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ORAL HISTORY TRANSCRIPT

ROBERT L. CRIPPEN
INTERVIEWED BY REBECCA WRIGHT
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WRIGHT: Today is May 26th, 2006. This oral history interview is being conducted with Robert Crippen for the NASA Johnson Space Center Oral History Project in Houston, Texas, at the NASA Johnson Space Center. The interviewer is Rebecca Wright.

Thank you so much for coming in today and visiting with us and giving us time for this project. We know you were here just a few weeks ago to celebrate the twenty-fifth anniversary of the inaugural flight of the Space Shuttle Program. You served as pilot for that first mission. Tell us how you were selected.

CRIPPEN: Beats the heck out of me. I had anticipated that I would get to fly on one of the Shuttle flights early on, because there weren't that many of us in the Astronaut Office during that period of time. I was working like everybody else was working in the office, and there were lots of qualified people. But one day we had the [Space Shuttle] *Enterprise* coming through on the back of the [Boeing] 747. It landed out at Ellington [Field, Houston, Texas], and I forget now where it was going.

But I happened to go out there with George [W. S.] Abbey, who at that time was the Director of Flight Crew Operations. As we were strolling around the vehicle, looking at the *Enterprise* up there on the 747, George said something to the effect of, "Crip, would you like to fly the first one?"

About that time I think I started doing handsprings on the tarmac out there. I couldn't believe it. It blew my mind that he'd let me go fly the first one with John [W.] Young, who was the most experienced guy we had in the office, obviously, and the Chief of the Astronaut Office. So it was a thrill. It was one of the high points of my life.

WRIGHT: Tell us how your previous assignments and even your military experiences helped prepare you for this first flight.

CRIPPEN: Well, I guess most of my adult life I'd sort of worked in that direction. When I was a freshman at the University of Houston [Houston, Texas], I remember writing a paper on rockets and doing some research to do that. I spent my sophomore year up at Huntsville, Texas, at Sam Houston [State University], and it was [at] that time that the Russians put up the Sputnik [satellite]. So it was very obvious to me that before long people were going to be going into space, and I'd always wanted to fly, and I guess flying higher and faster is the objective of most pilot types. So I wanted to continue working in that direction.

I ended up going to the University of Texas [Austin, Texas], where I got a degree in aerospace engineering. Planned on joining the Navy to go fly and work my way [to] test pilot school. I managed to make those objectives. Ended up at the Air Force Test Pilot School [Edwards Air Force Base, California], which at that time was called Aerospace Research Pilot School; they changed the name because they were trying to get spacey, I believe.

The opportunity came to apply both to NASA and the military, because the military was doing a man in space program called the Manned Orbiting Laboratory [MOL]. I applied for both. At some point in the process I had to decide one way or the other and ended up picking

MOL, because I thought NASA had more astronauts than they knew what to do with, and the [Apollo] program, even though it hadn't started, it was already starting to have some of the flights canceled. Ended up being selected for MOL, and sure enough, after a couple of years on that program, it got canceled. Was lucky enough to get transferred over to NASA, along with six of my cohorts that were crew members on MOL.

Started working on things like Skylab, and after Skylab I had an opportunity to work on the Shuttle, which was in the development [phase] at the time. Then I guess all that sort of added up, building on my experience. Working on the Shuttle, I did primarily the software stuff, computers, which I enjoyed doing. And I think all that, stacked up together, kind of opened up the doors for me to fly, whether it was on the first one, and I'm not sure whose decision that was, whether it was John Young's, George Abbey's, or who knows, but I'm sure glad they picked me.

WRIGHT: During those years of training with the MOL and also out at the Air Force Pilot School, you did some computer programming as well. In fact, I understand you took the first class at the University of Texas in computer programming.

CRIPPEN: Wow, it's interesting that you should know that. I did. It was my senior year. Computers were just starting to—shows you how old I am—to be widely used, I guess is probably the best answer. Not PCs [personal computers] or anything like that, but big mainframe kind of things, and Texas offered a course, and I decided I was interested in that and I would try it. It was fun. That was back when we were doing punch cards and all that kind of stuff.

When I got selected for the Manned Orbiting Laboratory, there was an opportunity to work on the computers with that vehicle. I elected to do that, along with my friend Dick [Richard H.] Truly. So because of that interest, when I got transferred over to NASA, when I was assigned to work on Skylab, I said I'd like to work on the computers for that, which they had a computer very similar to what we were using on the Manned Orbiting Laboratory. So I did that, and so it was kind of natural, when we finished up Skylab and I started working on the Space Shuttle, to say, "Hey, I'd like to work on the computers."

T. K. [Thomas Kenneth] Mattingly [II] was running all the Shuttle operations in the Astronaut Office at that time. Didn't have that many people that wanted to work on computers, so he said, "Go ahead."

It was one of the nice things in the Shuttle and in lots of vehicles; the computer sort of interfaced with everything, so it gives you an opportunity to learn the entire vehicle.

