

NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT

ORAL HISTORY TRANSCRIPT

JOSEPH P. ALLEN
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is January 28, 2003. This oral history with Joseph P. Allen is being conducted for the Johnson Space Center Oral History Project in Houston, Texas. Jennifer Ross-Nazzal is the interviewer, and she is assisted by Sandra Johnson and Rebecca Wright.

Thank you so much for taking time to meet with us this afternoon. We know you have a busy schedule.

ALLEN: Only because you guys make me busy. I'm happy to be here.

ROSS-NAZZAL: How did you learn that NASA was hiring a new class of scientist-astronauts, Dr. Allen?

ALLEN: I had been a graduate student at Yale University [New Haven, Connecticut]. I was close to finishing a Ph.D. It was 1966; there [were] some small news articles about NASA having selected a few individuals [to be astronauts] who were not test pilots, but rather were scientists. I was intrigued by that, not because I was interested, but just as kind of a curious thing. In my recollection of it then, the middle 1960s were troubled times, but maybe one possible bright spot was this Apollo Program. It was clearly dangerous, it was adventuresome, and if it worked, humankind would actually set foot on another planet. And to me, that was most interesting.

ROSS-NAZZAL: Were there any potential advantages or drawbacks that you considered when you were applying for the program?

ALLEN: Jennifer, I maybe should be embarrassed to tell you [this]. I saw some kind of a notice on a graduate school bulletin board that anyone interested [in NASA] should write. I was not interested in becoming an astronaut, but I was [very curious about] the process that they were going to use [to select these people]. So I wrote out of a curiosity, not out of an interest in the job. I was quite keen on the adventure of people going into space, and it was great fun to watch on TV, but I had no real intent or even [hope] of doing that. Like were I to buy a lottery ticket today, I would not expect to win the lottery.

ROSS-NAZZAL: You were actually planning on becoming an academic?

ALLEN: I was on a very good track to go on as a junior faculty member at a university and become a teacher of physics. I liked physics.

ROSS-NAZZAL: Tell us about the application and the interview process.

ALLEN: The application itself, I don't even exactly remember what I wrote. I think I filled out a form and sent it in. Then I physically moved from Yale University to the University of Washington in Seattle [Washington] and forgot about it. On or about the 29th or 30th of January in 1967, I got a communication from NASA, "Dear," and my memory says it's almost like, "Dear Occupant." It probably said, "Dear Mr. Allen: You have expressed an interest in pursuing this, and these are the next steps."

Someplace in it—and again, my memory hangs on to the thinking that in the communication to me there was a kind of a rhetorical question, "Are you still interested in the job?" A reason I remember that is the timing of my receiving [the letter]. And it had, by the way, been sent to New Haven and forwarded [to me, thus the letter probably had been posted]

three weeks earlier. A couple of days before I [received the letter, NASA had experienced] the terrible [Apollo 1] fire and killed three astronauts. When one read the words in the context of that fire, it was really [a] macabre communication. One could even say, “We have a few new openings. Are you still interested?”

Partly because of that, I was a little bit secretive and kept my continuing curiosity from my wife, because we had moved and set up new households there, but I did write back and say, yes, I’d be interested in seeing an application form, and they then sent one. ... I have no idea what was in [the application], but I filled it out and sent it back. ...

NASA only [selected] scientist-astronauts [twice]. These were people [who] were not professional pilots [but were scientists], but it was the NASA’s intent to make them professional pilots. ... Again, if memory serves, [these candidates] were to have the qualifications of a Ph.D. or equivalent in a science.

One, again, can look back at NASA records, but my impression is it was the conviction in the minds of those that ran NASA that Apollo would succeed. They, the agency, would have plenty of money left over to build laboratories to go into space, and they needed trained scientists to go into those laboratories in addition to test pilots. So they had set those wheels in motion starting in ’65, and then in ’67 to recruit some scientists.

Again, my understanding was the first people that looked at these applications was the National Academy of Sciences, and I think part of the reason for that was NASA in those years was taking an increasing amount of political heat, from scientists that were saying, “This is not a scientific undertaking at all. It’s just a crazy Cold War boondoggle, and you, NASA, say it’s for science, and we, the scientists, don’t believe you, because there are no scientists involved.”

So NASA said, “Why don’t we maybe hurry this up and bring some scientists in here. In order to make the scientific community feel better, we’ll make them a part of it.” Now, this is a little Machiavellian thinking in my mind, but it’s very plausible that [NASA had such a motive].

The National Academy of Sciences must have had a board that looked at the scientific

credentials of the applicants and selected some they thought were scientifically qualified. ... My memory is something like they had about maybe 14,000 applications in those years, but the National Academy of Sciences forwarded only maybe a thousand to NASA. And unbeknownst to me at the time, mine was one of them

Then, again, Jennifer, in my very mature years now, I realize I've had a policy all my life, if something good happens to me, I never ask why. I've just sort of been quiet for fear there was a typographical error. I didn't want it discovered.

But I was contacted in the spring by NASA saying that they now wanted to actually talk to me. Again, in my mind, I think what had happened, the National Academy had sent back maybe a thousand, but then NASA, with different eyes, looked through the thousand, and probably did a Duane [L.] Ross-type selection, which is, "Well, this guy may be qualified, but he's also sixty years old."¹ So they were moving a lot of applications off the table, unbeknownst to any of us at the time. But I was young. I also had been involved in athletics and things like that. Again, NASA, I suspect in those years, was looking at that sort of thing. I don't know, but I think they may have been.

