis." Immediately, of course, Deke [Donald K.] Slayton left and others did as well, but that was a very sad time.

So the Marines screened us down to two Marines. Jerry [Gerald P.] Carr was the other Marine who was selected, and finally NASA screened it down to nineteen astronauts, and we were invited to come to NASA. We called ourselves the "Original Nineteen," of course. At that time, there were thirty astronauts, and there had been the "Original Seven," so it was quite facetious…[to call ourselves "Original," our] nineteen people [made] it forty-nine or fifty.

I was notified that I was selected by Alan [B.] Shepard [Jr.]. I was out flying a reconnaissance mission in Cherry Point, and when I came off the flight line, the plane captain said, "There's a telephone call waiting for you in the ready room," so I went up and it was Al Shepard.

Al said, "Would you still like to work for us at NASA?"

I said, "Wow! I'll be there tomorrow." I said, "Yes, sir. How do I do this?"

He said, "Here's what you have to do. Keep it under your hat. At the appropriate time we'll announce this."

Then we came to NASA in 1966, in April.

Maybe I've run over some things or wandered on too long, but that's the way I remember it. That's how I got interested in aviation and how it ended up.

BUTLER: You mentioned that your wife hadn't thought about being a pilot's wife to start with in a military life. What did she think when you expressed your interest in applying for the astronaut program and being accepted?

LOUSMA: Well, she stated the fact that she hadn't signed up for this. [Laughter] But she wasn't opposed to it. She's always been very supportive. We work like a team. She does her things and I do my things, and together we make the family go forward. She's always been supportive of the wild things that I do, and she's always participated in them, and I've always tried to get my family involved so they know what's going on. So it's been a big team effort. She knows that if the old man ain't happy, it ain't happy for anybody, just like when she's not.

So she went through the military aviation training and through accidents, of course, that my friends have had and all of those things, all of the separation and whatnot that goes along with it, but all the while she was a team player and made things happen.

When I was working on the Skylab mission or on the Space Shuttle mission, you know, we'd be traveling a lot, I'd be gone a lot of the time. So she basically raised the kids. We worked together to make things happen. So it's been a very rewarding marriage, I guess you might say. So she had the confidence to believe, to begin with, that this was something that I wanted to do, she'd help out in it and go along with it, and she really contributed greatly. I don't know what I'd have done without her. She was always very gracious, very ready to assist and help and be the cheerleader and keep me under control. When I got the big head or got to flying too high, she'd take care of that, too.

BUTLER: That's wonderful. It's wonderful that you have such a partnership and such a team, as you said, and good family. That's a very important part of it all.

LOUSMA: It is. I've found that it's a very demanding life, whether you have a strong family or whether you don't. Having a strong family was very, very, very important in allowing me to focus on my work and not to have the other strain that might go with an unhappy home.

BUTLER: That's great. And there was a lot of strain. I've seen some of the other families at NASA in some of those times, and it's wonderful that you had such a good support in your family.

LOUSMA: I think it was tougher on the families. When you think about the risks here, and you sign up for a flight a couple years in advance or three years, and you do that in your easy chair and this is all down the road. But as time goes on, the astronauts get real active in what they're doing, the thing they like to do the best and the thing they're really looking forward to, but for the family it's a lot of time when you're not there and also a lot more pressure, because it's a great risk to the family as well as to the flyer. I think probably the flyer being involved in everyday duties, doing what he wants to do or she wants to do, is far different than watching and helping and waiting.

BUTLER: Very different, definitely.

When you did come down here, once you went through the whole application process, got selected, got the phone call, moved down to Houston then at that point, what were some of your first impressions and then some of the first things that you got involved with?

LOUSMA: The area was far different then. I don't know exactly when the Johnson Space Center was first moved into. It was here when we arrived in April of '66, but before that it had been downtown. So there [are] a lot of buildings here that were not here then. All the trees were a lot smaller. We used to like to bring the kids over and play with the ducks around the ponds and so forth. Most of the subdivisions were only just partially occupied. Nassau Bay was just building, and we lived in El Lago, and it was sparsely settled at that time. The original seven, some of them, had settled in Timber Lake, Timber Cove, I guess you might say. So it was a far different geographical terrain.

When I arrived, I checked in with Deke Slayton, and we were helped in finding places to live by the other astronauts who were here, and we got all of the information from them and the help we could get, found a place to live, like military people do. You see the house the first day and then you're moving into it the second day, and then you're off and running. You just hope you picked the right spot. So it's a very transient life in that respect.

When we arrived, I was really impressed with the professionalism of the team of people that was here, and most of them were a lot younger than I am right now. I think the average age of the people in mission control was twenty-seven years old or something like that. I guess we were too young and ignorant to know that we couldn’t go to the Moon, so we did it!

So those were really heady days. We were flying Gemini. I think Gemini X was the first mission that was flown after I arrived. I'd have to go back and look at the schedules, but it was about that time frame. We didn't get too involved in the Gemini Program except to watch it with great interest. All these guys were the old guys, the experienced guys, and we were novices, new guys on the block, and just trying to learn all we could. We did learn a lot from the Gemini crews and the reports that they wrote, because they had certain ways that they believed the spacecraft ought to be flown, ought to be designed, procedures that were used and so forth. They had strong opinions about what ought to be done. So those of us who were new read those reports and talked to them. This enabled us, then, to go on to be involved in the development of Apollo spacecraft and the Skylab spacecraft and talk with some authority because it came from people who had flown in space already.

So the first thing that we did when we came here was to get about a year and a half of basic astronaut training. We didn't have what we call astronaut candidates in those days; that came along later. But it was presumed that all of us were selected and were going to fly. That was basically it.

In those days, the program had a lot more far-reaching vision than it ended up with. In fact, when we arrived, the reason that we were selected was because Apollo was not just going to fly six flights to the Moon, it was going to go on and fly in orbit about the Moon for two months. We were going to land on the Moon and live there for a month. Those were some of the long-range plans. So that was going to take a lot of people, and we were going to be part of that cadre. So that was all very exciting. It was all men at the time, of course, and the women came later, in '78, but it was all men, and all of us had intentions to fly in Apollo, but we were all too late for Gemini.

It was very much of a seniority kind of a program at that time. Deke Slayton was the boss, a military guy who had become a civilian. He was refused the opportunity to fly his Mercury flight, but he was the boss and Al Shepard was his colleague. Al Shepard was the chief of the Astronaut Office. Deke Slayton was the Director of Flight Crew Operations. So that included not only astronauts, but all of the support people in the building that did the checklists and the mission planning, simulator operating, the airplanes out at Ellington Field and so forth. So Deke's scope of responsibility was broader.

I don't know where I was going with all this, but that was the setup of the office. We would have a pilots' meeting every Monday morning. All of us would be in there, and everybody was an individual. We had about forty-nine racehorses, and they all wanted to get out of the gate at the same time or ahead of another one. But all willing to work with everyone else to make sure that the whole program was successful. It was a great and exciting time, was really a heady time, I guess you might say. I just loved coming to work every morning just to be involved with what I was going to get into that day.

Early in the program, of course, what we got into was the year and a half of astronaut training and all the subject matters that came up in classrooms, which was spacecraft systems, the orbital mechanics, medical aspects of space flight, geology, astronomy, and all those kinds of subjects that would clearly be important to us.

During that period of time, then, we also, after we'd been here a while, were given other more applied assignments. This would be like a collateral duty. Besides [the classroom work,]…we all were assigned to participate somehow in the upcoming missions. I was probably one of the first assigned because the Apollo Applications Program was just beginning about that time, and the question was, how do we use the Apollo equipment for doing other kinds of things? So there were quite a number of concepts and ideas that were forwarded, one of which ended up being the Skylab Space Station.

Before that, there was one [proposed applications mission] that was kind of a reconnaissance mission around the Moon, where we wanted to get some close-up pictures, some very, very sharp resolution pictures of the surface of the Moon so that we could plan some of our future landings, some of our future exploration and so forth, of the Moon. There was a module that was designed to fit on the front end of the command module instead of the lunar module. This was a module that was cylindrical in nature and long enough for a person or two to get into, and it was going to have some high resolution and some very classified cameras in it that were going to be used.

Since I had just been in a reconnaissance squadron for a year, a photoreconnaissance squadron, it was natural that this would be something I might have some adaptation for. So I received that assignment when that Apollo Applications [Program] was being studied. I worked on that for about a year, I guess you might say, and then they decided not to do it. So I went into the Apollo support crew. One of the collateral duties we had was to be assigned to a support crew. For every Apollo crew, there was a prime crew of three, a backup crew of three, and then there was a support crew of three. The support crews were the new guys. This is one of the other ways we learned. We learned about mission control. We learned about test and checkout of the spacecraft at the Cape. We learned about building the mission and the mission procedures and the mission planning, and we participated in that right here at the Johnson Space Center. We had other people who were also connected with the interface between the rocket and the spacecraft to make sure that the rocket was going to do what we had hoped it might on the spacecraft. So we had those collateral duties.

While I was working on the Apollo Applications Program, some of my colleagues got assigned to support crews for Apollo 7, Apollo 8, 9, 10, 11, and so forth. Of course, in that time also we had the very disastrous fire where we lost three of our colleagues. That was less than a year after I'd been here. I arrived in April of '66, and this occurred in '67. So there was a stand down then, of course. We all properly remember the contribution of those three [astronauts].

We also participated in the redesign of the spacecraft to make it a hatch which opened outward instead of inward, to make sure that there was nothing in the spacecraft that would burn, no fuel. Anything that was a fuel was covered with a new white material that was now the spacesuit covering, sort of a fiberglass material, and that's why the spacesuits are covered with that material. Also to reconstruct the manufacturing methods by which the cables were laid within the spacecraft. Rather than bending them around a corner, taking a long cable and bending it around corners, they were all pre-formed so there wouldn't be any chance for cables breaking or wires breaking or insulation coming off.

So there was a delay while we got to Apollo 7. Our [Original 19] guys on the support crew started on Apollo 7 and so forth. I was finally, after the Apollo Applications Project I was working on was canceled, was put on the early phases of the orbital workshop, as a matter of fact. We decided to fly [the Skylab] Space Station, and the engineers decided to use the third stage of the Moon rocket, obviously, because there were a few of them left over, and the first two stages could put it into orbit. So this huge tank, probably about thirty feet long and [twenty-two] feet in diameter, something like that.

At first, the thought was that we would just…put on our spacesuits, do an EVA [extravehicular activity], open up the hatch that was built on the front of this, and then peer down on this big, empty volume, and then go down there and live somehow. There were lots of openings that had to be plugged up and so forth. But that grew and mushroomed into something bigger and better all the time.

That's about where I left it. I was assigned to a support crew, the first one that I was on, and that was for Apollo 9. I was assigned to be the lead support crewman on the test and checkout of the lunar module, the first one that would fly at the Cape. So I worked on that for about a year, and I spent a lot of time at the Cape. I was involved in most of the tests and checkout when the engineers were working on it. I represented the crew, and if something went wrong with the test that was crew-related, I would take a position on that and I would join the engineering team to persuade them to make the fix that I thought the crew would want.

