

**Oral History Interview of  
Steven Lindsey**

**Interviewed by: David Marshall  
February 01, 2018  
Lubbock, Texas**

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## Transcript Overview:

This interview features Steven Lindsey as he discusses space flight. In this interview, Lindsey describes the intricacies of space flight in more detail. He illustrates what it is like to experience zero gravity for a long period of time, as well as the precautions that NASA had to take before sending their first Israeli, Ilan Ramon, to space.

**Length of Interview:** 00:46:41

Subject	Transcript Page	Time Stamp
Zero gravity experiences	05	00:00:00
What bones do in zero G; other medical concerns	09	00:07:16
Issues with long duration space flight	12	00:16:45
Space foods	15	00:22:14
The personalities of the <i>Columbia STS 107</i> crew	16	00:25:41
Precautions NASA took before the <i>Columbia STS 107</i> flight	19	00:37:42
Why John Young was such a brilliant astronaut	21	00:41:52
Neil Armstrong's personality	22	00:45:03

### Keywords

NASA, Space flight, *Columbia STS 107*

**David Marshall (DM):**

The date is February 1, 2018. This is David Marshall interviewing Steven Lindsey at the Southwest Collection, Texas Tech, Lubbock, Texas. [Pause in recording] Okay so let's start again.

**Steven Lindsey (SL):**

Okay.

DM:

So I want to hear about your zero gravity experiences. Monty mentioned that, you know, after being in space for a while it took a little time to adjust.

SL:

Oh you mean like physical adaptation?

DM:

Yeah, right.

SL:

Yeah, so yeah, we did talk about that a little bit yesterday. Well, let's see. I can describe it generically. In terms of what generally happened. Because it's zero gravity, a few things happen. I'll talk about going up first.

DM:

Yeah.

SL:

Once you get up on orbit in zero G, I do remember on my first flight that as soon as we hit zero G—and I had experienced zero G before in airplanes, so I knew what it felt like.

DM:

Well what kind of duration do you have in an airplane?

SL:

Short. Twenty seconds, max. Thereabouts. So this is continual. So I remember when the engines cut off and went into this zero G thing. I'm used to going and doing it in airplanes, but then eventually coming back to one G. But of course never happened. I do remember, about the first day or so of my first flight, feeling like I was at about—my head—was about a hundred and thirty-five degree down angle.

DM:

Really? [laughter]

SL:

I remember feeling that way, and then it went away. And probably about, maybe 30 percent of astronauts get actively sick at first.

DM:

Really?

SL:

Uh-huh.

DM:

What's the countermeasure for that?

SL:

Well, first of all, everybody gets over it within a couple of days because you get used to it. We would carry medicines on board. We carried—probably the most effective thing we carried was something called Phenergan, for the motion sickness. I was fortunate, I never did. I never got sick. But pretty much every flight, the first day or so, I wasn't real hungry. I would eat, but I wasn't all that hungry. And I think a lot of that is zero G, your internal organs shift around. Other interesting things that happen when you get into zero G is your—you actually grow in space.

DM:

Huh. You expand?

SL:

Your spine expands. I did. I measured myself one time, and I think I gained about an inch and a quarter.

DM:

Is that right? [Laughter]

SL:

Unfortunately when you come back to Earth I lost that. I actually went lower, and then popped back up to where I was.

DM:

Really? How amazing.

SL:

You know, when you're vertically challenged like me that inch and a quarter is a big deal. [laughter] But anyway, so that's probably one of the biggest effects. And like I said, everybody gets used to it. And of course, learning how to work in zero G is another thing. We always tell the new folks, "Slower is faster." If I'm trying to float from this side of the room to this side of the room, you'd think, I just take my hand and push it on the wall. Well if I do that, I'm going to slam into that other wall. And so if you're going to do it, use a finger. Just push off with a finger. So faster is slower. Stuff management is one of the biggest challenges up there. Every crew member had—on shuttle—had a different color dot for their designation. Like commander was red, pilot was white and things like that. Or pilot was yellow, I'm sorry. And you could always tell the new folks because they'd be losing more stuff. You'd see more—like if you had a new pilot onboard—you'd see more yellow dots floating past as they lose stuff. [DM laughs] If you have to—everything usually has a piece of Velcro on it or gray tape or something, and you've got to make sure when you place something down you stick it somewhere and you remember where it is. Because otherwise it'll just float and follow the air currents into the filters, wherever.

DM:

[Laughs] Oh my goodness.