I was then brought in for this series of interviews. I think—and you might help me out here—I think the first one was we were taken to Brooks Air Force Base [Texas] and put through a weeklong set of [very intrusive] physical exams. [Thus] my curiosity had [gotten] me into a bit of hot water, because now I was learning more about this than I maybe was actually interested in.

...

And at the end of that week's time at Brooks, I did write a letter to my family saying I'd done this, and that I was sure nothing would come of it, but that it was okay because anyone who would knowingly subject themselves to that kind of a physical examination should automatically be disqualified for mental reasons, which is kind of how I felt about it, and to this day still do. I don't know exactly how NASA justified a lot of the physiological tests, other than I think the

¹ Duane L. Ross is the Manager of the Astronaut Selection Office.

physicians that were put in charge said—again, I’m surmising this; I can’t assert it’s a fact, but again, it sounds plausible—the physicians said. “We’ve never had [an opportunity] to examine [largely] healthy people. Our dataset[s are] always aggregated from sick people. This is terrific. We, as research scientists, now have healthy people. Let’s subject them to every test we can think of,” and they were doing that.

... Then I was surprised to be called [again and told now] they wanted to talk to us in person in Houston, and we were given very specific instructions as to how to [travel], and we were individually met by a NASA person [at William P. Hobby airport in Houston], and they were even keeping our name secret. They were extremely sensitive about folks they were bringing in to interview, and I don’t know how many they interviewed.

... [For these interviews], I can remember meeting NASA people that actually whose names were in the news. One was Deke [Donald K.] Slayton. Another NASA person was Max [Maxime A.] Faget, and another was Alan [B.] Shepard, [Jr.]. I met these people for the first time, and already that was then worth the doing, and I was quite thrilled by that, because these were world-famous names and obviously interesting people. So I felt that was terrific. ...

They also gave us in those years, and I think maybe still do, what they call “the dollar ride” in the NASA T-38s, and I’d never been in a high-performance aircraft before, and that was one of the most fun things I had ever done. [Later], of course, I got the chance to fly them [in person]. ... That was terrific fun. I’d seen the occasional fleeting movie footage of [such airplanes], but didn’t dream that machines like that had actually been built and were now being flown. ... I don’t know if you’ve ever been in one.

ROSS-NAZZAL: No.

ALLEN: Oh, wow. They’re magical; [never mind the fact they are now] old technology. They’re great. You strap wings to yourself, and you go.

ROSS-NAZZAL: When did you actually find out that you were selected to be an astronaut?

ALLEN: Again, I don't know on what day exactly. I think the announcement was made in—do you know when?

ROSS-NAZZAL: In August of '67, as you pointed out. But where were you?

ALLEN: I was at the lab. This is a physics laboratory. We were running an experiment in physics. There's an intercom system, and the [receptionist for the lab] said, "Joe, Joe Allen, there's a telephone call for you from a Captain Shepard." I mean, there were only two phones in the hall. I go down, I take it, and Alan Shepard said, "Joe, this is Al Shepard calling. We, NASA, are going to make an announcement of a class of astronauts. We want to make it at three o'clock this afternoon Houston time, and we would like your name to be on that list. Will you accept this job?" And I told him yes, I would.

Then I put down the phone, and the lady said, "Joe, who was that?"

I said, "Well, it was a NASA person. Nothing."

And I went outside. I had one of my co-experimenters continue the experiment. Climbed on my bicycle and rode home to tell my wife, and just said that I had the call and said, "Bonnie, can I take the job?" And she began to cry. ... I said, "Well, I have to do it," and she was crying. When I got back, she was not crying anymore.

I rode back to the lab. The announcement was made, and within a half an hour there were television trucks surrounding our laboratory with people from the news. It was very high-profile news, and all sorts of reporters came in wanting me to opine on the importance of the space program and the this and the that. In hindsight, in many ways it was comical and kind of poignant, because I didn't know a thing about the space program, not a thing about it, and I was

astonished at why the news people would think I knew anything about it. I was a physicist, for goodness sakes. They wanted to know this and this and this and this [about space]. I had not the vaguest notion what any of this was about. But that's how it came to pass.

ROSS-NAZZAL: Tell us about moving down here to Houston and the reaction of the astronaut corps to this new group of scientist-astronauts.

ALLEN: Well, that's a good question. That's a very good question. ... The astronaut corps, one could say is very elite, certainly hard to get into it. One could also say it's elitist. I don't think that's really true. I think the people that were there were, by and large, very honest, very well focused, very intent test pilots. This is a tough breed (you know several). Very strong mindset, very high confidence in one's self.

... I am talking about the [likes of] Pete [Charles] Conrad, Neil [A.] Armstrong, Deke Slayton. These are in many ways—they are personified by the description of Tom Wolfe in the book *The Right Stuff*. He exaggerates it, does Tom Wolfe, but he underscores a mindset of these people. They're a very extraordinary group, and they, no choice of their own, found themselves in an extremely high-profile job because of the wild enthusiasm in the eyes of the American public [for] this extraordinary undertaking and adventure. So they were the stuff of *Life* magazine [from the moment they were selected as astronauts].

When they had arrived here in Houston, they were celebrated. Houston celebrated the arrival of astronauts, and they were given many things, of course, in this day and age, even totally illegal. I think they were given homes in some cases. If somebody, God forbid, were to mention it, maybe to Al Shepard or somebody—Al didn't see anything wrong with it—that it was also illegal, Al would say, "Well, [I'll] talk to my friend the President. We'll see if it's illegal or not."