If that didn't happen, of course, then I would go see the crew, and if Jim [James A.] McDivitt said, "I'd like to have it done this way," why, I had a lot more leverage. But the crew didn't have a lot of time to do all those peripheral jobs. There was another support crewman who was assigned to a similar job with the command module and another who was more the coordinator of procedural development, flight plan development, interaction with mission control team and so forth back in Houston. So we kind of divided the responsibilities that way.

While I was working on the lunar module, there were a number of things, because that was the first lunar module, that went wrong. So there were a number of things that had to be fixed and repaired. Every day there would be something new. Finally, though, we got it so it would fly and moved out to the launch pad, and we did the same kind of checkout process out there when it was on top of the stack. So it was a long process in three different locations. [On every repositioning,] it had to…be rechecked and tested to make sure it was going to be okay on launch day.

So the launch of Apollo 9 came along, and I was the countdown voice in the fire control room. Of course, after the spacecraft has lifted off past the tower, control reverts to Houston, and we'd all be sitting there with our hands on our hips just watching this thing going, saying, "Just get up there." So that was just sort of a side job. My responsibility primarily was to take the lunar module through test and checkout.

When that was over, I was given the same job for the next lunar module, Apollo 10. That didn't take very long because the next flight was not too far from Apollo 9. So that was a several-month project.

By all that time, I had had an opportunity to get in the lunar module and learn a lot about the lunar module. So I figured I was destined for a lunar module slot sometime downstream, and that's what I was working for. Whenever the crew couldn't show up to use the simulator or if one of the crewman wasn't able to be there with one of the other prime or backup crewmen, then I would make myself available and jump in the simulator. By the time Apollo was over, I had 700 hours in the lunar module simulator training with the crews, so I was primed to go on.

Beyond that, then, Apollo 11 happened, and I was at that time put on the support crew for Apollo 13. For a while I would occasionally train with Al Shepard because he was going to be Apollo 13, but later on, 14 and 13 changed, and then I started working with Jim [James A.] Lovell. My role was different on this mission. I didn't do the lunar module; I did the command module to make sure that it got through test and checkout all right, but by that time the people at the Cape were doing this quite routinely and doing it very well, so it was not as big a job.

I was also one of the communicators for Apollo 13. We had four teams, as I recall, one extra team, but three main teams, and I was on one of those. So we traveled all over the country with the Apollo 13 team, in fact, to Hawaii once as well because of all the volcanic activity in Hawaii. It was going to be like their landing site on the Moon. So we set up an excursion area in

Hawaii which was as much as we could make it like the one on the Moon that they were going to land on, Fra Mauro.

So I trained with the crew as a communicator on several of the lunar expeditions, I guess you might say, and also for other things that were going to happen on my shift. I don't remember what shift it was, but part of it had to do with the translunar injection toward the Moon. So some other astronaut was taking care of the launch and the entry, but my shift happened to be that one.

I was on duty when the accident occurred. I recall that evening very, very well. It's just indelibly printed in my memory. Everything seemed to be going very well. They had launched into orbit, they had gone around the world about three times or so, and they…[were on] the translunar trajectory toward the Moon. [They had docked with the Lunar Module and extracted it from the third stage.] They were…just [comfortably] heading for the Moon…[when] they had the problem, as I recall.

That evening, all the family was in the back of the control center. You have to think of the old original control center. It was a glassed-off seating area that could seat about a hundred people or more, and they would watch the mission control team. That particular evening, the families were there, all the wives, the mothers and fathers, the kids, the grandparents, so forth, and aunts and uncles. All the crew had their family there watching the proceedings.

What was going on was that the crew was giving us a tour of the lunar module. They had opened up the hatch. They had made the lunar module habitable, but the command module was still controlling the two spacecraft as they went [docked together] toward the Moon. They gave us a very nice tour. It was on television. We didn't have television in space real early in the program, so this was kind of unique. Everything was just peachy-keen. They said, "That's it from Apollo 13. We're going to rest now," something like that, and the crew's families got up and left.

Before [the families] got home this accident occurred, and we got the words, "Houston, we've got a problem."

I said, "Say again?"

They said, "We have a problem."

I said, "Yes, sir. We're looking at it."

But before they got home, all this had happened, this loud explosion and all the reports from the crew of this disastrous chain of events that were occurring, making everything go downhill. So they, of course, the families, were all notified, but they went from—it was kind of like the Mutt and Jeff routine of the hot and cold or good guy, bad guy. It was just absolutely overnight a cataclysmic change in the demeanor of the whole mission.

So we in the Mission Control Center, of course, set about to solve the problem and get the crew back safely. I was there while the crew was "safed" and then [my relief] took over, and I had some other mission duties while the spacecraft was coming back, mid-course corrections and so forth.

That's the way the Apollo support crews got trained, and it was training in the line of fire, I guess you might say. It was really hands-on training. It was not classroom stuff. It was all on-the-job training and probably the best way you could learn, but it was an excellent opportunity for those new guys, us, to interface with all of the NASA system, from the Cape to the communications, to mission control, to recovery forces and the whole works.

BUTLER: It certainly is one of the best ways to learn something is just by doing it and getting that heavily involved in it.

LOUSMA: It is. It was exciting, too. It was so exciting. Like I said, I loved to come to work every morning because there was always something new. I loved the uncertainty of it all, that you couldn't depend on the same thing happening every day. I looked forward to the training. It's a good way to build your adversity quotient if you need that.

BUTLER: Definitely a good way.

To go back to a couple of details, you mentioned on Apollo 9 that it was the first lunar module that was going to be manned, so there were a few issues that came up with it. Do you recall, offhand, any big ones that were major issues for that?

LOUSMA: As I recall, the Apollo 9 mission went quite smoothly. The idea was to get into orbit about the Earth, separate the lunar module and the command module, and it required them to make a rendezvous and a docking. One of the things I recall is that one of the crewmen was ill and getting a spacesuit on, this was more activity, more movement, than had been done in previous missions because it had always been a small capsule, either a Mercury, Gemini, or a three-man Apollo. So there wasn't much chance to move around and get into position where you could feel ill. So Rusty got in his suit, and there was a lot of head movement and a lot more room to move around in and a lot of activity, and he didn't feel good. That was where we first became aware that this might happen.

One of the other things that I recall—there were probably other things—I think the spacecraft worked quite well, as I recall. Aside from a few more minor anomalies and things that needed to be fixed, I think that the spacecraft worked fairly well.

One of the procedures we changed was that the plan was to dock the lunar module actively with the command module, which was the target, and fly the docking, even on follow-on missions, from the lunar module. It turns out that, of course, the hatch is overhead, so the pilot is looking forward and having to fly the spacecraft with a ninety-degree different control system. It was not instinctive control to fly it when you're looking up with controls that are made for the pilot to be looking forward. That was a difficult thing to do, so we abandoned that approach as a result of that mission.

After that, then, the command module and lunar module dockings and orbit about the Moon were flown actively from the command module. The pilot in the command module docked with the top of the lunar module, and that was more straightforward and more instinctively controlled. So that was a major finding on that mission.

There may have been others that I've forgotten and should review, but I think those two are the ones that I remember the most.

BUTLER: That's certainly something major there, absolutely. That's been a challenge for them still today with the Shuttle, the two different systems.

LOUSMA: I remember being part of locating the instruments in the Space Shuttle for flying out the window toward the back and also trying to do the docking like this [(Lousma demonstrates looking overhead)]. We looked back at what we learned from the Apollo command module and lunar module-command module system, and that had a lot to do with the way that we made the control systems work within Space Shuttle. I was involved in that later, after I finished up with Apollo-Soyuz.

If you look in the back of the Space Shuttle now, you'll see that the attitude gyro is not mounted this way [(horizontally)] or that way [(vertically)], it's sort of in between, and that there are switches for the display on the attitude indicator as well as switches for the control system, the rotational hand control and translational hand control, where it says there's a minus-X selection so that when you're flying and looking out the back window, that's called minus-X axis. Then the controls are instinctive and so is the display. But if you're going to fly this way [(looking overhead)], what's called a minus-Z axis, then you flip the switch to minus-Z, and the attitude indicator as well as the controls work such that when you're flying overhead it's instinctive to fly in that direction. So this was a spinoff from what we learned with Apollo.

BUTLER: That's the value of taking these early programs and applying those lessons learned.

LOUSMA: That's it, yes. It was a real build-up, too. Every mission that we flew, and I think it's still this way with the Shuttle, needs to be something which is an advance of the mission that was flown before, some new technological achievement, some better way to do something, a safer way to do something. This is one of the real differences in our program and the Russian program which I noticed when I was over there working on Apollo-Soyuz, and that is that the Russians use the same spacecraft, use the same procedures, same techniques, same everything time and time again, and they become quite reliable that way and quite good at it, but on the other hand, they don't make the technological leaps that we were able to make in our program. So Space Station's long-duration flights lend themselves to that philosophy, whereas the kinds of things we were doing lend themselves to landing on the Moon and eventually missions to Mars.

BUTLER: Absolutely. You have been able to grow and make those next steps so that, as with Apollo, those missions expanded in their scope and what they were able to accomplish.

LOUSMA: Every mission was something better or more or bigger or different than the one before, from walking on the Moon to pulling a buggy, to riding a Rover, expanding your search and from landing on a fairly level place to flying into more mountainous areas. The kind of geology that was done was different as well, the kinds of experiments that were done. There was always something better and more well thought out, more improved, and capitalized on what we learned to take another leap forward and another step upward.

BUTLER: Absolutely.

You mentioned that as a support crew member, you were working on the lunar module and then on the command module and that you worked as Capcom [capsule communicator] some on Apollo 13. On Apollo 9 and 10, did you serve as Capcom at all as well, or what did you do during the mission then?

LOUSMA: I don't recall being the Capcom on Apollo 10. I may have been, but I don't remember that. On Apollo 9, of course, I helped with the liftoff, but other than that, someone else, and often it was the backup crew, would be handling some of the mission control responsibilities. I don't remember being Capcom. I remember being involved in watching the mission or being involved in solving problems because the support crew people were well acquainted with all the procedures, the techniques and equipment and so forth, and what the astronauts were thinking and what kind of solutions they'd like to have. So that knowledge was used along with the engineering team on the ground to solve problems as they came up.

BUTLER: Going on to Apollo 13, then, which you mentioned in a little bit of detail, I'd like to kind of follow up with a few things. You mentioned early on in the mission that things were going so well. In fact, I think at one point there was a comment about being bored to tears back on Earth, that things were going so well. Then, of course, the explosion happened and things came apart very quickly, as you mentioned. At what point while you were going through that stage did you realize the seriousness of the situation? How clear was it at first and how did that progress, that understanding?

LOUSMA: I think it seemed serious right away because we were so much in the dark with what was happening. We really didn't know what was happening. We lost most of the telemetry that was coming down, and I think we realized it was serious because we didn't understand it, because we didn't have the data and information we needed to, as we normally have in a simulation. Everybody looks at their scope and says, "Here's the problem. Let's fix it." Most of the scopes had "Ms" on them, missing information, and we had to rely largely on reports from the crew. The instruments in the command module, most of them were working properly. It was just that the telemetry wasn't getting down. So we relied on the crew's observations of the instruments, when they had caution warning lights that came on, when they saw that their oxygen pressures were declining.