SL:

So controlling—learning how to manage your stuff—takes a little bit of a learning curve.

DM:

What about sleep?

SL:

So sleep on shuttle—on Space Station we had sleep stations. Designated sleep stations where you had essentially, like, a sleeping bag attached to the wall. On shuttle we just had a sleeping bag that we'd roll up every day. When it came time to go to sleep you had some hooks on all four corners, and you'd just hook it up somewhere—floor, ceiling, you name it. Wherever—and crawl into it. And then it had some Velcro things that you could kind of hold yourself into the bag. But you would essentially—it's not like a bed, because you're floating inside of it.

DM:

There's nothing firm below you?

SL:

There's nothing firm.

DM:

It seems like that would be—

SL:

And that's something that took a while to get used to. You remember first flight, again, waking up in the middle of the night and I wasn't—I was floating inside my sleeping bag, but I wasn't touching anything. I was like, Where am I? What is going on? [Laughter] It's just a weird feeling until you get used to it. Some people—they had like a kind of a pillow thing on them and a Velcro strap, so some people would strap their head down to that to give them the feeling of a pillow. The other thing that's interesting—people with back pain, because your spine stretches, usually goes away. Or you do get some mild back pain. You can, because your spine stretches. And I never had back pain. But sometimes I noticed it. And we had Velcro around your legs, so sometimes I'd sleep with my legs tucked up and Velcro them down to kind of give my spine more a stretch kind of thing. But sleeping took a while to get used to it, and I don't think in any of my flights I ever got completely used to it. When I'm talking to long duration crew members they say after about thirty days you're pretty comfortable in it, so it's just a learning curve. And some people went up there, slept great. Just slept like babies. So kind of depending on the individual.

DM:

Al Sacco says he doesn't sleep much anyhow. He sleeps maybe three hours a night.

SL:

Here?

DM:

Here or there.

SL:

Oh wow. Well I slept a lot.

DM:

So he had to take reading materials into his little cubby hole.

SL:

Yeah, I'm sure. We had a designated sleep time. Usually they set aside eight hours. But I never—I slept a lot less on orbit than I did here.

DM:

What do you think you got?

SL:

Well I know what I got because I was wearing a little experiment a couple of times—two or three flights—that was tracking my sleep/wake, and I think I averaged just over five hours a night. Something like that.

DM:

Do they give you a sleeping pill or anything to encourage more sleep?

SL:

Well yeah. We carried all kinds of meds on board. You could get an Ambien or something like that if you wanted, or if you needed to.

DM:

But they're not—

SL:

The other thing that happened, we were always—Our launch time, then set our landing time—and we were always having to sleep shift to adjust to that landing time. So typically—like I remember on my first mission, we did a total sleep shift of eleven hours through the flight. So we were—essentially we were doing the college shift. Go to bed an hour later every night, so we called it the college shift. But then after a while that wears on you. I thought—of course I was a rookie—I thought they did it because that way they can work us twenty-five hours a day instead of twenty-four hours a day. [Laughter] But anyways, so you dealt with that. Now coming back—on a short duration/a long duration flight—Well let me talk about, for long duration crew members there is a couple of medical things that were really—that are concerning—that we're working on. The first one was when you get up there and you're in zero G for a long time, your body concludes it doesn't need your skeletal structure. Our skeletal structure is designed for one G. So as a result you start losing calcium, and you start losing bone density. Anecdotally, when the Russians were flying the Space Station, before they really had any adequate countermeasures, they would lose up to 30 percent of their bone mass on a six month mission.

DM:

Really? That's amazing how quickly the body reacts.

SL:

Yes. And so obviously that's a huge concern. If you're going to Mars, you don't want to land a crew on Mars and then they break their legs because they've lost all this bone mass. And it has—obviously—health implications. So one of the things on Space Station—we did look at countermeasures. We have a standard—we have a treadmill up there. We have a bicycle ergometer, much like we have on shuttle, but they also have a—it's called an AREB, "Advanced