So they were, because of their high profile, very well connected. [For example], John

[H.] Glenn [Jr.], Al Shepard, and others, were very good friends of John [F.] Kennedy, the extraordinarily popular young President. ...

I think NASA itself was astonished and probably felt they'd created a monster [with the popularity of its first astronauts. NASA] had no idea of the interest the world [would show] in these individuals. [Once named, NASA then had] within [its] midst what in essence is a Tom Cruise and a Jennifer Lopez—just wildly famous individuals.

Now, when the first group of scientist-astronauts came, my impression from them is they were not shunned as outsiders [at all]. They maybe weren't welcomed in, but the test pilots [who until then] had the monopoly sort of said, "Well, whatever. Whatever the government wants," and were rather gracious to [the scientists].

Then when we came, the second group, there were already some scientists there, and the [original] astronauts themselves maybe didn't feel quite so invaded by us. And I would say that our welcome within the NASA community was warm on an individual level. However, the astronauts themselves knew that there were too many astronauts [and not enough] missions. Deke himself, who was the epitome of Mr. Honesty, had a meeting with us at one of the motels that still is there on NASA Road 1. It used to be called the Kings Inn. I don't know what it's called anymore. ...

He asked us to come over and meet with him. There were just eleven of us, and he came over to see to see us in our hotel room, and he said, "Gents, I've got some bad news for you, and that is, we have been told by the government to take you, but we don't have a job for you, not any one of you. And we've had to make this announcement, but if any of you or many feel that you have more important work to do elsewhere, you will make no enemies by resigning."

I thought, "Oh, well." That was my kind of introduction to the government, which is the government really doesn't know what it's doing. [Since then], how many times have we learned that lesson?

But he was very candid. He said, "You will not be making spaceflights. ... We do have

a lot of work to be done, and if you want to work in the space program, there's a lot of very useful things to be done, and we will give you assignments. But don't fool yourself into thinking you're going to be space flyers."

We then, shortly thereafter, named ourselves the XS-11, so it's "X" and "S" one-one. The XS-11. They didn't need us. So we called ourselves the XS-11.

I'm trying to think. Within about a year, there were then nine or eight of us left, and then that number persisted. And contrary to Deke's forecast, every one of us did make a spaceflight, but in some cases, many years went by [before we flew].

All that said, I was in those years always asked, "Aren't you tired of waiting?" Because I came into the program in '67. I first flew in 1982. That's a number of years. I, for a long time, didn't understand the question [because during those years] there were many assignments, fun assignments to do, which I got involved in. [For example, one] of them was to be working the Mission Control through Apollo. That was a wonderful job, a most interesting job, and you didn't ever feel that you were waiting for anything. You were hard at work on some quite fascinating undertakings, and you were sitting [right there on] the front row [as you worked].

ROSS-NAZZAL: Could you tell us about the history of the creation of the name the XS-11? Who coined that phrase? Did you get together in a group and—

ALLEN: We were supposed to give ourselves a name. I think it was decided because the other earlier groups had, so, just in discussion, somehow it came out. Then we all said, "That's it. That's got to be it. It's perfect. XS-11."

ROSS-NAZZAL: That's a great name.

ALLEN: To most people it just looks like a code, X-S one-one. And nobody says—well, it

doesn't mean anything. But of course, those in there knew exactly what it meant.

ROSS-NAZZAL: Tell us about your first assignments at NASA.

ALLEN: Jennifer, first we sat in some classes that were rudimentary, with sort of handout workbooks that were about how spacecraft worked, obviously [written] by people that had never taught a class in anything in their lives. They were unintelligible. And I was a teacher, so I could tell that.

But then our minds were occupied because every one of us was going to go off to flight school, and that got sorted out within a month or so, and then we were sent away from Houston for one year to the Air Force. We were a NASA employee, but detailed to the United States Air Force. The eleven of us went off, and because of the NASA—this is a funny; I like this statistic—tests that they'd given us at Brooks [by] the NASA physiologists-psychologists, [NASA] pretty much deemed us to be crackerjack pilots, although none of us had ever flown before. [But the tests showed that we] had the makings of being very good pilots.

Now, the Air Force, by contrast, doesn't do much [testing]. It just takes Air Force officers [who] want to fly [and] give them a physical exam. If they pass the physical exam, they ship them off, and then they weed them out [of flight training] in kind of a brutal, no-nonsense way. If you're not keeping up with your lessons and you fail two lessons in a row, you're out, and no questions asked. Some of them are written, but most of them are flying lessons, and there's no place [in flight school for] a slow learner. That's how the Air Force sorts people out, and their success ratio is usually about seven out of ten make it through.

Well, we were eleven people with a Grade A endorsement. Eight out of eleven make it through, [close to] the same number, which I, in hindsight, laughed about, because the wisest brains at NASA were unable to administer tests that could identify a good pilot from a bad.

But that was a great year [for me]. I mean, [indeed it] was one of the most enjoyable

years of my life, because I was a student again. I love being a student. I've been all my life a very good student; [in the Air Training Command] I had a new kind of a classroom. I went in being unable to fly and came out fifty-three weeks later as a very highly qualified pilot.

ROSS-NAZZAL: You actually won an outstanding flying award.

ALLEN: I did.

ROSS-NAZZAL: Can you tell us a little bit about that?