WRIGHT: You really got on the ground floor, I guess, of that. How involved were you with the Approach and Landing Test?

CRIPPEN: I was assigned as a chase pilot for the Approach and Landing Test, flying in a T-38 [training aircraft] alongside the vehicles as they popped off the 747. But my first assignment on the very first drop, which Fred [W.] Haise [Jr.] and [Charles] Gordon ["Gordo"] Fullerton were doing, was family escort. On all missions it's been tradition that, with the spouses, that we have an astronaut there, primarily to keep them informed of what's going on, but also in case some contingency arises, you can help them with that. So I was out there with all the wives, not only for Fred and Gordo, but also the wives of the crews on the 747, and it was fun to get to watch it.

WRIGHT: Come back home again.

CRIPPEN: Yes. But then I did do flight chase on several of the Approach and Landing Tests.

WRIGHT: Did you continue your work on software issues? I also understand you did the cockpit displays. You started working on some of those.

CRIPPEN: I was continuing to work on the software at the time, and that naturally led, because the displays that we had on the cathode ray tubes are software generated, that was sort of a natural extension to work some of those displays. Not so much the flight profile displays, but the ones dealing with systems. Then Dick Truly and Gordon Fullerton and I also worked on the cockpit switches and displays—we sort of did it all together. It wasn't just me; it was all of us working on it. But it was an interesting time and a very busy one. As I mentioned earlier, we didn't have too many people in the office back in that period, so there was plenty of work to go around.

WRIGHT: There was the time, of course, that the nation wasn't flying, because we were preparing for Shuttle, and that kept the date moot. At what point in time did you feel that—and this is before Mr. Abbey told you that you would be flying—that you would feel like you would be able to move into that? Because during this time period that you were working on the computers, the Astronaut Office included thirty-five new guys that came in. So did you feel at some point that you would be able to fly, or were you going to have to wait a little bit longer?

CRIPPEN: Well, if I recall correctly, we had about twenty-five people in the office before the thirty-five new guys were selected in 1978, and that actually pretty much coincided with me being told that I was going to fly the first flight. So when they came on board, I was already aware of that, and I think we pretty much knew that we were going to take advantage of the experience we had in the office and try to bring on the new people as fast as we could.

One of the things that I should mention in the software, we put together a—I guess we called it the Tiger Team at the time, made up of Mission Ops [Operations] people and myself representing the Astronaut Office. It was being led by Phil [Philip C.] Shaffer, who was one of the Flight Directors. We were working the software as a unit for the operations, as far as requirements were concerned.

Unfortunately, Phil became ill and had to leave, and so they put me in charge of the Tiger Team. I really had an opportunity to work closely with the Mission Ops folks, MOD [Mission Operations Directorate] at that time, and help develop the software in a wider perspective, I guess, than just what the crew was seeing, because we were working it also for what the ground was going to see. That was really helpful.

I had worked as a capcom [capsule communicator] extensively and for all of the Skylab programs and all the Skylab flights, and also for the Apollo-Soyuz [Program], so I still think that today I have a close association with the folks from Mission Ops and Flight Control. They're what keeps you safe when you're flying. You've got lots of eyeballs looking at you. So working that Tiger Team was really important to me personally for the first flight.

WRIGHT: What type of insight did you get for the operations side when you worked in Skylab and also in the times that you worked in the ASTP [Apollo-Soyuz Test Project]?

CRIPPEN: Skylab was a unique time. I guess it's similar to what we're doing now with the International Space Station. It, in fact, was a Space Station, and we flew—our first mission was like twenty-eight days and then fifty-six and then up to, I believe, eighty-four. You don't sit at a console with those folks working long hours without getting to know them well and know how they operate and knowing their insight to what's going on. So that was extremely helpful to me.

I might mention that leading up to Skylab, I got volunteered for a unique mission, the Skylab Medical Experiments Altitude Test [SMEAT], where Bill [William E.] Thornton and "Bo" [Karol Joseph] Bobko and I spent fifty-six days locked up in a vacuum chamber.

WRIGHT: Small; a small vacuum chamber. [Laughter]

CRIPPEN: A small vacuum chamber over in Building 7. It was primarily to get what I would call the ground truth for the [medical] experiments. Everything was the same, including the atmosphere, except we weren't in microgravity. That was probably the start of where I really got to know the folks in MOD well, because I worked with them to help set up what we were going to be doing during the test.

WRIGHT: It was fifty-six days, I believe, but you spent more, almost a year or so, between the prep [preparation] time and the time you were in the chamber and the follow-up time. What specialties did you have to learn? We understand from Bo Bobko that he was almost—I believe

his expression was if he had pulled one more tooth, he'd have been a dentist. [Crippen laughs.] Did you have any special medical [training]?