Resisted Exercise Device”, which is essentially a weightlifting machine designed for zero G. But you can load up to six hundred pounds on it. [Laughter] Since ISS [**International Space Station**] crews have been using that—and I got to use it up there a couple times—they’ve not been losing bone mass. And they’ve been able to sustain it. I don’t think there’s any official studies out on it yet, or papers, but it looks like astronauts are coming back without bone loss now. So that might be a good countermeasure. There’s some other medical things going on up there. Obviously radiation is a big concern. The space station is at a low enough altitude that it’s inside the Van Allen Belt, so it’s pretty much protected from radiation. Although we always wore dosimeters. So they would track our lifetime dosage. We were considered radiation workers, so we had to maintain within a certain maximum dosage to be eligible to fly. Because of a lot of things, the dosage limits for men and women are different. Women are—the older you are when you fly, the more you can tolerate, because it has to do with your probability of getting cancer, essentially. The older you are—the further along you are—the more dosage you can take. Less time you have to get cancer kind of thing. I think the difference between men and women really have more to do with the fact that a woman’s life expectancy is longer than a man’s, therefore the total dosage has to be spread over a longer period of time.

DM:

Well the medical aspect is really intriguing.

SL:

Yeah, so the radiation is a big deal because if we’re going to Mars—long mission, nine months, one way, on chemical propulsion—then—and you’re outside the Van Allen Belts, then obviously radiation exposure is a big issue. We did provide—we have radiation protection in the sleep stations on Space Station—these bricks that we put in that help. But nevertheless, we have to keep an eye on that. And if you get a solar flare event, let’s say.

DM:

Right.

SL:

Fortunately, you have time. You have an hour or so to figure out if it’s coming, if it’s going to hit. And in those situations, when it looks like it’s going to be close, they’ll move the ISS crew into an area of the station that has the least amount of radiation vulnerability to try to protect them. So it’s obviously something you also pay attention to before you do the spacewalk. They do a space weather and look at the radiation environment. If it doesn’t look good then they won’t go out that day. So that’s another long-term medical issue. There’s some other ones going on. There’s an issue where astronauts have been having vision degradation up there that’s permanent. That’s one that I won’t get it into because I don’t completely understand it, and I don’t think they do either. What’s causing it. But it has to do with the change in pressure behind

your eye and things like that. Some people have it, some people don't. I'm part of the study. I'm not affected by it, but on the other hand I didn't do long duration. I only did short duration. So.

DM:

Something that can't be repaired, you say?

SL:

No.

DM:

Wow.

SL:

No. And so they obviously want to figure out root cause; they want to figure out whether it's genetic; figure out, "Can we screen for this? Make sure we know if somebody is predisposed to get it?" But it's one of the ongoing investigations. Let me fast-forward to coming back from flights. So after being in zero G for a period of time. And the longest I was ever in zero G was sixteen days. Most of my missions were about two weeks long. But the symptoms you get coming back is—First thing is you get used to zero G. You get used to things not weighing anything. I mean, they have mass. So if you're moving a big three hundred pound bag, if you move it too fast, stopping at the other end is really hard to do, kind of thing. But you can move large objects no problem. But you get used to zero G, and then when you enter and you hit the G field again, the G's start coming on. I can remember. We'd do the de-orbit burn, and I'd usually just place my pencil and float it and watch it. That way you could detect when the G field was starting to come on, because that pencil would start slowly dropping for the first time. And then you see the G field. But I can remember hitting a quarter G—which, here on Earth we're sitting on one G all the time—a quarter G, a quarter of my body weight essentially, feeling it and thinking, Wow, this is really heavy. Thinking, Shuttle entries went all the way up to one and a half G's. It's just unbelievable how heavy you feel. After my first flight—after I landed—I remember sitting the cockpit and we're doing post-flight stuff, and kind of looking at my legs and thinking—they felt so heavy—I'm thinking, I can't move my legs. They're too heavy. I could, but it was more recalibration than anything else. But I didn't think I could, because they felt so heavy. Everything felt so heavy. So as you enter the G field, you also—it makes you dizzy if you move your head. What I always did with my crews is, first thing is do isometric exercises as the G field is coming on. Where you're pushing your legs against rudder pedals or pushing your feet against the floor, those sorts of things. And then start moving your head. And I told everybody, "Move your head until the cockpit starts spinning, and then back it off. Move it the other way until it starts spinning and keep exercising it all the way through, on all three axis." So that whole flight by the time—particularly as a commander, you had to fly the vehicle under those conditions because it was a manual landing. Wanted to make sure I was as normal as

possible. Having said that, you're never really normal. I always felt like I was about sixty to seventy percent of my normal capabilities when I flew the shuttle to land it, because of the deconditioning. We compensated for that by a lot of training. Make sure that we could do it routinely. So that's probably the biggest entry. Rarely do people get sick. Most people were able to walk off the shuttles. Sometimes people were not able to walk off. Certainly the long duration crew members that have been up there for six months. I've seen a couple of them walk off; most of them not.