Then we also relied on their observations, "I heard a loud bang," or, "I look out the window, and there's a shower spray of something going away." "We can't quite control the spacecraft. It won't stay where we put it. It keeps wanting to move." So we deduced from all the information that what really had happened was something far more serious than we'd ever trained for or had ever anticipated might happen, and that we were going to have to handle this as a totally new situation and understand as best we could.

Once we got to that point, I remember that the crew and the ground, it seemed almost simultaneously, said, "We've got to get them in the lunar module." The crew had already started heading in that direction because it was clear, with the oxygen being expended from the command module, that pretty soon there was not going to be any electricity there, therefore you couldn't control the spacecraft, you'd lose track of your position in space, your guidance and navigation platforms would be of no value.

So what we had to do was immediately put the lunar module in control of the cluster, and we also had to get the crew into the lunar module in order to keep them safe. So that was a series of steps that we went through. That was one of the kinds of things you don't have time to simulate. That was something we had to do very quickly. So this was the right opportunity for our great mission control team to demonstrate how good they really were. I think until this time, why, they probably didn't think they had all the potential they did, but they responded in a very disciplined fashion. I would say it was disciplined chaos, is what it really was.

I happened to be the communicator at that time, so I had to relay the information that the ground controllers wanted them to hear. At the same time, everybody could listen to what the crew was saying. There was a flurry of activity then in the control center as well as in the rooms all around the Mission Control Center of all of these individual teams, all these experts, who made a career out of understanding cryogenics or electrical, guidance, navigation, and control. The best heads in the world were doing this, and of course, the flight directors then, Glynn [S.] Lunney and Gene [Eugene F.] Kranz, were on at the time, I believe, as I recall, and they were making sure the team was doing this in a disciplined fashion, that the right things were being done in the right order, that people were concentrating on doing a job without panicking, and trying to understand the problem and then taking the organized steps to fix it. I had to make sure that the words that I was sending up were all words that had been reviewed by somebody but had not come from a single source that had not coordinated this with the other people in the room because anytime you do something on a spacecraft, it affects not just one system, it affects everybody's system.

So there was a sorting process that I required, and then I worked this with the flight director to make sure that all of the commands, all of the information that was read up to the crew had first been massaged by everybody on the team to the point where it was an integrated response rather than an individual one. That discipline was maintained until we got the crew safely into the lunar module, got the lunar module safely in control of the cluster, knew that the guidance and navigation information had been transferred properly from the command module system over to the lunar module system. That was something we had done before, obviously, under normal circumstances, but now it was even more important to do it right.

So that was a rather chaotic evening, one I'll never forget, but it was a very successful one and started them on the right trajectory to home. During that time, of course, the decisions as to whether or not to fly them around the Moon or bring them back directly without going around the Moon were made, and all of the other calculations were made to determine how much electrical power there was, how much cooling water there was, what our consumable supply situation was, and whether or not there was going to be enough of all of those to bring them back safely.

BUTLER: At what point during the mission did you feel confident that everything would come together and they would come back safely, or did you feel that confidence in the team all along?

LOUSMA: You know, when the thing was all over with and we were in the Mission Control Center, we were all just relieved that it happened the way it did, that the accident didn't occur at a different time, for example, when the crew was on the Moon. It could have been a lot worse. But someone asked me later on, and maybe it wasn't that day, maybe it was somewhere else, they asked me, "What would you have done if you couldn't get the crew back?"

I said, "Gee whiz, I never, never dreamed that we wouldn't. I never thought that we wouldn't be successful." Because I think we were all so focused on making it work. We could see that there was a possibility that we'd get them back, and we never thought that we wouldn't. I think it was probably that positive attitude that had a lot to do with making the whole mission successful, but I think everybody had that feeling. I don't know if anybody didn't. We were so busy solving a problem that would result in success that we never, ever thought about failing, at least I never did.

BUTLER: That's good. They say there's so much in positive thinking, you're able to move forward with it, whereas with negative you can get too caught up in what could happen.

LOUSMA: Yes, that's right. The other part of positive thinking, I think, was worldwide. Very few times in history do you ever get to the point where everybody in the whole world wants to have the same thing happen or is concerned about the same issue or has the same hope and vision for its success, but this particular one was one in which that happened.

I think probably Apollo 11 in the space program was the first time that everybody around the world was glued to the news and glued to their television sets watching this happen. It didn't matter what country one lived in or what the culture was or the language or the religion or anything. These [astronauts] were people who represented all of mankind, so to speak, and they wanted them to be successful. It didn't matter who it was, as long as someone or humans like them were involved in this.

I think the same sense was perhaps even more strongly felt with the Apollo 13 crew, because this was, again, a place where the whole world found themselves captured by this drama, all wondering how it was going to come out and everyone hoping for success and everyone wanting to feel as though it was going to come out positively. We got mail and letters and encouragement from all around the world in every language, every religion, and every culture. That was encouraging for us as well, but I think this was one of those other times in history when it brought the world together for four days, anyway. Those things don't happen very often, but I think that's probably one of the great contributions of the space program to human relations and to humanity on this little spacecraft on which we live.

BUTLER: Absolutely.

Were you aware then, during Apollo 13, of all these offers of support and help?

LOUSMA: I wasn't, but I heard about them later. I guess it would have been nice if I had at the time, but we were so busy focusing outward on that, that we didn't focus much on the inward things. It was really a unique time in the world's history for four days.

BUTLER: Very unique. Very unique.

Mentioning Apollo 11 and that same bringing everyone together, do you recall where you were and what you were doing when they landed on the Moon?

LOUSMA: Yes, I do. I wasn't at the Cape on that particular day. I had been at most of the launches, but I had come back and I was starting to work on Apollo 13 already. Apollo 13 was sort of standing down for the Apollo 11 launch, I guess. Anyway, I was back here. I watched it from mission control, and I also watched it from home. Of course, we lived in El Lago, just a block away from Neil [A.] Armstrong, and his family was absolutely immersed in the news media. They were all around the house. They had the trucks and the big satellite booms, and it was just a madhouse around Neil's house for at least a couple days. We watched it from here rather than elsewhere.

BUTLER: Well, this is a good place to watch from.

LOUSMA: Yes, it is.

BUTLER: It certainly is.

LOUSMA: I came to the office every day and worked just like normally, but kept tabs on the mission like everyone else and went over to mission control periodically and checked in on what was going on. It was just a heady, absolutely marvelous time. It was a great time to be part of the space program.

BUTLER: You certainly got to see some very unique events throughout your career with the space program.

LOUSMA: I'm a very fortunate person.

BUTLER: And we're fortunate that you're sharing those memories with us.

You had mentioned that when you first came into the Apollo program that the idea was Apollo would continue on, would have these longer missions. You even mentioned the reconnaissance mission that you initially began doing some work on. At what point during your time on the support crews and working as Capcom, at what point did you realize that Apollo 17 was going to mean the end of the program?

LOUSMA: I think it was probably about the time of Apollo 14 or 15, somewhere in that time frame. After the landing on the Moon, in which the time between each mission was very short, up until that time maybe a couple of months, the time between missions after that lengthened out. We had made our goal, and there wasn't quite the rush there was before, and we wanted to add a lot to the missions, and we wanted to make sure that we did it safely. We had done it safely before, but it was a real crunch for everybody to make that happen.

So the missions were spaced out more, and I think that Apollo 17 must have flown sometime around 1972. I'm not sure exactly when it was, but I think so. So I think it probably was, since I flew the Skylab in '73 and I knew two and a half years before that that I was going to be on the Skylab crew, it must have been around 1970 sometime that I realized that I wasn't going to get to fly to the Moon. There was some reason to believe that I would have been involved in one of those missions, so it was some sort of a disappointment.

On the other hand, rides were very scarce in those days. They were not quite as plentiful as they are today, and fewer people went on them. So one couldn't be finicky about what he was assigned to. Although it was a disappointment not to be able to go to the Moon, everybody would have liked to have done it all, I guess.

The Skylab Space Station missions at that time had been fairly well defined. While I was working on the support crew on Apollo, the orbital workshop had gone from just a big empty tank which you peer into and glide around in and come back to a home in space. So I thought of the Skylab Program as being a place where we would finally take the operational knowledge that we had gained from Mercury, Gemini, and Apollo, how to operate in space, how to do things right, how to get the spacecraft built right, and how to make it perform, [all] very, very operationally oriented [accomplishments].

Although there was some science on the Moon, there wasn't much science besides that. But to finally take all of this operational knowledge and apply it to long-duration flights where you would actually have a laboratory in space and do scientific laboratory kind of work and apply the operational knowledge to producing results that are going to be good for humanity in the future seemed to me to be a worthwhile thing to do. Also, it was challenging because nobody had ever stayed there very long. So while there was disappointment about the end of the Apollo Program, there was still hope for an opportunity that would be significant, that would make a contribution, that would be something that had never been done before, and that would apply what we knew to what we want to do in space in the future, ultimately to go to Mars and do the other things.

And because there weren't many other choices, I was glad to be involved in the Skylab Space Station program. So there [was] a cadre of about fifteen of us who were working on the last three flights of Apollo. We were all in the same cadre, but [now] we were going to be the Skylab astronauts.

I found out one day from one of Deke Slayton's announcements at a Monday morning pilot that I was going to be on the prime crew for the second Skylab mission. There were going be three missions: twenty-eight days, fifty-six days, and fifty-six days. That's the way it was originally planned.

As an aside, I remember Deke Slayton would make those pronouncements every once in a while. He was the only one who chose the crews. NASA Headquarters would usually rubber-stamp Deke's selections because he knew everybody, he had a plan in mind. We never could figure out exactly what that plan was. We were always trying to second-guess it. But as it turned out, the people who were here first flew first, and the people who were of higher rank always flew in the command slots, or the people in lower ranks never superseded a person in a higher rank, a military rank [system], so to speak, and the civilians would have a ranking in his own mind. So there was some methodology to what he was doing, and he tried to get people experienced in the right side, or the co-pilot side, so to speak, first and then move him over to the left side, the commander side. That wasn't always possible because somebody had to fly the first one.

So there was some sort of a hierarchy in his mind, and it seemed like it was fair. It seemed like it was fair, especially for the more senior people who got here first to fly first. That makes a lot of sense. The higher ranks seemed to do better, or get assigned first. Deke was always very straightforward with everybody. You always knew where you stood with Deke Slayton and Al Shepard. There was never any guesswork. There was no politics. It was just a straightforward, "This is what we're going to do."

I remember whenever Deke would make the announcements of the next crews, we were never allowed to let anybody else know about this because it would make big news [with the media]and we wanted to focus on the mission at hand. So we always kept it very close to our chests. He would come in the pilot meeting and say, "Here's the next two crews," and he would name three prime crewmen for each flight, three backup crewmen. So he'd make six people real happy and forty people sad. So we'd always be wondering when our name was going to be called.

He would make those announcements, and then he would say, "And if you don't like that assignment, I'll be glad to trade places with you." [Laughter] Nobody could ever argue with that, because here was a guy who was refused his [Mercury] flight, and nobody wanted to trade places with him. So everybody understood his point of view. If you didn't understand his point of view, you could go talk to him about it, but it probably wouldn't change much.