CRIPPEN: The plan was, and I guess we were the leaders, to make sure that the crews, since they were going to be in orbit for a long time, could deal with what I would call minor medical emergencies, and part of that was to send us off to dentistry school. We ended up San Antonio [Texas] at the Air Force hospital there. In fact, Bo Bobko and I did extract several teeth. I recall this one young man came in. We'd done it several times with the real dentist overseeing what we were doing, and this one young man came in and his teeth were in terrible shape. He had a couple that needed to be extracted, and we asked the dentist, "Well, are you going to come in?"

He said, "No, you guys can do it."

So Bo and I managed to—the kid was probably about late teens or twenty years old, and he was a little bit nervous, but I did the novocaine with the needle and all that stuff, and Bo flipped the tooth out, because it wasn't in very firmly. I remember the kid, when he got up, he says, "You guys are the best dentists I've ever been to." We didn't let him know the real truth. [Laughter]

WRIGHT: I wonder if he knows that his dentists flew in space.

CRIPPEN: We had to learn CPR [cardiopulmonary resuscitation] and had this dummy that people still use today called "Resuscitation Annie." At that time in CPR, they always had you beat on the chest before you did the compressions. So everybody had been talking about it. It was my turn to go down and try, and I whopped the dummy on the chest several times. Hand kind of

smarted a little bit. Went through it, and it's okay. About that time my hand just started to swell up, and I had broken the fifth metacarpal, and everybody concluded they didn't want to have a heart attack with me around.

WRIGHT: [Laughs] Oh, gosh. Well, I can't imagine being fifty-six days and giving you that feeling of a Space Station environment. And working so closely with Life Science, that was, I guess, another unique experience where you became very closely involved with all of the experiences as well.

CRIPPEN: Since we had all the medical experiments on board that [were] going to be flying, and the medical aspect of it was a primary objective, we did work very closely with Life Sciences and did all of the bad things that we could think of to do to your body to make sure you were still healthy.

WRIGHT: What type of input did you give them as far as from the astronaut perspective about what would work, what's not going to work?

CRIPPEN: Well, the urine collection system on board was very vital to Skylab, because they needed to sample the urine and freeze it, and bring it back and those kind of things. It was sized too small and one burst in the chamber, which was not fun. But as a result of that, the system became larger.

WRIGHT: You also had input on communication systems and timelines and those types of things that are long-duration elements.

CRIPPEN: Primarily, it was, I guess, more like the psychological thing [to stay busy]. On Skylab they had a lot more [to do]. They were doing Earth observations. They were doing solar observations and those kinds of things, and we didn't have them. So we went through trying to add things just to keep us occupied, and I think that was carried over, that you want people to be busy, but you also want them to have time to relax. We did some of that; probably should have done it better, because we ended up overworking a couple of the Skylab [crews] somehow.

WRIGHT: Were these some of the aspects and elements that you thought you'd be doing as part of the Manned Orbiting Laboratory when you were part of the Air Force? [Crippen laughs.] Or can you share with us what you were supposed to do?

CRIPPEN: Well, if I told you what we were doing on MOL, I'd have to shoot you. It's still classified. But essentially, it was a laboratory that was going to go up for thirty days and do military experiments. So we had all the problems of living in orbit for long durations and working up there with two-man crews, because we were using the Gemini vehicle as our vehicle up and down. But many of the things, just with the living aspects of being in orbit for a long period of times were directly associated with Skylab, and that was one of the reasons I think most of us were assigned to work on Skylab.

WRIGHT: I understand, too, that you had a different qualification for being pulled in as part of the astronaut corps. All of you were very qualified, but the astronaut corps couldn't take everybody, so you were split in half.

CRIPPEN: Well, I remember Bo—we were having all these pilot meetings after the program got canceled, and we had, I believe, fourteen crew members at the time. We were all bemoaning as to what we were going to go do next. That was probably one of the lows in my life, when we have a program that was going great, and one morning I got a call, "Hey, it's canceled." So we were down in the dumps, to say the least.

One morning at the pilots' meeting, Bo said, "Why don't we call NASA and see if they could use us?"

We all pooh-poohed the idea, "Hey, NASA's got more astronauts than they know what to do with," because the program got canceled on June the tenth of 1969, just before Neil [A. Armstrong] and Buzz's [Edwin E. "Buzz" Aldrin, Jr.] and Mike's [Michael Collins] flight on Apollo 11. But one thing led to another, and we did formally ask whether they could use us, and it ended up all of us came down and talked to NASA. In fact, we were here during the Apollo 11 Moon landing.

I remember "Deke" [Donald K.] Slayton, who at that time was head of Flight Crew Operations, saying, "Hey, guys, I got more astronauts than I know what to do with. I really don't need you."

But his boss, at that time the Associate Administrator for the Office of Space Flight, George [E.] Mueller, said, "Take some of them."

So Deke said that, "Well, okay. I'll split the group in half and take everybody that's thirty-five and younger," and it was about that arbitrary. Then Deke said, when we came on board, he said, "Hey, guys. I've got lots of work for you to do, but there aren't going to be any flights until the Space Shuttle flies, and that's probably going to be like 1980." At that time, the Shuttle wasn't actually even an approved program. But it sounded good to all of us, and all of us came.