DM:  
Really?

SL:  
Yeah. But it's a longer re-adaptation process for them. Your feet feel weird when you land, because you haven't put any pressure on them. You haven't really used your legs for anything. To me they always felt kind of spongy. I know long duration crew members come back and their feet hurt, and their calves are sore. Because they haven't used them for—You try to work out, but it's not the same thing. And so that's some of it. Even after landing they always warn you about—you know, even if you're walking around—you have trouble, like, turning corners in hallways.

DM:  
Really?

SL:  
And sometimes people—I've seen it—people will turn short or long, or try to do this ninety degree turn. It'll disorient them and they'll crash into the wall and things like that. Usually for short duration crew members that lasts a day or so and then you're over it.

DM:  
How about for long duration? How long would that take to get your—

SL:  
Well they go through a rehab program. So we have ASCRs, they'd call them, "Astronaut Strength and Reconditioning—" team or Coaches or whatever. And they would go through a pretty long—in my day they were pretty much landing on Soyuz and so they'd go back to Star City in Moscow. The trainers would have them on the treadmill and doing exercise with them. I think the whole process is several months before they get them fully back and up and they evaluate them. But I mean, you know, after a week or so they're doing fine. But those first several days, it takes a little while.

DM:

Bonnie mentioned one story about you being in a hotel room, not long after returning, and having a hard time getting out of bed, I think, or something?

SL:

That was a—yeah, I can't remember which flight that was. I think it was on—it might have been—I don't know if it was my first flight but—Of course I was really tired after the mission. I was asleep and got up in the middle of the night to go use the restroom and I just got completely disoriented, and I couldn't figure out where the floor was. Because, you know, there's no floor in space. And I was crawling on my hands and knees because I didn't trust myself. I just literally—it was weird. My wife woke up and said, "Steve, what are you doing?" I said, "I can't—" I remember telling her, "I can't find the floor." [Laughter] So that just happened that one time.

DM:

That's amazing. Do you ever have a memory or a flashback of that feeling? I mean, long after a flight?

SL:

Occasionally, but not a physical disorientation like that. But it's—

DM:

But you think back to that?

SL:

Yeah, I remember. And every time I went up again, as soon as I got into zero G, I remembered it all. It's very familiar to me. It's—with the number of flights I have, every time I went up it's a very normal, comfortable place to be for me, because I'm used to it.

DM:

When you start to feel the weight as you come back to gravity, is there a particular place in your body where you feel the weight, or is it just an overall feeling of, "Oh! This is heavy."

SL:

Probably, yeah, I feel it in my arms because I'm moving around. I think I probably feel it mostly up here, because I'm wearing a helmet that's heavy. That's kind of banging around. That's probably where I feel it the most.

DM:

Not in your lungs or anything like that?

SL:

No. No.

DM:

It's not like difficulty of breathing?

SL:

No, I didn't know—I never noticed that.

DM:

Well that's a good point about having to land this thing with this transition going on, because, you know, in *Apollo* they were laying on their backs and just coming down. I mean they weren't trying to—They weren't having to land a spacecraft.

SL:

Yeah, it's a little different. Same with Soyuz. They were pretty much on their backs. I mean they still have activities to do, and I'm sure it was probably much more difficult for their guys coming down. I haven't flown a Soyuz, but coming down in a Soyuz after six months when you're pulling four or five G's, that's got to be really tough. But it's pretty much automated when they do it. But then there's been some Soyuz landings where they've done what's called ballistic entry, where they had a navigation failure and it goes into backup mode and they land three hundred kilometers away from where they're supposed to and then there's nobody there to get them out. They have to get themselves out of the capsule, which after six months is tough. A lot of times they'll—Soyuz—they'll land and they'll roll. May end up upside down. And really confused about which way is right side of up. There's stories of folks landing upside down like that, releasing themselves from the seats, and crashing into the other side because they didn't realize they were upside down. So that's a tougher ride than a shuttle. Shuttle is a Cadillac by comparison. [laughter]

DM:

Well you mentioned that you were not always hungry, but you ate. Was it pretty well required that you're going to get this amount of food down?