ALLEN: I shouldn't on tape, because—the military tests show on everything, and it's very important to military officers, because they then get queued up, and the people near the top get first choice of [their next assignments]. Maybe a little bit brutal, but that's the military.

There were five measures for the fifty-three weeks of the flying. One was academics; one was contact, just general flying; one was instrument flying; one was acrobatics; and one was formation flying. So, five.

Now, I'm going to preface this, Jennifer. I was thirty years old, and my classmates were twenty-two to twenty-five, college graduates, most of them, military officers. I will argue—no, I will make the observation that I was at a great advantage to them, probably because I was a little bit older, and flying, to a degree, is a mind discipline game more than it is a physical athlete's game.

I was also blessed in extreme with a very good education, and that is also helpful, because elements of flying are complicated, and you have to—in any case, of the five awards, I got first place in all five. I'm secretly very proud of that, but I have never told anybody about that much. However, I have a letter in my favorite letters, and that's a letter from Alan Shepard. "Dear Joe. I realize what you've done. You have made all of us at NASA very proud." And I

thought, “Wow, that’s something to keep,” because Al Shepard never gave compliments to anybody. I was quite thrilled by that.

ROSS-NAZZAL: What a wonderful document to still have.

ALLEN: [At the] graduation ceremony there at the flight wing, and I was given all the awards and then the top trophy [by the wing commander], and I took it home to my wife. I said, “Bonnie, I came home with a trophy.”

She said, “Well, it’s about time. You don’t even have a bowling trophy.” [Laughter] So, her making that equivalent of a bowling trophy sort of put me back in the right place again. But I was a good pilot. I was a very good pilot.

ROSS-NAZZAL: How useful do you think that experience was for either the Apollo Program or any of the other programs that you worked on for NASA?

ALLEN: Probably not at all. [Laughs] But that’s unfair, because to be qualified in an airplane does give you a way to think about things that’s extremely disciplined. [Later], when you get in a spacecraft, that’s important, and you take that disciplined way [with you]. That’s good. ...

Secondly, a spacecraft flies totally [differently] from an airplane. But [airplane experience] does make you very familiar with the way you use checklists and be doubly cautious here and very careful there. I think it’s particularly useful to somebody, to say, a scientist, particularly an experimentalist, who just says, “Well, what the hell. Why don’t we try this?” That’s not the approach you want to take to a spacecraft. You do not want to try any experiment. You want to only do it according to the cookbook, exactly as people know it will work and respond. There’s no place for imagination or invention in a spaceship. So I think [flying] was a good fundamental background [training. Of course, today] there are many astronauts now [who]

are not flight-qualified. ...

ROSS-NAZZAL: Yes.

ALLEN: So NASA realized it was kind of a thing of the past.

ROSS-NAZZAL: So after you came back from flight school, what did you do? What did you work on?

ALLEN: Then I sort of forget. Let me think a minute. Went in early '67. Came back in the summer of '68. Well, two things. I was still a scientist and a research scientist, and there were some cosmic ray experiments that were being done out of the [Manned Spacecraft] Center in those years, very unlike what it is now. And I worked on some of the cosmic ray experiments as a kind of collaborative research member, and it took place in buildings down near where the astronaut gym is. So I still had my hand in the science. Then we began to be taught Apollo systems, just part as a basic education. So there were classes in that.

But then within some months, I also began to transition in to elements of the Mission Control as a Capsule Communicator for Apollo, and I did some simulations as a Capsule Communicator, and then about the time I got back, Apollo 8 flew, and then followed quickly by Apollo 9, Apollo 10, and then Neil Armstrong's landing, 11, which was spectacular. That would have been in the summer of '69.

... I then was assigned as a support crew member to Apollo 15, which was already in training. There were several support crew members, but my specialty was to be to tie all the science of Apollo 15 together. Apollo 15 was the first really scientific mission to the Moon, and it was going to fly with a number of new pieces of equipment that were only for science. One of them was the rover. Another was [that] the service module [had been] upgraded dramatically

with all kinds of new remote-sensing instruments.

[As part of my responsibility], I became very involved in getting scientists to train the crew members in scientifically related things. In large part, these [scientists] were geologists, because [geological exploration was a prime scientific objective of the lunar landings. Apollo 11 had been successful in returning the first lunar samples but little else, scientifically.] Apollo 12, very perfunctory geology. Apollo 13 didn't make it. [Apollo] 14 was Alan Shepard, who wasn't all that keen on a lot of science. But [for Apollo 15, science] really stuck. We had crew members [who] liked the science, and we had all kinds of new [science] equipment, and it wound up being the first lunar [mission with geological] traverses that involved some serious distances across all kinds of geology in the rover.

So I just was kind of an integrator, facilitator for all of these scientific meetings and so on, and it was a great assignment. I found myself being very good at translation. In this case, it was translating what the scientists wanted to the test pilot astronauts, and what the test pilot astronauts needed to the scientists who didn't understand that. And I was quite good at—I mean, I think I was good at that, and I added a lot to that mission. Then [this assignment] culminated in [my] being the Capsule Communicator during the mission.

And so I will put myself in proper context, Jennifer. I came from a small town in Indiana, [and I grew up in a very frugal household]. And partly as a result, I had never made a telephone call across the ocean before, because they're too expensive. I talked to [people on] the Moon before I [made] a telephone call across the ocean, which is kind of bizarre, because I'd lived in Europe. But I always wrote. I never called [home], because we couldn't afford it.