WRIGHT: One of the other assignments you had before STS-1 is that you worked as part of the backup crew for the ASTP mission and was able to travel to Russia. Could you share with us how that was, especially since you had spent so much of your career thinking about Russia; it was during the Cold War.

CRIPPEN: It was during the Cold War, right. Well, actually, I was part of the support crew. I wasn't backup crew. Let's see, Al [Alan L.] Bean, Ron [Ronald E.] Evans, and I can't remember right now who the third backup crew was; maybe it's Jack [John R.] Lousma. We had Dick Truly, Bob [Robert F.] Overmyer, myself, and I believe Bo Bobko ended up being the support crew for Apollo-Soyuz. Tom [Thomas P.] Stafford asked us if we would do that. We'd been working on Shuttle up until that time, but it seemed like an interesting thing to do. You're right; since I'd spent most of my military career getting ready to go to war with the Soviets, to go over and interact with them like this was a little bit different, but it was really interesting.

We were the first group to ever go to Baikonur [Kazakhstan], what we called at that time Tyuratam, and see all of their launch operations and their training operations at Star City, and then ended up being a capcom for the mission. But it was interesting. It was great working with

the Russians. I found out that the cosmonauts—a pilot's a pilot the world over. We got along very well. Still [have] some friends that we interact with there.

WRIGHT: All those experiences you took with you on this trip to STS-1. You had so much training for all the things that you had done prior to that, but, of course, then you began training for the Shuttle, and you were learning along with the trainers, because no one had done this before. Share with us how you all came together and learned and applied that knowledge and shared that knowledge so that your crew and all the crews following you could be prepared for this new spacecraft.

CRIPPEN: Well, it was an interesting time, because we were trying to get the simulators to work. That didn't happen the first time out. So then we were trying to validate that the simulators were as accurate as we needed from a system standpoint and from Flight Control. So we were developing procedures as we went.

I also was the crewman assigned to work what we called Flight Techniques at the time. I remember Neil [B.] Hutchinson, who was the Flight Director, was leading the Flight Techniques for ascent, and we worked out all of them, the calls that we would make. Today when they lift off, they get "Roll program; go with throttle up." And "SRB [Solid Rocket Booster] sep [separation] and up," all of those things we worked out prior to that first flight, and they use pretty much all of them still today.

So we were all sort of learning together. Unfortunately, they gave us more time to learn than we wanted, because the mission kept slipping. We were named in '78, and at the time we thought we might fly in late '79 or even '80. Of course, it ended up being '81. But we took

advantage of the time. Unfortunately, or maybe fortunately, we wrote procedures for every emergency that we could conceive of that we could do something about. I think the crews are still training for those today, even though we've pretty much proven that they're not realistic in many cases.

WRIGHT: Talk about those first simulators and how they evolved through those years. How did you change them? Again, you were trying to train for something that was the unknown, so what are some of the lessons learned, or what was some of the information that trainers and experienced astronauts were bringing to the table to apply to the Shuttle simulators?

CRIPPEN: Well, prior to doing the first flight, all we had to go on was the engineering data that we had, and we used that to make sure of what we could do, as far as you could reach something or you couldn't reach something during ascent or entry. So, there are certain switches that weren't accessible during those periods of time, so we had to make sure that the procedures would match what our capabilities were.

After the first flight we actually came back and did some modifications to the simulator, mostly in the motion, as to how it felt in our motion-based simulator, and tried to make it a little bit more accurate. I know on the first flight we learned that the reaction control jets, which are used to maneuver the vehicle while you're on orbit, really are loud. It sounds like a Howitzer [gun] going off outside the window, and of course, no sound is transmitted through space; you're getting it back through the structure of the spacecraft. But it was a good thing to at least try to simulate that a little bit better in the simulator so that people weren't really surprised by it.

WRIGHT: And that's, of course, something you didn't know till you got there. [Laughs]

CRIPPEN: Well, I knew they'd be loud, but it was louder than I expected.

WRIGHT: In the history of the Spacecraft Center and Mission Control, the Sim Sups [Simulation Supervisors] have always such a reputation of being tough on their crews. Did you encounter that as well?

CRIPPEN: Oh, absolutely. I don't guess they could be Sim Sups if they weren't tough. What they were primarily trying to do is to make sure that the procedures we had in place would work and that we knew how to use them. That was for both us in the cockpit and for the Mission Control folks, because we all had to work together. They would run you through the wringer, which is what we wanted them to do. If there was something that could fail, we wanted to make sure we could deal with it.

It was kind of funny that my middle daughter is one of those simulator instructors today. [Laughs] And I hear she's pretty tough.

WRIGHT: She might need to use you as a student. I understand that maybe one of the rules that you can't drink coffee during training simulations is your doing. [Crippen laughs.] Want to explain to us how that rule came about?