SL:

Well we—that was just the first day. So we would—typically for every mission—we'd always go through food testing. Go try all the food. And then you would make your menus out. So we made our own menus out for breakfast, lunch and dinner. Now for Space Station crews they didn't do that. They kind of had a standard—it's just not practical to plan out of six months of meals. But for shuttle missions we'd plan them out. We could pick what we wanted for each meal and do all that kind of stuff. Usually a nutritionist would look at it. In my experience they

always insisted we had more food than we could possibly eat. I never ate, I don't feel like I ever ate half of what they sent me. They always claimed, "Well you're going to burn just as many calories on orbit as you do on the ground." I never believed that.

DM:

What did you choose?

SL:

Oh, you know, a variety of things.

DM:

Any favorites?

SL:

Favorites? Anything with a lot of spice, I liked. Obviously, I'm sure you heard this from other folks, the shrimp cocktail. I liked those because they were spicy. And the food was pretty good. We did a kind of combination of freeze-dried food. We had portions of MREs, the military use, up on Station. A lot of times we'd eat Russian food, which was good just to try the variety. I felt like up there eating I was mostly eating for effect. Eating so I could go keep working. I didn't worry too much about the food. Now if I was on a long duration flight, probably be a lot different. Food is a big morale thing, right? It really affects your psychological well-being as well your physical well-being. But for shuttle flights you could eat anything. I knew one person that when they did menu planning for shuttle, he just picked the same meal for every meal for all the days. Just the same thing. I couldn't do that. [Laughter]

DM:

Is it mushy? Is it something you can chew?

SL:

All different textures.

DM:

Really?

SL:

Oh yeah. Yeah. We had—you know—The way we usually prepared food was if it's hot food it was rehydratable, usually. So you would have little instructions says, "Two ounces of hot water." And let it sit for however many minutes. So you would—it had a little receiver and a needle and you would stick it in the machine, dial in the number of ounces, hit hot or cold. It would inject it in, you would pull it out. And then we had a little oven that would kind of heat it up and you'd

just throw it in there and heat it up if it was hot. If it was cold you just do it cold. A lot of things had to be rehydrated. Sometimes the MRE stuff—the military stuff—it already had the moisture in it. You would just throw it in the oven and let it heat up. Then when it come time you learn how to open it with scissors and carried a spoon and ate it. We'd carry tortillas and things like that.

DM:

Really? But it's always a spoon. Is that your only utensil?

SL:

No, we had—I guess we had spoon, fork, and knife, but spoon is easiest to use so just use a spoon.

DM:

Can you just squeeze this stuff out of the pouch?

SL:

Some of the pouches you could. Like we'd carry like cheese spread and you'd squeeze out. Like interesting thing about opening food, you learn very quickly is that if you're opening a pouch and you're using a pair of scissors to open a pouch here on Earth, you're just going to cut across the top. You don't cut all the way across the top in space, because if you cut across the top now you have two pieces of stuff to manage in zero G. So you leave it attached. Just little tricks like that makes it easier to manage. But you learn how to do that by experience.

DM:

That's interesting.

SL:

Uh-huh.

DM:

Let's go to another topic, if that's okay?

SL:

Okay. All right.

DM:

You talked at the press conference yesterday about the personalities of the *Columbia* crew? That's 107. Can you go back over that for me?

SL:

Sure. Well, let's see. I'll tell you my own experiences with them. So Rick Husband, the commander. Actually Rick and Kalpana and Mike Anderson—we're all in the same astronaut classes. So we all came in in the same time. But Rick—a few things about Rick. He was a similar background to me. A little bit older than I was. He obviously came through here. He was an F-4 pilot, so was I. I never—I didn't know—I'd heard of Rick, and I think he heard of me, but I never crossed paths with him until we got to NASA. So he was a test pilot just like I was. He was at Edwards, though. I was at Eglin. He went through test pilot school before I did. So I got first—they were—he and Evelyn were probably the first ones we met when we moved to Houston. We were staying at the same apartments. We were waiting to sell a house, they were waiting to buy a house. So we were in the same apartments. That's where I first got to know them. So interesting things about Rick. He was—a lot of people don't know—he was just about one of the funniest people I ever met. He was hilarious. He would—as I did family escort for them, he did family escort for several of my flights. Was also my casualty—my CACO [**Causality Assistance Calls Officer**—on a couple of my flights, too, for Diane. He was so funny that my kids would—they'd be going to an event down in Florida when I was in quarantine and he was escorting them around, and they were kind of half like, "Well we don't really want to get off the bus and do whatever event we're doing with Dad." You know talking across the ditch, because I couldn't be with them. "Because we just want to sit here and listen to Rick all day tell jokes." [DM Laughs] And so he was a funny guy. He was an outstanding singer. He had a great voice. I know when we went to school here he was a singing waiter at one of these restaurants around here. So he was really good at that. He was very musically talented. And just a good guy. Great pilot. He was probably my—probably my best friend in the office. So he was a great guy.