That came home to me when I was interviewed by a German radio station, having completed my first communication to people during a lunar EVA [Extravehicular Activity]. And because I could speak German, some of the German reporters sought me out and wanted to do some interviews on radio and television, which I could do in German. My first was a radio interview on a telephone, and I commented to the reporter, I'd never made a call across the ocean

before, and he looked at me like I was crazy. He said, [*“Sind sie veruckt?!”*] He said, “Are you crazy? You’ve been talking to the Moon for eight hours, and now you’re impressed by this?”

And I thought, “Oh, that is rather strange, isn’t it?”

But that kind of takes me up through—let’s see. I was CapCom [Capsule Communicator] on 15, and then I was a CapCom also on 17. So we popped out the end of the Apollo era, and I had been gainfully employed on really fun things.

I can continue on, but do you want to lead me as to—

ROSS-NAZZAL: I have some questions for you about the Apollo Program.

ALLEN: Keep going. Keep going, yes.

ROSS-NAZZAL: Why don’t you tell us a little bit about the field trips that you took for Apollo 15.

ALLEN: Okay. I will refer you, by the way, to one of Tom Hanks’ shows, [*From the Earth to the Moon*]. I don’t know if you’ve ever watched those. But one of those, and I think it’s called [*Galileo Was Right*].

ROSS-NAZZAL: I think I know which one you’re referring to.

ALLEN: It’s a very nice rendition, and it comes actually—those things are based on Andy [Andrew] Chaikin’s book, that I’m sure you guys know of, and it has to do with how the scientists and the teaching scientists started to become involved with the strange new class that were called astronauts. I saw that again recently, and I sat and watched it with Lee [Leon T.] Silver, who was one of the professors, who is a grand man. Is his name on here, by the way? He’s a character and a half. He is a teacher’s teacher. ... Several persons [whom he instructed]

got so hooked on the science that they still [follow] it as a hobby, and one of those is John [W.] Young. I don't know if you're aware of that. Here John Young's a Navy test pilot, for goodness sakes. He's a test pilot's test pilot. He, John, knows as much about lunar geology as a hobby—as a hobby—as many college professors know about it as a profession, and it's due in large part to the inspiration that Lee Silver brought to [us all].

Now, your question, again, was what was my recollection of it?

ROSS-NAZZAL: Your recollections of the field trips for Apollo 15. Where did you go, what did you do?

ALLEN: Well, they were just great fun, and I'll be hard pressed to remember all the places that we went. We went to about, I think, six. One of them was Hawaii. And some of these may have been Apollo 17. I can't remember. One of them was the Nevada test sites where we looked at craters. One of them was to the Orocopia Mountains in California. Now, an earlier trip had gone into the Pentecote Mountains in Mexico.

One, I think we took a fairly short trip to see anorthosites outside of Ely, Minnesota, which is a remote part of the world. Anorthosites are a mineral form. They also are the mineral that makes up some of the oldest rocks that have been found on planet Earth. So we went up to see those. I'd be hard pressed to tell you now how they differ from some of the newer rocks, but at the time we were proficient and could tell. Jack [Harrison H.] Schmitt was a leading force in this, by the way, because he's a Ph.D. geologist, and he knew a lot of these people and talked them into becoming our teachers.

Where else did we go? I think we went up to Canada, and we saw a test of the Canadian military where they blew a rather large hole in the ground with chemical explosives, and they did it in order to test Army equipment that had been parked very methodically at various distances from ground zero, as to how well it withstood a huge bomb explosion. But they very

deliberately set off quite a large bomb that really shook the rafters, I tell you that. They put us several miles back with ear protectors and everything. You could feel the ground shake.

But then we immediately went in and [examined] how the crater had been built, and how one could identify evidence of a cratering caused by an impact. In this case it was an explosion, but it's the same as an impact. And how one could pick out the inversion of the layers. It kind of takes a layered Earth, and it folds it back. So the layers out here [gestures] are now inverted. And that's an evidence of a massive impact. Because we were headed towards the Moon to try to get better understanding of the craters impacting on the Moon and causing the cratering of the Moon and with the geological evidence as to how that had happened, and then possibly some idea of when. And I don't remember the name of that [Canadian] site, but in itself it was a pretty interesting [event].

And I think that's an incomplete list I've given you, Jennifer. There are a couple of others. But keep in mind, this was on like a year's training program, and I've already talked about five places where we carved chunks of three and four and five days out of the schedule, and these days were devoted just to the science, not to the learning to fly the spacecraft.

ROSS-NAZZAL: Did you have any role in a simulation, say, on a field trip? Did you have any duties like that?

ALLEN: I mean, we would set them up as though we were going to do a traverse, and the professors would set up a challenge for us, the crew members, "Glean as much information you can from this," and you have a limited period of time. So this is not what a real geologist would do in a real field situation. They would go in and take as much time as they needed to get a complete set of data or a suite of the samples. ...

We were already wedding together the constraints of a mission to the desires of gleaning scientific information, but we wanted to do it efficiently in as short a time as possible, so we used

those rules, rather artificial rules.

ROSS-NAZZAL: Why don't you tell us a little bit about the relationship with your other fellow crew members and the scientists for this mission.

ALLEN: Again, I knew the crew members very well, and we would fly together, and I knew the jargon and so on. At the same time, I got to know and rather quite enjoyed the scientists. So again, I'm a bit of a stranger in two strange worlds, if you think about I was not a test pilot. But I came to know and appreciate test pilots. I was not a geologist, but a physicist is even more eccentric than a geologist sometimes. So I really could easily know and appreciate the geologists. So again, what was I? I was a facilitator. I was a translating device between these two worlds.