CRIPPEN: Oh yes. Early on we were getting ready for one of our first big integrated sims [simulations] with Mission Control, and John and I used to—we would climb up in the cockpit

with our cups of coffee and sit down in our seats and proceed to work. [Then] one day with this simulation going on, we climbed in and put our coffee down, and we set them on some checklists, books that we had sitting there on the console.

Somehow during the process of getting ready—this was before the sim started—my cup of coffee ended up spilling over, all over the center console between the pilot and the commander, which was full of electrical apparatus. Sure enough, lights started to light up everywhere in the cockpit and on the simulator's console. So we had to fess up that, hey, it was probably not going to work that day, and we had to come down.

I'm curious as to whether people carry coffee into the cockpit anymore. I doubt it. [Laughs]

WRIGHT: I don't think so. One of the other tools that you used to train for the mission was the STA [Shuttle Training Aircraft].

CRIPPEN: Right.

WRIGHT: Talk about the Shuttle Training Aircraft and how that helped you.

CRIPPEN: Well, the Shuttle Training Aircraft, which is a modified G-2 that has a computer in it, that essentially tries to model the way the Shuttle is supposed to fly, and so when the pilot moves the control stick, it goes to the computer. The computer goes through and tries to move the aerial surfaces on the airplane to simulate the Shuttle. It also has the thrust reversers, which are

normally used in airplanes to slow you down after you land, were modified so they could be applied during flight so you could simulate the drag that you get on the Shuttle.

The folks did a marvelous job coming up with that vehicle. The ground-based simulators give you some idea of what it's like to fly, but it's not like the real thing, and the STA does an excellent job of that. We did extensive approaches, primarily using the runway out in White Sands [Test Facility], New Mexico, but we also flew at Edwards [Air Force Base, Edwards, California], and we flew it at the runway at the Kennedy Space Center [KSC, Florida].

I think John and I had on the order of fifteen hundred approaches each before we flew that first flight, and even today all the crews that fly get lots of practice in it. I think that's why they've made all the landings look as easy as they have, because they do have that practice. It is different than flying an airplane, especially in the final touchdown phases. It's similar, but without that simulator I think it would have been very tough to do as great a job as John did on the first flight and the rest of the crews have after that.

WRIGHT: Do you feel like it's as close to being the real thing as doing the real thing?

CRIPPEN: It is as close as I know how you could do it. The thing that's different primarily is if you're in turbulence. Because of the wing loading on the Shuttle Training Airplane, it bounces around more than the actual Orbiters do when they come in. They're so big, and the wings are such that you can pretty much plow through most of the turbulence without bouncing or feeling it.

WRIGHT: To get you prepared for this mission, you also did some simulations involving actually repairs of tiles. You prepared by learning to do EVAs [Extravehicular Activities]. Could you share with us about what you didn't have to do on that first mission?

CRIPPEN: Well, the tiles were a big concern. Initially, when they put the tiles on, they weren't adhering to the vehicle like they should. In fact, [Space Shuttle] *Columbia*, when they brought it from Edwards to the Kennedy Space Center the first time, it didn't arrive with as many tiles as it left California with. People started working very diligently to try to correct that problem, but at the same time people said, "Well, if we've got a tile missing off the bottom of the spacecraft that's critical to being able to come back in, we ought to have a way to repair it."

So we started looking at various techniques, and I remember we took advantage of a simulator that Martin [Marietta Corporation] had out in Denver [Colorado], where you could actually get some of the effect of crawling around on the bottom of the vehicle and what it would be like in zero-G [gravity]. I rapidly came to the conclusion I was going to tear up more tile than I could repair, and that the only realistic answer was for us to make sure the tiles stayed on.

Now I know today after the loss of *Columbia* that people are looking at similar kinds of things again. They've got more capability, especially when you're docked to the International Space Station, to access some of these places than what John and I would have had on the first flight. But it was something I concluded, that at that time we couldn't have realistically repaired anything.

WRIGHT: What about the EVA training? How did that evolve from this time when you were being prepared for that?

CRIPPEN: Well, we only had two of us on board, and we concluded it was not realistic for both of us to go outside, that somebody needed to be inside to handle the systems if we had a person outside. The big thing that we worried about from an EVA standpoint was the payload bay doors. They were absolutely critical. As far as reentry was concerned, they had to be closed. They're kind of big items with lots of latches that are somewhat complicated, and so we started trying to come up with ways that if they didn't close normally, that I could go outside and get them closed. We devised winches with ropes and whatever, pulleys to pull them down, and then latches that we could go apply when the real latches didn't work. So we did quite a bit of simulation of that, and I felt fairly confident that if we ran into a problem, that perhaps I could correct it. But it was not something I was looking forward to.