DM:

Was he a practical joker? Was there a lot of that in the astronaut corps?

SL:

There's a lot of that in the astronaut corps. I'm probably more of the practical joker than he is, but he was just funny. He was just funny. Willie. Probably one of the smartest guys I've ever met, no kidding. I mean, he's brilliant. Very quiet, unassuming, humble, so was Rick. But really smart guy. I had the opportunity with Willie to—he was in the class behind ours—but he and I worked together on—we upgraded the space shuttle cockpit to a glass cockpit and upgraded all of the displays. He ran the trajectory stuff in that upgrade program, and ran that team. Like I said, he was brilliant, and he did great work on that. A lot of the stuff that he designed is probably the only piece that actually ended up on the space shuttle. A lot of what he designed is the roots or the basis of what's on *Orion* now. Most people don't know that, but I do. Because I know what he did. But really smart guy. Quiet. But a great guy, and I was really good friend with Willie too. I remember the day that Willie got assigned to 107, because he came up to me and said, "Hey, I

just got called on 107. To be on 107.” I told him congratulations. I said, “That’s a great flight. You’re going to be in the thirty-nine degree inclination.” And that’s the angle of the orbit to the Earth, which is great for looking out on the Earth. And that’s like the best Earth observation angle to be at. And it’s a long mission. You know, a sixteen day mission. And I said, “You’re going to have a great time.” So I was really glad to see him assigned. So I still remember that day. Let’s see, Mike Anderson, also a classmate. He was also an Air Force officer, pilot. Good guy. He and Rick and I were all in—when we were ASCANs [**Astronaut Candidates**]  
—we had bible study, so we were all in that bible study together. I knew Mike really well, I knew his family really well. It was Mike’s second flight. He was—he was a pretty quiet guy. Nice guy. Very, very capable, competent, good guy. Let’s see, Kalpana, she was really interest. She was also my classmate. I flew my first flight with her. So we flew our first flight together. She was from India. She’d come over to this country—I think she got her undergrad degree in India and then she came over to this country. She really—I don’t know if the right word is “black sheep” of her family, but culturally, what she did as a woman—to go into engineering, and come to the States and do all the independent things she did—was not the cultural norm from where she came from. As a result, I think she was kind of considered the black sheep for doing that. Now I can tell you her parents loved her. Her dad, particularly, because I talked to him at length. Very, very proud of her. What she was able to accomplish. But I imagine culturally what she did was very difficult in those days. But she came over here. She got advanced degrees, I think, from UT and also from CU, up near where I live. But she was a brilliant engineer, and she was full of life. She absolutely loved to fly. She flew all the time. She was a private pilot. She loved to fly, she loved adventure. Because we knew each other so well—I think it’s debatable which of us gave the other the hardest time, constantly. But it was all in good fun. But she was wonderful. She was great to fly with. I remember she—on my first flight—we were—she was so excited about the flight, having so much fun, she decided we had to write a haiku—you know, like a Japanese poem. She said everybody in the crew has to contribute a line to this haiku thing she was writing. I don’t even have it. I don’t remember what it said. Of course I was the last holdout, because I’m—that’s not me. [DM laughs] She finally cornered me on the middeck one day and made me. Wouldn’t let me go until I gave her a line, so I finally did it. But she was full of life. She had these little toy airplanes on her desk, and they were all neatly arranged all the way around her desk. Whenever I went over to her desk, talking to her, I would start taking those airplanes and moving them around. [DM Laughs] Turn them upside down. It used to drive her crazy. And she knew it. She knew I was doing it on purpose. But it was fun. Anyway, that was Kalpana. Dave Brown and Laurel Clark I didn’t know as well. They were in the class behind mine. I mean I knew them. I worked with. They were both medical doctors. Dave was like the crew photographer. He always had a camera. He was always filming on them. Wherever they were going they always had a camera going. He was just totally into that. Dave was interesting because he was a flight surgeon in the Navy that eventually went to pilot training. Became a pilot also. So he was a flying flight surgeon. Laurel was also Navy. I guess she was a flight surgeon—she was a doctorate as well. Of course I knew all their kids because I did family escort for them