ROSS-NAZZAL: One of the things that [David R.] Scott credits you with is the hammer-and-feather experiment on board Apollo 15. Can you talk about how this idea came about?

ALLEN: I don't actually remember it, but I will take some amount, and whether it was my original idea, or I just somehow—but I was a teacher, and to a degree I still am, and I love clever little things, and I thought, "This might be kind of fun." I might say, Alan Shepard, the mission before, had hit a golf ball, which struck me as less than inventive, although he was, I'm sure, quite proud of it, and the Professional Golfers Association loved him for it forever more.

But I got to thinking, what is it about the Moon that might lead to something rather intriguing? And there were two things popped in. One was the very weak gravity. So things will fall, but slower. And the other is the fact that there's no air. So I thought of it as the Galileo [Galilei] experiment. Galileo supposedly dropped a relatively heavy object and a relatively light object off the Leaning Tower of Pisa, and had a friend sit at the bottom and report that the light

object hit the ground at the same time as the heavy object. And from that, he began to get some understanding of gravity, which was later augmented by Sir Isaac Newton. But, in fact, all things fall at the same rate, and I don't know, this may be lost on you. And by and large, that's true. If an object becomes so light, like a ping-pong ball, that air resistance interferes with it, then [the measurement is confused]. But you can make air resistance "go away."

But the more I thought about that, I said, the Moon is terrific, because we can drop something that's very light and a lot of air resistance, a feather, and we'll drop it with a lead hammer, and the Moon's weak gravity will cause [both] to fall, but rather slowly. And that's what happened. I'd mentioned that to David Scott, and they were Air Force people, and the Air Force mascot is the falcon. So he went to great trouble to get a falcon feather for Air Force tradition. So it was a falcon feather, and it was the hammer that they used for geology, and Dave [dropped them both together. Their falling slowly and simultaneously was recorded by a video camera mounted on the rover. The resulting] videotape is [still shown] in science classes to this day.

ROSS-NAZZAL: Prior to the experiment, had you told anyone that this was going to occur on the lunar surface?

ALLEN: I don't remember. Not very many people, because in those years you could get various things aboard the spacecraft. Later we no longer do, but the feather just went aboard. The hammer was already there.

ROSS-NAZZAL: Were you able to tell Ed [Edward I.] Fendell that the experiment might occur so that he could actually film the experiment?

ALLEN: Oh yes. We were well aware if they had time when they were going to do it, yes. But

they pretty much were filming everything. But Ed, indeed, was there and got it. I was thrilled.

And I tell you, up until the time I saw it, you know, there's all sorts of things that can happen here there's not going to be good, including static electricity. What if when he lets go of the feather it doesn't really leave his hand? Which I was quite worried about. I mean, it could just sort of sit on the tape and never let it go anyplace.

ROSS-NAZZAL: It all worked out, though.

ALLEN: It worked out beautifully.

ROSS-NAZZAL: Did you propose any other experiments for the mission?

ALLEN: Oh, Jennifer, golly. None that pop into my head. We were talking about various things all the time. There was a very long list of formally proposed experiments that were carried out, but I can't claim to have contributed any of the original thinking to any of those, although how one got it implemented, we worked hard on implementation of the experiments.

ROSS-NAZZAL: Can you share with us the details of implementing an experiment?

ALLEN: Well, for an example, there was the first mission that actually took a deep drill core sample from the Moon, and this is a drill that's not uncommon. It's used on Earth. In fact, people that are doing oil wells will go down and they'll take samples of the Earth and bring it way out. Then by looking at the various layers, they have some idea of the likelihood or nonlikelihood, of oil that may be lying below. In trying to determine elements of the age of a geological area, a geologist will core way down, and pull out the [layers]. We built a device to take a core sample of the Moon. I think it went down about twenty feet, with drill stems, and

this was a strange mechanical device that had to be hand-operated, and it did indeed drill way down, [but] it's kind of hard to do.

In the case of Apollo 15, we got [the drill bit] down, then we couldn't get the thing out [of the surface]. So there's a long portion in the transcript where we're trying to extract the drill, but it did [extract after a long struggle. The resulting core sample was very important to the] scientific accounting of what was learned on the Moon. ...

I can tell you a funny story about [the drill], though. The drill worked by a vibration up and down, and also turned. So it had a cutting core, and then the material would go up into it. It was kind of like shark's teeth, like that. So it was a pretty lethal-looking device. And you press the button, and it went into all these motions, and it would just cut through things easily, including the ground.

Alan [L.] Bean had flown to the Moon on Apollo 12, and [he] was very highly sought after as a commentator on the various news media, and was being interviewed as to what it would be like for Apollo 15, and he was asked by NBC [National Broadcasting Corporation] Television to demonstrate the coring sample. So he brought the thing that we use for training over [to the TV studio]. He [had] never operated it before. Not to worry. I said, "Al, you just activate it by pressing the button." But I said, "Be very careful. It really drills in a hurry. So be super careful when you use it."

[The interview was] at a NBC studio in a hotel there on NASA Road 1. [NBC] had provided for him kind of a little sandbox that had some stones and some dirt. [The box was about two feet deep], and then it had [a] plywood [bottom]. ... Al went over to [the box] on live television, and held the drill out like that [gestures], touched the button, and the drill dropped straight down till it itself was imbedded in the sand, and everyone thought that the drill stem had somehow broken, because it just went [down]. What had really happened, it had drilled down through everything. It'd gone through the steel, [the dirt, the plywood], the rug below into the concrete, [through the concrete] and had come out [of] the ceiling below, all in the matter of

about five seconds time. [Laughter] And Alan Bean himself didn't know what had happened.