I thought he and Al were always fair about the assignments that were made, and I was glad to be part of this cadre of fifteen guys that was going to fly in the Space Station and especially glad to be on the prime crew with Alan [L.] Bean. I don't know how I got in the crew with Alan Bean. Alan must have had something to do with it. Then Owen [K.] Garriott joined me on that one as well.

We knew about that about two and a half years before we flew. So we flew in the summer of '73. Sometime back in 1970 we must have known we weren't going to go to the Moon. That's the question that you asked.

BUTLER: You said you were happy when you did get assigned to the crew, and it did give you, as you said, different challenges, new challenges. It's certainly something that the American space program didn't have a lot of experience with, long-duration space flight. When you began to get into the training, how were things different, getting ready for that type of a mission compared to in the Apollo Program?

LOUSMA: Well, they were quite different. Of course, when you're going for a long-duration flight, that's different than training for a short one. Let me get into that in a minute.

One of the things that occurs to me is that it was during this time also that the Russians—we were still competing with them, even though we'd gotten to the Moon first, and now they were flying long-duration flights. At that time, it ended up that they had been in space three times as long as any Americans had. With their long-duration missions, they'd built up the time very quickly, and they were bragging about how they had had three or four times as much time in space as the Americans did. They were flying the Salyut Space Station, which really wasn't much of a Space Station. It was more like the front end of the Skylab. It was sort of like a big module, although it was projected to be quite large. There are some interesting stories about that.

They were getting this time in space, but before they even did that, they tried to do a long mission. They put up a crew for twenty-three days. This is while we were getting ready for the Skylab series of missions. Nobody actually knew what was going to happen to someone in space for twenty-three days. We knew for twelve days, to the Moon and back, but that was about it. They still hadn't done their long flights. They had a spacecraft accident after this twenty-three day flight, and the spacecraft landed in Russia and all of the pilots were dead. They had perished because they had been exposed to a vacuum and shouldn't have been.

We didn't know what caused the accident at the time. Here we were getting ready for these long-duration missions, so the question was, was this a spacecraft accident or was this from being in space too long, some sort of space malady from a long-duration mission? The Russians were asked what happened, and they came back with the answer, said, "We had a spacecraft accident." So that relieved us greatly. It didn't happen right away, but it relieved us greatly because we were concerned that we'd have some kind of space sickness that would keep us from going, and what was this thing and how could we strategize against it?

But they came back quite quickly and said that they had lost the three cosmonauts. They'd tried to cram three people in a two-man capsule, and because there wasn't much room, they couldn't wear their spacesuits during the reentry, as we had always done. During the separation of their modules, a valve had stuck open and let all the air out of the compartment, and they had died of being in a vacuum for too long.

In fact, when we flew the ASTP [Apollo Soyuz Test Project], that was a serious fix that we made them make before we'd ever even come close to flying with them, among other [problems]. For a while it kind of put the dampers on what we might be doing in the Skylab Program, but once we learned that, we pressed on with new confidence that we could probably live there that long and go on these long missions.

So the differences in training for a space flight like that is that for a long mission, you have to give a lot more attention to living, habitability in space. You know, it's not three astronauts in this little sardine can going up and back to the Moon. You have to attend more to waste management, hygiene, sleeping, eating. All those kinds of things have to be more well thought out. How you transfer big packages through a big volume of spacecraft that you never had before, how do you move through that big volume? How do you transfer these packages? Do you need to have special apparatus or nothing? So that made a big difference.

Also, psychologically you have to plan ahead. Medically what could happen to these people that we don't foresee, so what kind of medical precautions have to be taken? What kind of space illnesses or space illness events should you be equipped to handle? So there were a number of those kinds of differences that were ones we had to attend to.

BUTLER: We'll go ahead and take a break here if we can.

LOUSMA: Maybe I'll think of some more.

[Recording interrupted]

BUTLER: We were just talking about some of the differences in training for the long-duration space flight. You had mentioned some of the concerns from the Russian programs with their long duration and then the unfortunate accident when they returned. How did you then move into your training for Skylab?

LOUSMA: Well, of course, I mentioned that one of the differences for a long flight is you have to pay a lot more attention to habitability: hygiene and trash management and waste management and eating, sleeping, and so forth. Another thing, of course, that you have to do is to prepare yourself psychologically. You're there for the duration. This is not a short trip. We were looking forward to this, of course, but it's the difference between a long mission and a short mission.

A short mission is something more like a camping trip. I can liken it to that, where you know if you're out there in the woods and you have to swat mosquitoes for a week, you say, "Well, I'm going to be gone in a week, so I'll just go through the days and this is going to get over with pretty soon so, not to worry." Or if you don't feel well, for example, you know that this is a short mission.

Whereas for a long mission, it's more like being in a remote outpost where you're far from civilization, you're far from help if you need it, and you have to realize that if you don't feel well, you may not feel well for a long time, so you'd better get to feeling well real quickly. The comforts have to be a little bit different. So you have to mentally project yourself out to more of a self-reliant position, I guess you might say. You have to depend on yourself a lot more to be up to this task physically and mentally. So I think self-reliance is different. Also, communications might be different. You might be out of communications for longer periods of time. Actually, I like that. I like the opportunity to use some resourcefulness in getting things done.

So the long-duration mission is not like a camping trip. You have to really become a space person, because your body adapts to different elements of being in weightlessness at different rates. Different parts of your body respond at different times. I felt that maybe it took us maybe three to four weeks to really feel as if we were on the Earth in terms of a feeling of well being. I think you don't get that same sense when you're on a shorter trip. So the point is, you have to really become a space person.

You also have to prepare the people on the ground for this. I thought one of the good things that NASA did in that respect was it allowed us to have a communications system which would keep us in touch with our families twice a week. So we had a chance to talk with them over the radio. We would arrange a time, and they had a communications system in the house. Normally, of course, on all the missions, the family can listen to the voice of mission control and the banter between the spacecraft and the ground, which is not normally out in the general public, but in this case these were so-called private conversations. We weren't always convinced that they were private, but we were told they were, so we treated them that way.

We didn't have a satellite that was up there for constant communication during the Skylab. We had to only communicate when we were over our ground station. That was maybe for nine minutes over the United States or twelve minutes, something like that, then maybe six minutes or three minutes somewhere else, depending on what stations you were over. So we always tried to plan them so that we were going over the United States to have as long a conversation as possible.

These were planned well in advance, and sometimes there were things that happened on the ground that Mother needed to know about, you know, or wanted to ask about. "Who do you call when the washing machine breaks?" "Listen, the kids want to ask you a question about whether to continue playing football or to quit, and they need a little encouragement on doing better in their studies," or something like that, you know. So there were some everyday matters that you had a chance to be involved in by talking at least twice a week to your family. So that was a different kind of preparation than you do for a short-duration mission as well.

There are a number of things like that that are of great interest. There are probably more that I could think of. There is a big difference, and if I were to choose between the long flight and the short flight, I would take the long flight every time. If I had to choose one, I really enjoyed being there a long period of time and would like to have stayed longer. So that would be my choice.

BUTLER: It certainly gives you a lot of chances to get things done, to meet some new challenges, to do some interesting work while you're up there.

LOUSMA: It does. It allows you to do things for a longer duration. There are many things that you'd like to study that are long-duration studies. You just can't do them in a few days. So that enables that opportunity.

Then, of course, there's the challenge of being up there for that period of time, to see if you can actually stay up there and do useful work. That was one of the things we were trying to determine in Skylab, was can the body stay in weightless condition for long periods of time, do useful work and be productive, or will it have to have a rotating Space Station with artificial gravity and all the expense and complexity that goes with it? So we were able to demonstrate in the Skylab that at least long-duration missions up to three months were feasible and that we could actually perform and do useful things…[in weightlessness]. A lot of what we learned in the Skylab was then transferred over into International Space Station as we see it today.

BUTLER: Yet another example of applying those lessons learned, certainly, a few years later than it was for some of the early programs.

As you were building up in your training, how much training was focused on the different areas? Obviously, a lot of it was, as you have mentioned, getting used to the habitability, figuring out how the long term was going to work. Then what about for the experiments and the different procedures for what you were working on while you were up there, including the EVAs? How did all that training break down?

LOUSMA: We did have a broad spectrum of things to do, and there were just three of us to do it. I think we had some sixty-odd experiments, most of which were repetitive kind of experiments, rather than one-shot opportunities. So we had to learn how all of those experiments worked. We also decided that we were going to be cross-trained as much as possible. In the event that somebody was sick or incapacitated in one way or another, it was important that their job get done. So we were quite well cross-trained in everything on orbit, whether it was systems management, doing experiments, solar physics, earth resources, materials processing, all those sorts of things. We all trained so that we could all do those jobs, so that took a lot of training.

The experiments were one set of training exercises. Those were primarily in medical and earth resources and solar physics, in materials processing, in astronomy, and a variety of other odds and ends. We wanted to know as much as we could about all of those areas. So we got briefings, we learned from the experts what we were trying to achieve [with their experiments]. So it gave us a broad knowledge of a lot of different areas, which is what is so exciting about being in this program, is you learn about a lot of different things. We didn't learn everything there was to know about them, but we learned enough to do our job. We had to understand the principles behind these experiments and what the data was important for so that we could do a better job of producing it. So we learned a lot about the science of the sun or the science of the Earth and its resources or medical procedures.

One of the other things that I failed to mention earlier in preparing for a long-duration mission is what do you do about fixing things and what do you do about the medical problems that might occur while you're there? We became quite good at fixing things. We learned to fix some of the things before we left because we knew they were a problem. Other things that occurred on the spot, we would, of course, get help from mission control on, and they would throw the junk on the table like they did in Apollo 13 and say, "Here's what they have up there to fix this with. Now you figure out a way to do it, and we'll tell them." So we had some of those episodes. But there were a lot of things that were repaired that were not planned for repair before we left.

The other part that you need to prepare for on a long-duration mission is possible medical problems. You don't want to come home for a minor problem. You'd like to be able to fix it while you're there. So we had the equipment on board to do that. We had some medical instruments. We had some dental instruments. We had medications. We had a big book that we could use to track down what illness events there were. We would never, ever prescribe any medication or any treatment without conferring with the doctors on the ground, of course, and try [we would] to give them pictures of what we were doing.

We also had, of course, some microbiology, and we could stain slides. We could grow bacteria that were taken through throat swabs or cultures in [blood] agar [in petri dishes] and let them be subjected to different kinds of little medications to determine what kind of an illness that was so that we could treat it properly. We could stain slides of urine and stain slides of blood and read them with a microscope. We had an incubator where we could incubate these specimens overnight. So we learned to do all of that before we left so that we could treat illness events.

We were able to give a shot of epinephrine to the heart to stimulate the heart with a needle about that long [Lousma gestures]. We could give intravenous solutions. We could set bones. We learned how to suture wounds, how to treat eye, ear, nose, and throat kinds of problems. We also spent some time in the Saturday night Ben Taub [General] Hospital emergency room [in Houston] helping the doctors there treat emergencies as they came in.