as well. And let's see. Finally, Ilan Ramon. Ilan was the Israeli astronaut. I first met Ilan when I was at an elementary school in Houston for my oldest daughter. It was one of those things where they, like, do the dinner and then the PTA meeting and then open house. And so we were sitting across from his family. As it turns out, Ilan's oldest son and our oldest daughter were in class together and knew each other. So we're sitting across from his family, we introduce ourselves. It's clear by their accent that they're from Israel. So we got to talking and they're from Israel. I said, "Well what are you doing here in Houston?" And Ilan looked at me and said, "Well I'm training to be an astronaut." And I looked back at him, I said, "No you're not. I am an astronaut, and I don't know you, therefore you can't be one." Of course I was wrong. But he had just—they had just gotten there. Been there for about a month. Well they were—they hadn't announced the flight yet and none of us knew that there was going to be an Israeli astronaut on the flight, so it was kind of being held quiet. So it turns out I was wrong. But anyway, I got to talking to Ilan and Ilan was an F-16 pilot in Israel, Israeli Air Force. He'd flown a bunch of other airplanes too, but I got to talking to him, and of course I had flown F-16s as well. I started telling him this story that while I was a test pilot I got to go to Fort Worth, pick up a brand new F-16 and deliver it to Israel. Flew it to Israel. I described the airplane, the tail number, and where I flew it to. As it turns out, I flew that airplane from Fort Worth, delivered it to his squadron while he was in it. Of course we didn't know each other at the time. Because I told him the tail number and where I went to. He was like, "Yeah, that was my squadron. I used to fly that airplane all the time."

DM:  
Wow.

SL:

And so it's like, what a small world that is! What are the chances of that? And so anyway, I got to know him. Good friends with them. Of course our kids were in the same class together. But Ilan was a quiet, humble guy. He was extremely capable. Obviously a great pilot. One of thing that a lot of people don't know about Ilan is back in 1983 when the Israelis launched a mission and took out—I guess it was an Iraqi nuclear reactor that the Iraqis were building to get nuclear weapons. Israel obviously didn't want to that, so they launched a raid using half a dozen F-16s to take out that reactor. As it turns out, Ilan was on that raid. He was the last guy in over target, and he's the guy that planned the raid. He was the youngest guy. He was like twenty-six years old when he did that. But that was all highly classified. It didn't really come out until after the *Columbia* accident. I had known about it beforehand because he told me. So yeah. But he was a great guy. So, I think that's all of them.

DM:

What kind of precautions did they take when he was about to fly?

SL:

So that was interesting. That's why we had—For every mission, NASA—or the Astronaut Office—we'd assign two family escorts to take care of the families. Our job was to take the families down to launch and the landing, to act as a liaison, let them know what's going on during the mission, get them to when they do video teleconferences and do all that kind of work. Take care of their kids—babysit their kids—whatever they need. For this particular flight we did—we had four family escorts. And the reason being was they were a dual-shift mission. So they were working—half of them were working during the first part of the day and half of them were working during the second part of the day, because they were doing science twenty-four hours a day. Because of that they were all on different sleep schedules. So we needed four family escorts to do that. But additionally, because Ilan was flying, there were a lot of security concerns. Like normally, the families for a launch would stay at a particular condo in Cocoa Beach. Actually Port Canaveral is where we stayed. And we work out of there. But because of the security surrounding this launch, instead of staying there we actually stayed at Patrick Air Force Base. So we stay on the Air Force base. We had special drivers and we had police escort every time we went onsite to protect the families of the crew. Primarily because of concerns around security. So that was a little different. We didn't do that for landing, but we had to do that for launch. So that was very unusual. That's something I don't know if we've ever done before. So that made it a lot more complex.

DM:

Yesterday you talked about your—about John Glenn. What he was like. Can you talk about some other individuals that you knew at NASA—people that would pop into mind. People that were important to you, and just tell me a little bit about them?

SL:

Well, let's see. Like, people that are, like, historical/famous kind of figures?

DM:

That would be fine, yeah. Or anyone really that's important to your mind.