Now, fortunately, [the drill] did not hit an electrical conduit [on its downward journey], because had he done that, there would have been hell to pay. But [Al] was less than amused by that than I, because I thought [the interview] was funny as could be. I told him, "It really drilled.' But, no, no, no, he didn't listen.

ROSS-NAZZAL: One of your other duties for Apollo 15 was naming lunar craters.

ALLEN: Yes.

ROSS-NAZZAL: Can you talk to us about that?

ALLEN: Well, that's always kind of a fun thing. First of all, it's totally unofficial, and you just do it so you have [names] as you look at the maps and talk about this [crater and that feature]. The real crew members have no time to think about [such trivia], but you, as the support crew, can kind of arbitrarily do it. By then, we had some very good friends [who] were geologists, and we had terrific fun naming them. I still have lunar traverse maps that have those names still on there.

ROSS-NAZZAL: How did you select the names?

ALLEN: Oh, just where my hobbies and interests were. I even kind of forget what they are right now, but there are some characters from science fiction, and a couple of names were names of music compositions done by my brother-in-law, David Darling, who was then and still is a professional musician. He has written music and gives it quite inventive names. I think Ghost Beads Crater is an example, because he wrote this very haunting piece called "Ghost Beads." I

forget what some of the other names were. Icarus is another crater. Well, that's from, I guess, Icarus is a Greek God? Maybe Roman. No, I think it's Greek, because Icarus was the one that invented wings from wax, then flew too close to the sun. But David had written a piece called "Icarus." That actually was the name of an album at the time, his album.

ROSS-NAZZAL: I'd like to talk to you a little bit about your role as the lunar EVA CapCom.

ALLEN: Okay.

ROSS-NAZZAL: There were a couple of exciting moments when you were working that shift, in particular when they found the Genesis Rock.

ALLEN: Right.

ROSS-NAZZAL: Could you talk to us about what the mood was like at the MOCR [Mission Operations Control Room] at that time?

ALLEN: Again, you never quite would know what you had, but just based on—now, conversation, that's all we could communicate with them, and a little bit of TV, there was an excitement about that, and again, it is interestingly documented, with some poetic license, in the movie, in the Tom Hanks production. [The rock] was physically very large. Most of the samples were small. They were just stones that came back, physically about like this [gestures], which got loaded aboard and brought back [for detailed study. But the Genesis rock was] a conglomerate. I'm not sure what it was made up of, but a lot of basic information came out of that rock. The fact that it was different and physically large and had what seemed to be quite unusual characteristics was exciting to us. There are some photographs in the NASA archives

that show Dave Scott and me looking at the rock in the Lunar Curatorial Facility afterwards, all wearing our white clean-room caps and so on. ...

ROSS-NAZZAL: Tell us how you were able to balance the needs of the scientists during this mission versus the needs of the flight controllers and the reality of the time constraints for the astronauts.

ALLEN: Jennifer, you're asking a very fundamental question, and I can't give an answer to it, but I hope the history shows that there are two very different agendas that somehow found themselves on Apollo. One was to take an American to the Moon and return him safely. That was one agenda. And the other agenda, unwritten and uncommitted to, but kind of adopted increasingly as the missions unfolded, was a scientific agenda. "As long as we're there, let's get as much scientific information as we can."

If you're a flight controller and your highest priority is only to get somebody there and back, you just want him to step down onto [the surface] and then come back, because this is a very risky place, and the more time you spend in a risky place, the more chance there is for a catastrophe to happen, in front of everybody.

If you're a scientist, the more time you can spend and the more activities you can do, the higher the likelihood will be that you will learn something of fundamental importance, and you realize that these [two agendas are] mutually perpendicular, or maybe they're opposed to each other.

So the Apollo that resulted was a combination and a compromise of those two totally different agendas. Now, was the proper balance achieved? No one knows the answer. A balance was achieved, and each agenda was satisfied to a degree. Neither perfectly. To this day, the scientists would like to have spent more time on each of the journeys out, and they also would like to have flown Apollo 18, 19, and 20. And we had hardware to do it and people to do

it. But every time you [flew to the Moon you took] a huge risk.

After Apollo 11, there were very strong forces that argued for never—"Don't go back." It's what I call the Rocky Marciano approach. He was a heavyweight champion of the world long before you were born, but I remember him. He was physically not a very large guy, and yet he prepared himself for, and he fought for the heavyweight championship of the world. Then he defended his title, I think one or two times. He was never defeated. He was completely healthy, and he retired. A lot of people wanted to take the Rocky Marciano approach. "Don't go back to the Moon. We have done it, and we're the best in the world, and let's not run a risk of spoiling that."

But others said, first of all, "Wasn't that fun, and can't we learn a lot more?" Ultimately, those arguments prevailed, and people did go back and [consequently we learned considerably more about the Moon].

One could assert that an appropriate balance was achieved. Nobody was injured. So we played a risky game, but we got away with it, and we learned an [enormous] amount more about our solar system than we had known before. We didn't learn everything, but we learned a vast amount more about our solar system. ...

ROSS-NAZZAL: Do you have any other memories or stories or anecdotes you'd like to share about Apollo 15?