I do recall in one of those simulations in one of our small water tanks—at that time we didn't have the big WETF [Weightless Environment Training Facility] that they've got today—I was in the tank working, and in a suit, a space suit, and the leg on my suit, my left leg, I believe, blew off, which you would not want to happen in space. I'm not sure whether somebody just didn't put it together right, but we ended beefing up the suits after that, because they were absolutely critical. But that got my attention. In fact, I was happy that I happened to be sort of in an upright position when it happened, because if I'd been inverted, which I was climbing around a lot of ways, all the water would have come down into my suit and into my helmet. But luckily enough, that didn't happen.

WRIGHT: That was quite an experience. You mentioned earlier about how the date was slipping, and, of course, you had the tile issues. And I know that at some point you had main engine

issues that you were working through. You were involved with all those aspects. How did you and John Young remain focused on training and trying to get these objectives down when you had all the attention of this first flight, plus all the press coverage, and then the delays?

CRIPPEN: Well, we mentioned earlier that we had the class of '78, the thirty-five new guys, come on board. I think they made it possible, because we essentially assigned each of those individuals to some aspect of preparation for the flight. So they would go out and go to the Flight Techniques meetings. They would go run what we'd call the SAIL, our Shuttle Avionics Integration Laboratory. They were looking at the hardware at the Cape [Canaveral, Florida]. So we had a multitude of people that were focusing on making sure that John and I could focus on the flight. But it did keep us busy.

WRIGHT: Well, the day did finally get there. Well, first you had one day. April the tenth came and it was the original date for launch, but the flight was delayed due to a computer issue. What were your thoughts about that, since you—did you get to help resolve that issue?

CRIPPEN: [Laughs] You know, the vehicle is so complicated, I fully anticipated that we would go through many, many countdowns before we ever got off. When it came down to this particular computer problem, though, I was really surprised, because that was the area I was supposed to know, and I had never seen this happen; never heard of it happening. It was where the backup computer couldn't hear what the primary computers were saying. There were four primary computers and one backup computer, and we considered the backup absolutely essential to have, but they weren't communicating properly.

I know John and I spent an extra three hours out on the pad strapped in on our backs, for a total of six hours strapped in, before we finally gave up. In fact, that six hours is still used as the max [maximum] to put people through, because it does get pretty uncomfortable strapped in on your back for that long a period of time.

But we climbed out, and I said, "Well, this is liable to take months to get corrected," because I didn't know what it was. I'd never seen it. It was so unusual, and the software so critical to us.

But we had, again, a number of people that were working very diligently on it. In fact, they used the SAIL again, and they proved what the problem was, which was an initialization thing. We just happened to catch a minute window when we started up the backup computer that caused the problem to occur. So it was rapidly concluded that, "Hey, if you go do it again, the odds are it's not going to happen."

So we scrubbed on the tenth, pretty much figured out the problem on the eleventh, and elected to go again on the twelfth. But when we went out there, I didn't think we were going to go again. I thought, "Hey, we'll go out. Something else will go wrong. So we're going to get lots of exercises at climbing in and out." But I was wrong again.

WRIGHT: Well, as part of ASTP, you helped strap the crew in.

CRIPPEN: I did.

WRIGHT: Now this role was reversed, and someone was strapping you in. Were some of the same procedures and some of the processes that were done during the Apollo time, were those transitioned over, or was it a completely different way of doing business with the Shuttle?

CRIPPEN: It was similar. It's a different vehicle. You still have a closeout crew; still have somebody running the closeout crew. Günther [F.] Wendt, who's infamous and famous at the Cape, has been the pad führer since the Mercury days, and he was the pad leader on Apollo-Soyuz when I was the crewman assigned to go in and help with the closeout. We still use that today, and we did for STS-1, put an astronaut in with the closeout crew that is there to help the crew strap in and make sure the vehicle is configured properly for flight. So those things have carried on and are still being carried on today.

WRIGHT: Well, you were ready to go, and Launch Director George [F.] Page put a hold on. Will you share with us your thoughts about where you were at that point, and then, of course, what you felt as Shuttle did lift off for the first time.

CRIPPEN: Well, George Page, a great friend, one of the best Launch Directors Kennedy Space Center has ever had, really ran a tight Control Room. He didn't allow a bunch of talking going on. He wanted people to focus on their job. In talking prior to going out there, George told John and I, he says, "Hey, I want to make sure everybody's really doing the right thing and focused going into flight. So I may end up putting a hold in that is not required, but just to get everybody calmed down and making sure that they're focused."

It turned out that he did that. I believe it was at the launch-minus-nine-minute point, and it was for a few minutes, to get relaxed. I was sitting back and, you know something's going to—it's after you pass that point that things really start to come up in the vehicle, and you are looking at more systems, and I said, "Hey, we're going to find something that's going to cause us to scrub again." So I wasn't very confident that we were going to go.

But we hadn't run into any problem up to that point, and when we did come out of the nine-minute hold, five minutes, I started up the APUs, the auxiliary power units. Everything was going good. The weather was looking good. About one minute to go, I turned to John. I said, "I think we might really do it," and about that time, my heart rate started to go up. I think they said it was—because we were being recorded, and it was up to about 130. John's was down about 90. He said he was just too old for his to go any faster. [Laughter]

And sure enough, the count came on down, and the main engines started. The solid rockets went off, and away we went.