We also went over to, I believe it was Kelly Air Force Base, to the dental clinic over there and went into the dental clinic with recruits lined up along the hall with dental problems, and we treated them. We…[all practiced tooth extractions on recruits that needed it, under supervision of course!] We sutured up the gums and [did] whatever had to be done. We made fillings. We could do [all] that in space. We didn't have to do too much of it. Nobody got injured too much. There was only one doctor on one of those missions, and that was on the first flight with Joe [Joseph P.] Kerwin, but I think that's what kept everybody from getting ill, because everybody knew that the other guy didn't know anything more about medicine than he did. [Laughter] So it was motivation that kept…[us healthy].

BUTLER: Big motivation.

LOUSMA: But that's one of the things that you need to plan for for a long flight, kind of like if you went on an expedition to Antarctica. You need to have medical attention immediately available as best you can make it. Otherwise, you need to be real careful that you don't hurt yourself.

So we did a lot of training for medical problems. We did a lot of training for space walks, of course. We had some things that we had to fix, that we knew we were going to fix when we went up there. We originally had planned to do three EVAs on our mission, one about ten days in[to the mission] to put new film in cameras in the solar telescopes primarily. Then we'd do that halfway through the mission and at the end as well. But we knew that we had to fix the shade over the Skylab [immediately]. We had some other things that broke that we had to fix while we were up there.

So we did a number of repair jobs during EVA as well. A lot of the space walk training was tailored from the first mission, between [missions], into the second mission, and a number of the things that were learned on the first mission that needed fixing, new training, additional equipment had to go up there. …We had learned everything that we needed to know up to about the time of the first mission. …[After the first mission,] we spent most of our time training on those things that we knew were different as a result of the first mission having flown.

So we trained for all of the experiments. We had an extensive course in solar physics. We had an extensive course in earth resource management, an extensive course in the medical aspects of space flight to take the data that we needed to get to understand what happens to the body in space. We had high school student experiments. We had metallurgical experiments with an electron beam welder and the combustion experiments to see what happens to fire propagation in spacecraft and weightlessness. We had a lot of astronomy to do. So we had all of those different kinds of experiments to train for.

Besides that, of course, most important was to get up there safely and back. So there was a lot of launch training, a lot of recovery training. What happens if the capsule springs a leak and tips upside down and the only way you can get out is by flooding the compartment and swimming out? We did a lot of training for rendezvous, of course, and for docking and all of the other operational functions that we had learned to do so well or at least our colleagues had during the Apollo Program. We now had to apply them to Skylab as well.

So there was a broad amount of training. We worked real hard at it. I think some of the most satisfying training that we had was the simulations that we had with the Mission Control Center, different segments of the mission where we could plug in the simulator with the control center, and the diabolical simulation supervisor was over there dreaming up problems to give us to make sure that we knew all we needed to know, and…the mission control [needed to know], before we left. So that was some of the more interesting and some of the best training that we had.

When we went on the Skylab, it was not as complex as the Shuttle. The Shuttle is a software-driven machine, and the Apollo is partially software, but most of the rest of it is just regular mechanics, like operating a car. Throw a switch and something happens, you read what happens on a meter. It's directly hooked to a sensor, and you don't have to go through multiplexers and de-multiplexers and computers and everything else. Pretty much anything that ever happened on the spacecraft we knew something about it, and we knew exactly what to do if everything was…normal, and we knew so much about the spacecraft and about the equipment and all of the other things it might do, that there was almost nothing that they could talk to us about that…happened in space that we didn't know [something] about.

So it was very extensive training, and we trained very hard. It was a real advantage to have Alan Bean as the commander because he had been through this once before and he knew exactly how to prioritize our training and what was most important and what wasn't and what to think of that nobody else had ever thought of. So that helped a lot.

I was mostly the systems guy and operated the systems on the command module as well as the Space Station. Owen was the science guy. He was the one who was most well versed in all the science that we did. All of us did all of those other things, though. He did systems and I did science and so did Alan. We all had a specialty before we left where we were the expert, but we traded and shared our knowledge with the others so that when we got in space anybody could do it.

BUTLER: Certainly useful. As you said, there was only the three of you and a lot of work to be done while you were up there.

LOUSMA: We planned to be successful, and we planned to stay there for the duration, and we were not going to let anything that had to do with training or any other act of preparation keep us from doing it.

BUTLER: It certainly sounds like you were well prepared by the time you did get up there. And you did face a number of changes along the way. As you mentioned, you would discover that new things needed to be done on the EVAs, for example, that you would then build into that training, and it all paid out well in the end.

One thing that I neglected to mention was the launch of the vehicle itself, of the workshop itself. Where were you during the launch, and when did you realize about its problems that it had?

LOUSMA: My wife and I went to the launch, as did my crewmates and their wives, so we watched the thing go, and it looked like it was good when it went past us. But as we listened to the banter in the control centers on the loudspeakers out there at the launch site, even, we could tell that something was wrong. So we got the word quite quickly as to what had happened and that part of the Skylab's outer shield, the micrometeorite shield, had peeled off [early in the launch], as had one of the solar panels, and the other solar panel was jammed. So we had a pretty good understanding of what had happened.

My view at the time was that I guess it could be worse. At least it's up there. It may not be able to produce as much power as we'd hoped, and it may be fixable, so let's figure out a way to fix it, and what can I do to help? So we all got busy on that. So rather than crying in our beer, we got busy and said, "Let's make this work." So everybody around the Space Center had the same idea. I mean, all the engineers and managers and technicians and everyone was focused on, "Well, we have a problem. We'll fix it. Let's understand the problem first." So we did.

I came to work the morning after I got back from the Cape, and Al Shepard said, "You're going to Langley Air Force Base, so put on your blue suit. There's an airplane ready to go. They're waiting for you. We're figuring out different kinds of fixes to cover the Space Station."

It had been determined that the outer shield, which is a micrometeorite shield to protect it from meteorite hits, when it got into space, it was commanded to pop [up] about [six inches on] mechanical lever[s] so that if a meteorite hit it, [the meteorite] would be broken into a lot of little pieces before it hit the hull. Well, that [shield] had come off. But that also protected the Skylab thermally, kept it from getting too hot inside. So it got real hot, and we had to figure out a shade.

There was a shade that was being devised here [JSC] and one elsewhere and one at Huntsville [Alabama—Marshall Space Flight Center]…and one at Langley [Research Center] and maybe another one somewhere [else], maybe three or four… The one that was developed here, of course, was called the parasol, and that was the one that was finally selected. Another that was devised at Huntsville, at Marshall Space Flight Center, was this twin pole sunshade, and that was taken up along with the parasol as the backup method, or the third backup.

Let me just go back and say that there was a two-pronged problem once the first crew was to get there. One was to cover and shade the spacecraft to cool it off, and the other was to get this solar panel that was jammed against the side of the orbital workshop sprung out so that the solar panels would extend and you could generate power. Of course, the other wing was gone. It was in the ocean. So there were two separate problems. Solving the shade problem, one of the fixes was the twin pole sunshade, but it was a backup to the parasol, which was devised here [JSC]. The parasol was just a temporary fix, so when we were going to go for the longer mission, it became clear that we were going to have to put the twin pole sunshade, which was already in space, over top of the parasol.

Another fix for the shade was done at Langley, and I was sent to Langley to work with them. It was an inflatable shade. It was a big sheet about twenty-four by twenty-four feet square, but it was made of layers, and it had air compartments in it that you could pump nitrogen in there and it would all unfold and expand and cover the spacecraft. I worked with the engineers there in developing that. In just three days it was built and demonstrated, at least on the floor, at Langley. It was packed up and sent to the Cape.

Rather than come home, I went to the Cape to brief [Charles “Pete”] Conrad [Jr.] and his crew on this particular fix. They were briefed on the others as well. Everybody got their heads together and decided which ones to use and which ones probably not. The inflatable one had certain deficiencies that were a concern that the twin pole sunshade and the parasol didn't have, so those two went [with Pete and his crew]. The first crew was able to put the parasol over, and you probably talked to those guys about that.

It was always felt that that material would, over time, deteriorate and lose its capability as a shade. It was very, very thin material. So the twin pole sunshade was decided on [as a more permanent repair]. It would be put out on our mission, and Owen and I got the job to do that. We trained for that in the water tank right here [and in Huntsville]. Some of our backup crew really helped develop it. Rusty [Russell L.] Schweikart, as a matter of fact, was probably the lead on getting the procedures established to get the twin pole sunshade up, under water at least, and then transferred the knowledge to us.

Then we went and did it a few times, and we got out in space and did it. Being in space, everything blurs together, all of those sixty days except for the space walks. All those days blur together except they're separated by the space walks, of which we had three. The twin pole sunshade had to go out early in the mission so it was approximately on Day Ten or so we went out and did that.

My job was to stand up at the apex of where this sunshade was fastened [to the Skylab]. It was made of two long poles. Each pole was fifty-five feet long. It came in [eleven] five-foot sections…. They were about this big around [(one inch diameter)]. When you got a hold of that pole, you could whip it like a fishing rod. There was some concern that it would be too whippy up there.

Owen was down by the airlock, and he had the poles and the pieces all down there. He would put them together and fasten them, he would send it up my way, and he'd put another piece on. Pretty soon I had this pole that was out there about forty feet, [oscillating back and forth,] and just playing with it a little bit. I was fastened with my feet in a foot restraint. I'm convinced that when you're in zero gravity, if you have a place to fasten your feet, you can move the world, so to speak. It's like being anchored on the ground with 1 gravity. It wasn't all that tough to do.

I had a fixture down there into which I put both of those poles in sort of a V fashion out…over the top of the [parasol and the] workshop. So I'm looking toward the back of the workshop sort of like standing on the locomotive going backwards down the track, going [forward] but looking [back].

LOUSMA: Then each pole had a rope on it kind of like a flag pole. In this bag below my feet, there was a big duffel bag so with this sheet in it that was about twenty-four feet square, and it had a hook so I could hook on the hooks on the rope. As I deployed this out of the bag, I could pull on the ropes and it would go out over the top of the parasol. I got this all the way out there, got it out of the bag, but it still had to go quite a ways on the ropes before it got to the end. I noticed that what was happening was that the doggoned sheet was not spreading out in a nice flat plane like it was supposed to. In fact, what it was doing was sticking together and was causing the poles to bend inward [towards each other], and it wasn't covering the workshop.

It turns out that this was made in a hurry, just made in a few days, and there were sections of this sheet that were fastened together with some kind of adhesive, and the adhesive had not had time to cure by the time they packed it in the bag. It [was] folded up like an accordion, and some of those seams were sticking to the accordion piece next to it. So it was all kind of clumped up.

If you look at the picture of the Skylab, you'll see the creases in that shade. It was pure white when it was put out there, but it got brown, a light brown, over the period of time there, being in the sun. So what I had to do was I had to [reel] all of this sheet [back] in toward me and separate all those folds and unstick them. …This thing was billowing up everywhere and just doing all kinds of acrobatics over my head in zero gravity and almost out of control, but it was still fastened to the rope. …Every time I'd touch it, it would do something else.