SL:

Well I think—You know, I talked about John Glenn. I would say the Astronaut's Astronaut, the man who just recently passed away, John Young. He was—he kind of had this aw-shucks, low-key attitude when he talked. But he was really smart. He was almost like the conscience of NASA, particularly from a safety standpoint. If there were safety issues, he would write a memo about it and send it out to the world. I collected all of them. I still have them all. I call them Young-o-grams. But he, "This, that, and the other subject." I didn't necessarily always agree with what he put out, but he was our conscience. He was always advocating for safety and doing the right thing. Obviously, having been through *Apollo I*, and *Challenger*, and then later

*Columbia*. He actually retired right before *Columbia*. He was always watching out for that. I flew with him in airplane, I flew with him in the sim, and even at—by that time he was probably close to seventy, and he was still a really good pilot. I mean he was just—and same thing in the shuttle. He was just—he was probably the guy I really looked up to. I mean when you think about astronauts—I mean, I met Neil Armstrong, and I knew him. He was an awesome individual. I know Buzz really well. I know Jim Lovell, who is a super guy. I know a lot of these guys. But the one—probably because he worked at NASA the whole time I was there—is John Young. He's the one most astronauts will say. You know, "Who is the guy?" They say, "He's the guy."

DM:

Everybody says he was brilliant.

SL:

Um-hm.

DM:

But I don't have an idea of how, you know? Was he especially smart in this area or in that area? How did that manifest?

SL:

I would say that he just knew—he was really good at—I thought—at understanding trajectories and aborts in the space shuttle. He was really focused on the emergencies during ascent. That was probably a big area of emphasis. I know that—like here's a flag he raised at [0:42:31.7], right before I flew the John Glenn flight. Because of some of our payloads, we were testing some equipment for the Hubble Space Telescope. And the Hubble is at a very high altitude compared to everything else. Normally we fly at two hundred and twenty nautical miles, is where the Space Station is. Roughly two hundred and ten, something like that. We normally fly at those altitudes, but Hubble is up at about three hundred and ten nautical miles. It's right at the limits of where the shuttle can go. Because we had these Hubble experiments on board, they wanted to use the same environment. So when we flew *STS-95*, while we didn't go to Hubble, we went up to Hubble altitude. So we went to like three hundred and five nautical miles. The problem with that is—you get more radiation exposure, but that's not that big a deal—but the real problem with that is it's right at the limits of what the shuttle can do. So when you launch—when your engines cut off you're in a particular orbit, and then you have to use these orbital maneuvering systems engines, they're a couple of six thousand pound bigger engines, to orbit adjust. Well we launched—I remember, because we launched that flight completely full, 100 percent full of fuel. When we finished the burn that got us to three hundred and five nautical miles, I looked at my gauges—because that was one of my systems—and I had 52 percent propellant left. We still had to do a satellite deployment and retrieval. Well 52 percent propellant left means you use pretty much half your propellant just to get there. Which means you're going

to have to use the other half of your propellant to get back. Which also means that if you have an engine failure or anything—a prop failure or a tank failure or anything—you’re not coming home. Because of that—and typically on lower altitude flights you have a little more margin to get home with. John raised the flag at the flight readiness review. “You’re putting these guys at unnecessary risk because you’re going so high, just to get an equivalent environment—which is probably not much different than being at two hundred and fifty miles,”—or something like that. And so that’s an example. But he looked at everything. It wasn’t just trajectory he was expert at. He’d been in space program for so long he’s seen everything. He knew everything. He was always energetic and trying to make a different.

DM:

What is—what was—Neil Armstrong like?

SL:

Neil? I only met him a couple of times, so I didn’t know him well. But Neil was a—you had to pick somebody to be the first to walk on the moon, he was the right guy. Because he was very humble—very gifted, I mean. On one of his *Gemini* missions, you know when the vehicle went out of control—

DM:

The spin.

SL:

—he saved it. He was very cool under pressure. You know when he landed the lunar lander. You know when he had very little fuel left and had to fly it past some boulders and things like that. He was—

DM:

Keep talking. [movement] [door opening] [voices outside]

SL:

Are we out of time?

DM:

[speaking to a woman] Yeah, oh okay.

SL:

But he was a very quiet, unassuming man. First time I met him he was—when we came back to Houston after one of my flights—I don’t know which flight it was—you know, that’s when I first met him. He showed up for my landing ceremony in Houston. It’s like, you know, I felt like,

Well I don't deserve this! [Laughter] What are you doing here? But he was—and he was just standing quietly. You wouldn't even know who he was if he didn't introduce himself to you.

DM:

God, that's something.

SL:

So he was just a—and John was like that too. John didn't really have a choice but to be—because everybody recognized him. But he was like that too. Neil is a great guy.

DM:

Okay. Anything else you want to add?

SL:

I don't think so.

DM:

Okay. I really appreciate it.

***End of Recording***

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