WRIGHT: Just as planned.

CRIPPEN: Just as planned. Pleasantly surprised.

WRIGHT: You had, going into the mission, approximately 140 mission objectives on this two-day flight. Share with us how you two were able to accomplish so much that you did and to get the systems checked out for the next flight.

CRIPPEN: Well, of course, on those initial flights, including the first one, we only had two people on board, and there was a lot to do. We didn't have any payloads, except for instrumentation to look at all of the vehicle. So we were primarily going through what I would call nominal things for a flight, but they were being done for the first time, which is the way a test flight would be done.

First you want to make sure that the solids would do their thing, that the main engines would run, and that the tank would come off properly, and that you could light off the orbital maneuvering engines as planned; that the payload bay doors would function properly; that you could align the inertial measuring units; the star trackers would work; the environmental control system, the Freon loops, would all function. So John and I, we were pretty busy. The old "one-armed paper hanger" thing is appropriate, in this case.

But we did find a little time to look out the windows, too.

WRIGHT: You had been a pilot with the Navy and then served at the Air Force school. You'd flown many types of aircraft, with hundreds of hours flying in planes. How did being a pilot in the Shuttle differ from being a pilot in the airplanes?

CRIPPEN: First, we use the terms *commander* and *pilot* to confuse everybody, and it's really because none of us red-hot test pilots want to be called a copilot. In reality, the commander is the pilot, and the pilot is a copilot, kind of like a first officer if you're flying on a commercial airliner. So my job on this particular mission was primarily systems oriented, working the computers, working the electrical systems, working the auxiliary power units, doing the payload bay doors.

However, I was also trained to fly the vehicle if that should be necessary. So usually when you're flying an airplane, you don't have as many systems to worry about, or they're much simpler, and you're also doing the piloting. Most of my career was spent in single-piloted airplanes. I didn't fly with copilots, so it was different from that aspect. But the vehicle is such that you need two people, or more, if you can get them.

WRIGHT: You had ejection seats in this first mission. What were your thoughts about if you had to use them and what type of training and information was given to you in the event that you would have to utilize these?

CRIPPEN: Well, because there was a test flight and people felt like we needed some way to get out if something went wrong, in truth, if you had to use them while the solids were there, I don't believe you'd—if you popped out and then went down through the fire trail that's behind the solids, that you would have ever survived, or if you did, you wouldn't have a parachute, because it would have been burned up in the process. But by the time the solids had burned out, you were up to too high an altitude to use it.

On entry, if you were coming in short of the runway because something had happened, either you didn't have enough energy or whatever, you could have ejected. However, the scenario that would put you there is pretty unrealistic.

So I personally didn't feel that the ejection seats were really going to help us out if we really ran into a contingency. I don't believe they would have done much for you, other than maybe give somebody a feeling that, hey, well, at least they had a possibility of getting out. So I was never very confident in them.

WRIGHT: One of the tasks was to make sure the payload doors worked the way they were supposed to. Tell us about, when you opened them, what you found.

CRIPPEN: Well, first, it was my first flight. We knew people had a potential for space sickness, because that had occurred earlier, and the docs [doctors] made me take some medication before liftoff just in case. I was very sensitive when we got on orbit as to how I would move around. I didn't want to move my head too fast. I didn't want to get flipped upside down in the cockpit. So I was moving, I guess, very slowly, and when it came time to open up the doors, I eased back into the rear cockpit and—I only go through that because I was standing there, starting to operate the doors, and I turned to John. I said, "You know, this feels like every time I've done it in the simulator, except my feet aren't on the floor." I was there floating above the thing. But it was that kind of thing, because the simulations were very good. So I went ahead and did the procedure on the doors. Unlatched the latches; that worked great. Opened up the first door, and at that time I saw, back on the orbital maneuvering system's [OMS] pods that hold those engines, that there were some squares back there where obviously the tiles were gone. They were dark instead of being white.

So I went ahead and completed opening the doors, and when we got ground contact—because we didn't have ground contact but, oh, less than 25 percent of the time at that time, because we didn't have the satellites in orbit. We had to depend on ground stations. We told the ground, "Hey, there's some tile missing back there," and we gave them some TV [television] views of the tiles that were missing.

Personally, that didn't cause me any great concern, because I knew that all the critical tiles, the ones primarily on the bottom, we'd gone through and done a pull test with a little device to make sure that they were snugly adhered to the vehicle. Some of them we hadn't done, and that included the ones back on the OMS pods, and we didn't do them because those were primarily there for reusability, and the worst that would probably happen was we'd get a little heat damage back there from it.