I was able to unstick those [accordion folds] and run [the shade] out there and got it to the very end of the poles. Then I had to take each corner that was nearest to me and unfasten myself and [float] hand over hand to the front of the spacecraft on both sides and hook it so that it would spread [squarely] rather than sort of being in a V shape. Then the whole apparatus could be rotated [downward] so it was just flush right on top of the parasol.

It worked, but there was one fold that I didn't get out. If you look closely at the shade on the spacecraft, on the Skylab, you will see that it's all kind of brown except for one area that is whiter than the rest. It's along one of the creases. It turns out that that was the one crease that I apparently didn't unstick. So it stayed stuck together like that for maybe weeks or months before it popped itself open, and it got less sunlight than the rest of it so it is white. Next time you look at it, that's the story of putting out the twin pole sunshade.

BUTLER: I will look for that, definitely. That is a very interesting story. Certainly quite challenging, as you described, trying to get everything all unstuck.

LOUSMA: It took about three hours. We could do it in about an hour and a half in the water tank, but when you do something on a spacewalk…my observation is that although you could do it faster, you do it more slowly because you want to make sure you do every step right. You check and double check, take your time, make sure you don't lose anything. If you drop it in the bottom of the water tank, it doesn't matter much, but if you drop it in space, that's not good. So it takes more time.

The space walks are just absolutely the high point [of being in space]. That's a pun, and no pun intended. It really is the most memorable part of being in orbit. It's just an unusual experience, in that when you go outside, it's [so much] different than being inside. When you're inside, you look through the window and you see [a small] part of the world. [When you're outside, you can see the whole 360° sphere and]…it's huge.

[Inside,] it's like a two-dimensional picture, as if you were going down the track in a train looking out the window at the scenery go by. But when you outside, you're dazzled by the brilliance of the sunlight, to begin with, and everything is glowing and glistening and gleaming, and it's very bright. But when you get out there, you have this whole three-dimensional perspective now that you didn't have inside, so now you can really sense the motion over the ground and your speed. But there's nothing flapping in the breeze, there's no vibration, there's no sound. It's like gliding along on this magic carpet, going into the sunset and…[into] the sunrise every hour and a half, sunrise, sunset, doing that for about six hours. It's just a remarkable experience.

The world looks like about this big. It's all round. From that altitude, about 235 nautical miles, but 275 statute miles, with the naked eye you could see freeways and cities and airports. You couldn't see a building, but you could see a city. You can see the rivers. For example, over Chicago you could see up into the middle of Hudson Bay, and you could see Washington, Baltimore and

New Orleans and Denver. You have this big, broad perspective, and you feel this thing really smoking along because you're outside with this whole three-dimensional view. It's just an experience you want to prolong if you can.

We had lights on the spacecraft so when we went into the darkness we could see what we were doing. I remember being out on the end of the Apollo Telescope Mount one time replacing the film, and it was sort of on the end of the spacecraft, way up there, and hanging on by one foot. We went into the darkness, and we must have been over Siberia or somewhere, because it was absolutely pitch dark. Here, gliding along at 17,500 miles per hour, 275 miles above the Earth, can hardly see your hand in front of your face, just hanging on by one foot. It's just a remarkable sense of, "Wow! I've never been here before. This is really exciting. I'm out here, just it's me, God, the spacecraft, and my buddies, and that's it." It's just a wonderful memory, a great sensation, I guess, to be able to do that sort of thing.

We tried to stay out there as long as we could. We wanted to use up all the six or seven hours that we were allowed, so sometimes when we were out there we would take our time more than we should. Because we weren't over a ground station reporting all the time, mission control didn't know [everything] we were doing…. Sometimes, if we were lucky, we could miss all of the stations for a whole revolution. We were just out there on our own. When we reported to them, we often reported, "No, we don't quite have that done yet," when we actually [were almost finished], just so we could stay out there longer. We just didn't want to come in on the space walks. So it was just a remarkable experience and the memorable part, I think, of being in orbit.

BUTLER: I certainly don't think anybody would blame you for wanting to stay out there as long as possible. It certainly sounds like an experience that would just be tremendous.

LOUSMA: It was.

BUTLER: Hopefully, some day more people will have that chance.

LOUSMA: Well, a lot of them are doing it now, gee, with the Space Shuttle, all the space walks, and much bigger structure and very complex jobs. There are going to be more of them as time goes on. Even after the Space Station is built, there's going to be a need for more of that. So we're well prepared for it.

It's one of the things, by the way, that Skylab did add. In the Gemini Program we found that there was a lot we didn't know about…[doing zero-g] space walks… Gemini XII, I think, was the first Gemini flight that really made a mission task to try to understand how to…[perform better zero-g EVA's]. It was about that time that we started training in the water tank and so forth. [So in Skylab, we were well prepared for EVA, and we validated our new EVA training techniques].

So there was a lot we didn't know about being weightless, even in the Skylab, and we were therefore, I think, more well prepared. That made the space walks go well. We [worked] hard to understand what happens in weightlessness, what we can do and what we can't do, how to make the equipment so that you can't possibly fail to get it done. A lot of thought went into that. We were able to demonstrate then in Skylab that with the proper equipment, proper training, knowledge and understanding of procedures, that we could do all the great things that are being done in Space Shuttle [EVA's] today.

BUTLER: And will hopefully continue now, as you said, with Space Station going on and getting more complex, bigger structures. They have very valuable experience to build off of.

Before you can do the EVAs, you have to get to the Space Station. If you could you describe some of building up to the launch and your arrival at Skylab and some of your impressions once you got there.

LOUSMA: Well, Alan and Owen and I trained for the Skylab mission for two and a half years. It seemed like a long time, I guess, but it actually went by quite quickly, and all of a sudden here we were. We were getting in this little bread truck that was going to take us out to the launch pad and this was no simulation. This was no drill, you know. This time it was for real, all of the flashing lights and the checkpoints you had to go through.

I remember getting up on launch morning, and the doctors check you over, you know, to make sure you're still warm. You have your steak and eggs breakfast that we had at the Cape that was traditional, and then we went into the room where we got suited up. I remember on this day that the technicians that would put the electrodes on for the biomedical experiments and others that would get you in your spacesuit and make sure it didn't leak, they were a little more shaky this morning than they ever were before. They weren't saying much of anything because I think they were afraid they would disturb you. So you could tell that they knew that this was the moment of truth, and it was quite clear that this was the day we were all waiting for.

So we got in the little truck that took us out to the launch pad, and it became even more obvious. Once we got out to the launch pad, it looked a lot different than it ever had before because there was nobody there. Usually it's a beehive of activity, people working twenty-four hours a day with hard hats and things going on. But here's this big beast out there steaming, with the liquid oxygen boiling off in the searchlights, and you three guys in the white suits get down at the bottom of the elevator and say, "Wow, I'd better get in there where I know what I'm doing before I change my mind." But we were just eager to get there.

They dropped us off, and we went up to the top of this thing. There were a few people up there, maybe three or so, Guenter [F.] Wendt and a couple of others, to strap us in and to make sure that we were all suited up properly and then close the hatch behind us. I guess I was the last one in, so I had a chance to stand on the gangplank, the walk that takes you out to the white room, and look down for a while at the Cape and all the searchlights below, and boy, was this the absolute 2001 experience. Here we are in 2001, by the way. At that time, that seemed like eons in the future. This was really spacey.

So we got in there, in the spacecraft. They closed the hatch and went away. So we're out there on the launch pad all by ourselves now and we can feel the [rocket sway] in the breeze a little bit, and we're hoping for good weather. We're there about two and a half hours before liftoff, helping the ground crew check out the spacecraft. I fell asleep for a little while. It was early in the morning, and I was awakened with my next task.

Right at liftoff, with the Saturn rocket, there was a heavy vibration as it lifted off. That kind of damped out, but as we went up, it was a ride that you could feel chug a little bit every once in a while and we really started to feel the acceleration. It got up to about four and a half Gs.

Of course, the launch is a little different in terms of staging than it is with the Shuttle because the Shuttle's engines are always going from liftoff. The liquid hydrogen and oxygen engines are always burning, and they just drop off the solids and continue on up, whereas with the staged rocket [like the Saturn], before you can light the second stage, the first stage has to be shut down. So after this tremendous boost, all of a sudden the engine shuts down, and you're coasting there for a while and say, "Gee whiz. I sure hope this next [stage] lights." You can feel the [detonations] occur as the explosive charges break the first stage away and separate the skirt around the engines. I remember seeing a big circular fan of debris going in all directions, sparkling in the sunlight from that explosive [discharge]. Then the second stage lights and you're on your way [again].

At some point up there, we had to get rid of the launch tower. We had a launch escape tower on the command module that was up above us. It had a conical-shaped blanket that went around the spacecraft to protect it from the atmosphere or the wind as we were going up. You could only see out of one window, and that was the hatch window. Otherwise, this blanket covered the other four windows. So when we were at a certain altitude, we jettisoned that [escape tower with]…a switch, and the thing lit off as the rocket itself, and it took off like a scalded eagle, went way up there and carried this blanket with it. Now we could see all over, but remembering that thing going on its way was a memorable [event].

It took us about ten to ten and a half minutes to get to orbit with the Saturn. We circularized our orbit, and we then took about seven and a half hours to rendezvous. We rendezvoused with the Space Station, the Skylab, over the Amazon River. I remember I took pictures of it. I was the photo guy for the docking. We flew around it.

The parasol was on it. The first crew had put the parasol on. It was a kind of flimsy thing. As we flew around it, we noticed that it was flapping in the breeze. Perhaps you've seen the pictures. It's the exhaust from our thrusters that [was] causing it to do this. We were afraid we were going to blow it [off], so we suspended the fly-around and went in and did the docking, but I remember that it was done over the Amazon because of the great pictures of the Amazon River just behind it.

We got our spacesuits off. We got inside this big tank. I noticed I wasn't feeling very well in a short time. We hadn't spent a lot of time in…[a] volume [this large]. It was mostly in confined quarters where you don't have to move very much. But now we were climbing out of the command module and going through the tunnel into this big volume, and we had all kinds of room to operate in and move around in, and suddenly I feel, "Boy, I don't feel real good." None of us felt very well. We had anticipated this might be a problem before we left, so we did a lot of training in a rotating chair on the ground before we left, making head movements until we were just nauseous, just on the edge of nauseous, so that we could condition ourselves.

Actually, on the ground we were one of the most resistant crews to that kind of experience, but when we got in there, we were one of the least resistant. So we moved slowly for a couple of days. My observation was that whenever I felt ill, I'd just stop, shut my eyes, and my gyros would unspin, and then I'd go to work again. I'd just keep doing that, and pretty soon, in a day or two, why, that feeling went away. It slowed us down a little bit to begin with, but we managed to get the job done.

One of the things that we realized once we got there was that we had over-prepared for mobility or getting from place to place and moving packages in space, because we found that taking packages out of the command module and gliding along with them and pushing with one hand and holding on with the other was an easy thing to do. We didn't need any special tracks [for moving large boxes,] so we didn't take any either, but it turned out that we did take a fireman's pole. Perhaps you've heard of that. The fireman's pole was fastened to the top of the orbital workshop down to the floor, which maybe was about [thirty] feet, so that we wouldn't have to drift [uncontrolled] through this big volume from the open hatch above down to the living area. We decided after using that fireman's pole for about half a day, we found out it was just in the way and we didn't need that. So we packed it up and put it somewhere. I don't remember where it was, and we never saw it again. Every time we moved from the dome of the hydrogen tank in which we were living down to the living area, we just did it by pushing off with our feet and gliding to where we got and stopping where we wanted to.