ALLEN: I have many, many, many. I almost wouldn't know where to start, and I don't know, actually, what you want to focus on. Gosh, Apollo 15, per se, well, it was a landmark mission in that we raised the bar an enormous amount on what one could glean scientifically from the Moon. [Apollo 15 gave the world] a significantly increased scientific return, which was repeated and actually improved upon with Apollo 16 and Apollo 17. In simplistic terms, I would suspect that virtually everything we know about the Moon comes from the discoveries of Apollo 15, 16,

and 17. Some initial things came from Apollo 11, very important, very basic. But the complex set of detail [about the Moon] comes from the last three missions.

From Apollo 11, just imagine it. [Prior to that first landing], we had no idea whether life had ever been on the Moon or not. ... When the first bad TV pictures came back from the lunar surface of Neil and Buzz out there in the black and white TV picture, one immediately saw there were no giraffes or kangaroos or trees [behind them]. We didn't know that [before we Earthlings together saw those first TV pictures.] ...

Then later, analysis of the soil showed there seemed to be no hint of organic compounds or even remnants of organic compounds of any kind. [Before this first journey], the smartest minds possible had gone to great trouble to construct something called the quarantine facility, to try to protect planet Earth [from] the first Moon walkers [when they] came back covered possibly with lethal pathogens. They didn't come back covered with anything other than Moon dust, and nothing organic, and nothing dangerous. [But] we didn't know that before they went

Gosh, I have so many recollections. A fond observation I have—fond to me, at least—[is] there are some great things, great monuments on planet Earth. One is the pyramids. We're not sure what [they are] monuments to, but [they] represent the collective effort of, clearly, tens of thousands of people. Now, it was probably the physical effort of most of them, but some mental effort of a few. One doesn't know.

In my mind, the Apollo Program in its entirety is a monument of the same magnitude and beyond, and it represents the collective efforts of hundreds of thousands of people. These efforts are the aggregate of virtually every bit of human skill and knowledge in one way or another, all the way from knowledge of mathematics that had to do with the trajectory, to the knowledge of sewing [that] had to do with the putting together of the spacesuits: These bits and pieces of knowledge, processes, techniques, technologies, are across the entire spectrum of the human intellect, and they were all [combined to accomplish Apollo]. I think that is just extraordinary. I mean, I'm now reflecting upon a truly heroic effort on the part of a lot of people, including even

the generosity of the American taxpayer. Virtually everybody in this nation celebrated that, I think, that effort as a victory. To my mind, it was a victory of the human organization, dedication, and the human spirit.

[As great an accomplishment Apollo was, it was nonetheless quite different.] You know, there were victories of exploration from earlier times, and there are names associated with them—[Christopher] Columbus, [Ferdinand] Magellan. And these are obviously brave, perhaps even foolhardy daredevils [who] attempted and did something. But, when it came to Mercury, Gemini, and Apollo, they are no longer an individual [persons named, because the accomplishments were an aggregate of human effort]. To me, that makes [the achievement even more remarkable].

ROSS-NAZZAL: That's a nice summary of the program, to look at it from that perspective.

ALLEN: Another recollection I have [is] this. [In the 1970s], I spent some years at NASA Headquarters [Washington, D.C.] as an Assistant Administrator of NASA, with the responsibility of explaining to the Congress what it is that NASA is supposed to be doing. Difficult job, thankless. But never mind.

From that vantage point, I thought some about [the] person with [this] job in the years after Kennedy made his "Let's go to the Moon speech" and before we arrived at the Moon. There were many compelling arguments that were offered to bolster the President's commitment—[it's America's destiny to explore], the scientific results will be huge, etc., etc., etc. [Yet] never was there a word said that on the way to the Moon we humans will set eye on the Earth. ... [That said, without question], the greatest thing that came from the Moon missions was on the way to the Moon humankind set eye on the Earth.

... If you look back at the environmental movement, it suddenly seemed to catch fire in the last of the 1960s. Now, why would that be? Because there'd been people like the Rachel

Carson and others saying, “Hey, planet Earth is not infinitely supplied with an immune system against all the contamination we’re bringing it, and it’s not so large that we can’t do damage here.” Nobody listened to the Rachel Carson [in her book], *Silent Spring*. [She] was ignored by most except a few academics

Suddenly, just after [Apollo], the seeds of the Environmental Protection Agency [were] sown and all kinds of legislation [was proposed] that began to restrict elements of the bad things that we were doing to our environment. Again, you can’t argue this from a historical point of view, but to me, a strong parallel can be drawn from the timing of every human-seen photographs of the Earth, and the sudden new awareness of the possible fragility of our planet. ... But that’s not the reason we went, but look at what came from it. [Extraordinary!]

[You and I] know many space travelers—I don’t know of anybody [who] has come back [from a space journey] and now is just complacent about and disinterested in the Earth. I don’t know of a soul, because [during those journeys] you see [Earth] in its breathtaking beauty. And the apparent fragility of it all [is indescribable].

ROSS-NAZZAL: That’s a nice connection. Well, I think we are about out of time, so I think this might be a good place for us to stop, actually. Next time we’ll pick up with Apollo 17, the next time we’re able to actually meet again.

ALLEN: Okay.

ROSS-NAZZAL: But we really enjoyed you coming out here and talking with us.

ALLEN: Well, you guys are great. I appreciate your taking the time to do it, and it’s worked well. I’m now off to Tucson, of all places.

[End of interview]