After we were there a few days, it was instinctive for us to float. We never thought about walking. We could spin our bodies and arrive pretty much where we wanted to with our hands and feet ready to stop our motion. If we had to spin a little faster, we just tightened up into more of a ball. If we [wanted to spin more slowly to plan a better arrival,]…we could spread…[our arms and legs to slow our spin rate] and we'd arrive where we wanted to [on our feet] just like a cat. So it was instinctive to float. It was a very relaxing, pleasant, comfortable feeling. We really enjoyed being weightless.

After we'd been there a few days, we could do these flips and tumbles all day long. We never felt ill. We could do the rotating chair like we did on the ground and we never felt sick. We got to feeling better and better and better, and there came a time after a couple or three weeks when I felt as good in space as I'd ever felt on earth, and that wasn't really something that we knew before. Now, the first guys had gone up for twenty-eight days and seemed to tolerate it okay, but we were going to extend beyond that, and the doctors on the ground really didn't know if we were going to be able to withstand this either. So every seven days they made a new decision whether or not to keep us there seven more days. They would look at all the medical data that we sent down. We did medical experiments every three days, and they would look at the information and, working with us from the ground, decide whether or not we could stay for longer. So we did, and we stayed for fifty-nine and a half days.

About Day Forty, we asked if we could stay longer. We knew that the third flight was supposed to be fifty-six days, and we wanted to make sure that we stayed longer than they did, so we asked for an extra ten days. The reason we picked ten was because [every five days] we were over the landing site and we did the same track over the ground…. As the world turned and our orbit recessed and so forth, it took five days to get back to the same place. So we asked for ten days.

The ground deliberated on that and kept us in suspense for about a week. They came back after about a week, when we had about another ten days to go, and said, "You guys have used up all of [the] food and water that belongs to you, [and] all your allocation of film and tape for the earth resources equipment. All of your consumables you've used up. So we're going to bring you back." When they said that, we said, "Well, all right. Let's get it done and go back." But we would like to have stayed longer if we could. We really enjoyed being there, and we got along famously before, during, and after the mission. It was just a remarkable experience for all of us.

BUTLER: It certainly sounds like it from what you've shared with us.

In fact, early on in the mission, you experienced some leakage in one of the command module, the RCS [Reaction Control System], thrusters. That actually, at one point, did have some threat of possibly making you come down even earlier. [Recording interrupted]

BUTLER: We were going to talk about the RCS problem on the command module and how, when the problem arose, there was actually a possible threat of having to bring the crew down early and run a rescue mission, in fact. Could you discuss some of that problem, how it arose, what some of the discussions were surrounding it, some of the concerns, and how that eventually worked out so that you were able to stay up there for your full mission.

LOUSMA: I don't remember how many days it was into the mission. It must have been about ten or so. It was seemingly after we'd gotten up in the morning, whenever that was. We worked on Houston time. There is no morning or night in space. It's [a day-night cycle] every hour and a half. You have to sleep fast and wake up! We stayed on Houston time so that it would be possible to staff the Mission Control Center with lots of people during the day and just a skeleton crew at night to watch it. So it was morning here in Houston when this happened.

We were, I believe, either coming into sunrise out of the darkness or just had gone into darkness, at a point where it was dark on the ground, as I recall, and dark all around, except the sun was still shining on the spacecraft. …I looked out the wardroom window, and it looked like just a shower spray of something moving away from the spacecraft. About the same time, the caution and warning lights came on, the caution and warning tone inside the spacecraft.

So we deployed [to our stations] the way [we trained for] you do under those conditions. I don't know who went to the command module, but we found that the problem was an RCS light, that there was a leak. We could see [the quantity] going down on the meter. So we shut off all the valves and made sure everything was secure, just closed up all the plumbing, and reported it to mission control. I don't know if they'd had any prior knowledge of this or this had happened outside of communications with them, because as I mentioned before, we weren't always in communication with the ground, only maybe thirty percent of the time, as a matter of fact, on an average per revolution.

So they were made aware of the problem, and it turned out that we had lost half of our propellants to get home with. Of course, we have to use some of the RCS to control the spacecraft during the de-orbit burn. Before you jettison the service module, you have to use the RCS to control the attitude. We had planned to do a two-stage de-orbit. That is, we would back off from the Space Station and fire the main service propulsion system engine to lower our orbit on one side and then later on lower it again to do the reentry. So it was a two-stage process, and we needed a fair amount of RCS fuel to do that. It's not a matter of keeping RCS and using it all before you come home; you need something to get home with.

So the mission control team set about to help understand where this leak was, and I think we participated with them in that process. By going through malfunction procedures, they were able to determine where the leak was, and they were able to duplicate the problem on the ground, I think, and isolate it to some of the [B-nut] connections…I believe, where the probable leak was, and were able to determine which thruster quadrant it was and which control parameters of…the command service module would be affected most.

They weren't exactly sure whether or not we'd have another leak. If we had another leak, we sure wouldn't have enough to get home. It was this, I think, that caused them then to position the rescue vehicle on the launch pad, another Saturn I-B with the command module on top, and it would have been manned by two astronauts. Bean and I had worked on the rescue configuration of the command module before we left, because we were the most likely to have to go and rescue someone. If Pete's crew had to be rescued, we would be the ones who did it because we were primed for the next mission and ready and trained to go.

So Al and I worked with Rockwell and the NASA engineers in configuring a command module that had two flat couches underneath the three couches on top, and that would handle five people, two that went up to make the rescue and then five that went back. In the center between the two people on the very bottom floor, on the bottom bunk, so to speak, in between there was enough room to put some of the experimental data and other kinds of things you'd want to bring back for data reduction and for at least understanding as much as you could.

That was all prioritized, the medical experiments, the tape[s] from the earth resources package, some of the samples from the metallurgical experiments, as well as medical experiments. So there would have been two astronauts who would have flown up, one [in each]…of the outside couch[es to make] the rendezvous and the docking. All five of us would have then piled into the command module as it was and come home.

So it took about thirty to forty days from the time that that launch vehicle got out on the launch pad to do the test and checkout that we normally do and to activate it. So even if they had planned to come get us, it would have taken them thirty or forty days. So it was important to start early.

Meanwhile, they also deduced that we had enough RCS propellant in the event that we didn't have another leak to come home if we only did a single-stage burn to come back. Rather than the two-stage reentry burn, we were going to do just the single stage. So if there had been more leaks, the rescue crew would have come up. If there were no more leaks, then it could stay on the ground and we'd come home normally. Fortunately, the latter is what happened.

Meanwhile, it was not all that big a deal to us except that the biggest concern we had was not whether or not we were going to get home. We figured there would be a way to do that. The command module sitting there with a little less propellant was not a threatening thing. We could continue working in the Skylab space station doing our normal daily activities and continue on until the decision was made as to what to do. Even if they were going to launch a rescue ship, we were safe. There was no chance of fire, no increased chance…of losing pressure within the spacecraft. So those are the two things you need to keep you alive. We had plenty of food and water. The biggest concern we had was that we were going to have to shorten our mission and were going to abort the mission and come home early. I think until they told us after ten days or so that we could stay and get our job done, why, we were most concerned about having to come back empty-handed, the biggest fear.

BUTLER: I could understand why that would be your biggest concern, certainly. You certainly want to stay up there, and you had trained for this mission. You wanted to get a lot of valuable work you were wanting to do and it was an exciting opportunity, too.

During the time up there, was there any sort of a typical day that you would have that you could describe to us? I know that you said it all kind of meshed together in between the EVAs. What sort of pattern would the day follow?

LOUSMA: There was a typical day. We had a flight plan like that [(thick)], of course, with every day in it, but when things don't work as well as you want to or some experiment has a problem and you have to fix it and use it later, the folks on the ground, the flight activities officers, all get together and decide what the priorities are, talk it over with their principal investigators on the ground, make sure everybody gets at least a piece of something. So that changes the whole routine.

What we had, of course, was a teleprinter, and the flight planners on the ground would plan the next day's activities for each individual person during the night while we were sleeping, and then they'd send it up on the teleprinter in the morning. It was a little strip of tickertape paper, sort of like on an adding machine, about that long. It was heat-sensitive paper, so they could write on it what they wanted to.

Each of us carried a little notebook in our back pocket. I carried a blue one because I was the pilot, and the commander carried a red one. We were red, white, and blue. It was the food we ate, the equipment we used, in those color codes. I had this little blue book, and it was fashioned so that I could put these tickertape pieces in it of everything I was supposed to do the following day. The other two guys had a similar kind of thing for what they were going to do. Sometimes we worked together and sometimes we wouldn't. Sometimes there'd be three of us working together. Often we'd be working individually on three different things. So it was an enormous planning chore, and sometimes that tickertape got very long.

My job in the morning, one of the jobs when I first got up, was to go to teleprinter and get that piece of tickertape. Sometimes it was thirty feet long. It was as long as the normal workshop sometimes. With the scissors, I'd cut it all up in pieces and distribute everybody their piece of work. We'd look it over, and like I said before, we all knew so much about the spacecraft and the mission and all the equipment in it, that the fact that it was done differently every day didn't even matter. We'd just pick it up and say, "Okay. I know all about that," and we'd get to work. So that was one of the first chores of the day.

We'd usually be awakened after about six hours of sleep or so, sometimes with music and other treatments by the ground, appropriate for the day, of course, and always exciting to understand what that was or look forward to what it was going to be. So we'd glide out of our sleeping bags and sort of get our clothes on and rendezvous somewhere there, usually around the kitchen table, and start having breakfast. Sometimes we had breakfast together, sometimes we didn't, because sometimes the sun was up and we had to get somebody on the solar telescope right now, right at breakfast time. So it was a little haphazard in eating breakfast.

We all ate what we were supposed to eat. We had a very well-defined menu. You've probably heard about this before, that we had certain food items we had to eat every day, and it was according to a menu that repeated itself every sixth day because this was part of a metabolic experiment to understand how the body metabolizes food in the weightless condition for a long period of time. So it was pretty well understood what came out of the food locker every day for each one of us. We would each get busy and get that out and start working on a little bit of breakfast.

We also had to brush our teeth and shave if we wanted to and take care of the morning duties, weigh ourselves every morning with the mass measuring machine to determine how much we weighed if we were on the ground, and go off and get the tickertape and spread it out. So that was kind of the beginning of the day, the post-sleep checklist, and also arousing certain systems in the spacecraft routinely that would shut down overnight.

Then we would have somebody on the solar telescope anytime the sun was out and we were awake. It could have been Al or Owen or me, any one of us. That was all preplanned, however. So as we went around in orbit, we were going around the world every ninety-three minutes, and usually about sixty minutes of that was in the sunlight and thirty to thirty-three minutes was in the darkness or the shadow of the Earth. So for sixty minutes in every orbit we had somebody on the solar telescope unless we were all tied up doing something else.

Then we would also, every third day, do our medical experiments. We didn't have to do all medical experiments in one day, but we'd do the lower body negative pressure and ergometer and so forth one day and the rotating chair and other things the next day. But we had to do our medical experiments every third day.

We also had the earth resources experiment package to look at the earth and its resources so we'd understand how to manage them more effectively and more efficiently. When we did that, we usually did that for about three revolutions in a row [and] the solar telescope wasn't used because it took all three people to operate [the earth resources] equipment. So there would be some of that interspersed in the day, there would be some experiments that would be done on the metallurgy suite of experiments, the electron beam welder to see how you could weld things in space, and so forth. We had some student experiments. The experiments were mixed in every day depending on how every principal investigator's experiment was moving up in terms of being finished, and you'd try to keep them all together [in terms of forward progress].

Other things we did had to do with the manned maneuvering unit, the flying backpack that is now used on the Space Shuttle. The first one was used in the Skylab Space Station. [The station] was big enough so that we could fly [the backpack] around [inside of] it. It was the forerunner of the one that's used out in spacewalking today with the Shuttle. We thought it was a good idea to check it out inside before we took it outdoors, and that's what we did. This particular one had actually more control modes in it than the current one does. It was just to see which kind would work the best, and we picked the two best out of three and put them in the [Shuttle maneuvering unit]. So there were those kind of experiments.

There were other ones that we put in the scientific airlock, one of which was pointed at the sun, had the parasol in it, so that [airlock] was no longer of any use, but the one that faced toward the Earth, we could put other experiments out into space through that scientific airlock and operate them. So there were all those experiments that were blended in every day in different order every day, but carried on through for essentially the whole mission.

Then there was a certain amount of photography that we had to get done. There was an Earth observations program that was devised on our mission. You [asked] what we contribute[d] to Skylab. We [became] so efficient working in space that we got things done a lot more quickly than the ground had expected, and so we had time left over.

We wanted to be busy all the time, so…after ten days we did an assessment of where we were compared to where we were supposed to be, and we found out we were behind. So we decided that we were going to end up ahead. We weren't going to take any days off. Instead of taking every seventh day off like the Lord did and rested, we were going to have to work. So we did. We worked right on through.

We got so efficient at doing these different tasks that we knew exactly where everything was or we didn't have to refer to the checklist in so much detail sometimes, and we could get these things done so quickly after we'd done them once or twice that we actually got ahead quite quickly, and we ended up doing 150 percent. …[We added more of out planned tasks and added some new tasks].

One of the things they added was the earth observations program to see what you could see with the naked eye from space, look for something that was on the ground that they would tell you about and where it was, observe it, document it…write notes, take pictures…how was it different today than it was yesterday, looking for things in the ocean, looking for things on the land, looking for things that had to do with weather, all kinds of different things just to see what the human observer could see from space and try to calibrate it and document it and define it. So we did quite a bit of that.

That was an add-on. We created that sort of experiment while we were up there, and we did that routinely, almost every day, and that became valuable enough that they made [it] a defined experiment or a part of every mission after that. I think still it's probably being done on Space

Shuttle. We did it on STS-3. We had done earth observations, a programmed set of observations that we were asked to make. So that's another thing that we were able to [contribute on Skylab].

Those are the kinds of things that we did. We seldom ate lunch together, or we seldom ate it on time. We also had to do exercise. We exercised for an hour to an hour and a half every day. We found that if we didn't exercise that much, that we didn't feel quite right. So we exercised, usually on the ergometer bicycle that we normally would use for medical experiments. We used that for exercise as well. Then we had some other exercisers, bungies that you could pull on to strengthen your upper body. We had one that was a rope around a drum with a spring inside of it. You could set the tension on it and fasten it on the floor or the ceiling, wherever you wanted to, and pull on it, and then it would reel itself back in. The tension was like weight-lifting. Or you could put it up above and do this [(chinups)]. So we had all those kinds of neat things to do, a hour and a half or so with exercise every day. We usually didn't do that on time either, [but we always did it, even if we had to stay up late].

The things you needed to do the most to prolong your life on Skylab were the things that got the least priority: eating on time, sleeping on time, exercising on time. All of those things we got done. We made sure that we didn't go to bed, we would never quit, until it was all done. We [seldom] left anything until tomorrow. The three things you should do the most, we…worked around to get all the experiments done. But we would eat on the fly, for lunch for example. Sometimes lunch was postponed till three in the afternoon, so we had a close dinner. But we were usually at a point in the evening where we had things under control. A little more work after dinner, and we could get it all done before we went to bed.

So we usually ate together and shot the breeze and told sea stories and lies to each other. We never lost our sense of humor. We always had a good time up there. We always enjoyed being there. I think the thing that made it the most enjoyable was that we knew we were doing well and we were getting our work done and we were contributing something that was worthwhile and we were getting the next guys ready for the next flight. I think that's real satisfying, to be able to get your job done.

When we got back, I remember when we splashed down on the water, I was one of the most contented guys in the world. First off, I was alive, and, second, we had gotten our job done. It's the most rewarding professional experience, I guess you might say.

I hope it kind of helps to understand what a day looked like. Finally we had to go to bed. Al was real good at acrobatics. He was a gymnast in college. So he's the guy you see in most of the pictures doing the acrobatics up in this big volume, and all the spins and tucks and turns and stuff. He's really good at it. Owen and I would often save our dried strawberries from our cereal in the morning and our ice cream for dessert at night and have an ice cream sundae and just look out the window. We never tired of looking out the window. We never had enough time to do it, but we never, ever tired of it, and we always spent as much time as we could looking out the window at the Earth, at the northern lights, the auroras from both the southern lights and the northern lights. Owen was particularly interested in them because he's a scientist, and he must have used up several hundred miles of film taking pictures of them. Really fascinating.

To see the Earth from space is just remarkable and to see all the places you'd like to go and visit sometime. I've traveled widely since then, internationally, and often I tell folks, "You know, I've been within 200 miles of this place 800 times, but it sure is great to be here for real." So it was a real lesson in geography, too. It got to the point where you didn't have to look at the map to know where you were. You'd just look out the window and say, "Oh, there's the Amazon," or, "We're over Siberia," or, "It's China," or the United States. Just by looking out the window you had a feel for where you were. So it was just a remarkable experience, and I'd take the long flight anytime.

BUTLER: I think I would, too. I think I would. I can't imagine how anybody would ever tire of that view and of everything that could just be experienced that way.

I think we're probably at a good point to go ahead and stop for today. I certainly thank you for sharing everything that you have with us.

LOUSMA: Sorry I've been so long-winded. I told you I was long-winded.

BUTLER: Oh, no, no. Nothing to apologize for. It's been very interesting. I've certainly learned a lot from it, and I appreciate the opportunity. You say you looked forward to going to work every day, and I can say that I'm fortunate enough on this job to be able to do that, at least get to share a little bit in these wonderful experiences. So I appreciate your sharing that with me and with all of us today.

LOUSMA: I'm looking forward to hearing what everybody else had to say, because I know there are some things there that they observed that I didn't. It's just like history anywhere, if you get enough people together, they all say, "Gee whiz, is that why that happened?" I think it's maybe more probable or prevalent with the politics of how all this happened and what people were thinking and what they were doing, not necessarily just the politics either but the rationale that went into certain decisions that I may not understand now and obviously didn't at the time, but if I look back on what they say, I would be able to put more sense behind what I don't know or experienced or always questioned. So I think from that point of view that piecing this whole puzzle together is real important, to get a lot of people's inputs.

For me, just to talk to my colleagues, the other people in the space program, about a certain era, they will mention something, and I'll say, "Oh, now I understand why this happened or why it was done this way." So it's really an important thing to do, and I hope that people in the future will profit from it. I'm sure they will.

One of the disillusionments I had when I was working with the contractors that were helping NASA devise the Space Station, develop it, was that the people who were doing that development for the Space Station the way you see it today were mostly new people, and rather than going back and reading about all the lessons learned, which is really well documented, a big library—I think NASA did a wonderful job and so did the contractors of putting together the pieces of the Skylab that we're talking about now, habitability, how do you live and work in space. It's all written down somewhere, but these people never refer to it.

I would go to these factories, or these companies, and talk about certain elements of design that were important especially to the crew in habitability, living and working in space. They would be asking the same darned questions that we had answered fifteen years ago. It's like training people all over again. It was disappointing to me that there wasn't more study of all of the record. So this record you're making will maybe be not as useful in that arena, but may be in lots of other arenas [instead].

BUTLER: We certainly hope so. I guess in your example, it's fortunate that you were advising them and that you could give that guidance built on those lessons learned, since that was a hole that had been missed in their preparations. You were able to help fill that.

LOUSMA: That's one of the questions you had in there later about the CAMUS [Inc.]. That was Jerry Carr, really, and then he joined people with him to help devise Boeing's version [of the space station]…. So that was a valuable thing to do. I think he found the same thing, that people weren't reading the books.

CAMUS, by the way, was not my company, and it wasn't Bill Pogue's. It was Jerry's. CA is for Carr, and M-U-S is for Musick, his wife's maiden name, CAMUS, Inc.

Jerry, being an entrepreneur, he put together a team to—I wasn't a partner in the company. I was just asked periodically to join them for certain elements on an advisory basis for the Boeing people. Bill Pogue was more regular than I. He was one of Jerry's more frequent contributors. I was an occasional one. We did that for Space Station. We also did that when Boeing was looking at the various scenarios on the trips to Mars, whether to go to the Moon first or whether to go direct from the Space Station or direct from the Earth, the different scenarios. So there was an operational part of that that astronauts could contribute to. So that was another thing that Jerry's company did.

He had more people besides Bill and me, people who were engineers and who were in mission control. He'd call on them from time to time, depending on what Boeing wanted to know.

BUTLER: It certainly sounds like a very important role to be filling.

LOUSMA: It's fun to do, because you only do it for a day or two and then you go do something else. At that time I had about six different jobs. This was in the late eighties. I worked with the European Space Agency quite a bit, too, helped train their German astronauts, helped with the Hermes Space Shuttle that they were designing. They didn't have any astronauts who had an operational or a piloting role. They were all scientist-type people or pilots who had gone along in a non-flying role. So we've had an opportunity to contribute in a little way, anyway, and had fun doing it.

BUTLER: That's one of the important things. You should always be fortunate enough to enjoy what you're doing.

LOUSMA: Well, you need to go home and get well. The rest of us need to go home and get dinner.

BUTLER: Go home and visit with your family.

Well, thank you for doing this.

LOUSMA: Not at all. We can either continue on some other time or not. Don't be afraid to decide not too. You won't hurt my feelings. I'm glad to contribute how I can.

BUTLER: Providing all goes well with the project, we'd certainly love to follow up because there definitely are areas that we weren't able to get to.

LOUSMA: We got through Skylab pretty much.

BUTLER: Pretty much.

LOUSMA: There's ASTP, and then there's the Skylab rescue and the Shuttle, Space Station.

BUTLER: And we would like to talk to you on some of your consulting work because that certainly is applicable for today's work, definitely. We can visit it on that.

LOUSMA: Make another session. Okay.

BUTLER: It'll take a few weeks to get all of this put together for you. It'll probably take about six weeks.

LOUSMA: Okay.

[End of Interview]