But, of course, the big question on the ground was, well, if some of those are missing, are there some on the bottom missing. So I know there was a lot of consternation going on on the ground about, hey, are the tiles really there. But there wasn't much that we could do about it if they were gone, so I personally didn't worry about it, and I don't think John worried about it very much. But it was one of the items in the flight that got a lot of publicity here on the ground, I know.

WRIGHT: Others that you'd like to share that kind of was a nice reality for you to experience there, something you hadn't done in a simulator and then you saw that it worked well, or some other experiences on that first flight that you'd like to share?

CRIPPEN: Well, it was all fantastic. People ask me sometimes, "What was the best part of the flight?"

I use John Young's answer, which is, "The part between takeoff and landing." It was all great. Getting to look out at the Earth and see it, and going around it once every hour and a half, is phenomenal. It really is a unique experience. I would have liked to have spent more times

looking out the window. Now, I discovered that the commander gets to look out the window more than the PLT [pilot] does, so on my subsequent flights I took advantage of that.

But I will remark that I was worried about potentially being sick, and it came time after we did the doors, to go get out of our launch escape suits, the big garments we were wearing for launch. I went first and went down to the middeck of the vehicle and started to unzip and climb out of it, and I was tumbling every which way and slipped out of my suit, and concluded, "Hey, if I just went and tumbled this way and tumbled that way, and my tummy still felt good, then I didn't have to worry about getting sick, thank goodness." So I was probably not one that was afflicted with that.

But the other part that came there was that this vehicle was big enough, not like the Command Modules of the Gemini or Mercury, that you could move around quite a bit. Not as big as Skylab, but you could take advantage of being weightless, and it was delightful. It was a truly unique experience, learning to move around. I found out that it's always good to take your boots off, which I had taken mine off when I came out of the seat, because people, when they get out and then being weightless for the first time, they tend to flail their feet a little bit like they were trying to swim or something, I'm not sure. So I made sure on all my crews after that, they know that no boots, no kicking.

One of the problems that really bugged the heck out of me on the flight was, I mentioned earlier, we had a lot of development flight instrumentation. We had some recorders for that, and one of them was not working. We really wanted it to work for entry, because it was vital to getting some data. So the ground asked me if I would go change it out with another recorder. We'd practiced a number of in-flight maintenance procedures—not this one—so, "Sure, we'll go give it a try."

When I tried to take the panel off that it was behind—it had some screwlike devices there—I tried screwdrivers. I tried power wrenches. Couldn't get them off. Called John down and asked him if he'd try. He tried. He couldn't. We couldn't get any of them to move, and we finally called down to the ground and said, after we'd worked on it for a couple of hours, that, hey, it was useless. It turns out after we got back down on the ground that we'd discovered that the ground tech [technician] who put that on decided he wanted to make sure it stayed on, so he used some material called Loctite to make sure. You'd have to drill out the screws to get it off. So it was an exercise in frustration, which we made sure we didn't use that on subsequent flights.

We had lots of—the potty didn't work very well that first flight. In fact, we went through several flights before we finally got it to where it was functioning. That wasn't pleasant. But the food was great on board, those kinds of things. So all in all, it was a delightful experience that will stick in my brain for a long time.

WRIGHT: Now, was this the same food that you had to help test for Skylab during that time, or had it improved some?

CRIPPEN: Well, it was derivatives of the Skylab food. But there was a lady named Rita [M.] Rapp that handled all the food for Skylab, handled the food for me for SMEAT, and she was handling it for Space Shuttle. She was a great lady. We even had steak. It was irradiated so that you could set it on the shelf for a couple of years, open it up, and it was just like it had come off the grill. It was great. So we had great food, from my perspective.

WRIGHT: Sounds like it. Hated to come home, huh? [Laughter] But you did. You had to bring it back home, and you landed back at Edwards, where you had spent so much time, and although you weren't the commander, you still had quite a bit to do for that landing and reentry. Tell us about that, coming home.

CRIPPEN: Well, that was also one of these test objectives, to make sure that we could deorbit properly and how it would work on entry interface. We did our deorbit burn on the dark side of the Earth and started falling into the Earth's atmosphere. It was still dark when we started to pick up outside the window; it turned this pretty color of pink. It wasn't a big fiery kind of a thing like they had—with the Command Modules and those kinds of things, they used the ablative heat shield. It was just a bunch of little angry ions out there that were proving that it was kind of warm outside, on the order of 3,000 degrees out the front window. But it was pretty. I've often likened it—it was kind of like you were flying down a neon tube, about that color of pink that you might see in a neon tube.

But things were working well. The autopilot was on. It was going through the S-turns. John was somewhat concerned on that first flight that when we got down deeper into the atmosphere, whether those S-turns were going to work right. He ended up taking over control at around Mach 7, and it was during this time, we didn't have communication with the ground, from, I think, I guess, Hawaii; it was before Hawaii. But we had a good period there where we couldn't talk to the ground because there were no ground stations. I'm not sure it was so much a blackout like you used to get in the Command Modules, but it was just there was nobody to talk to because there was nobody down there.

So I think the ground was pretty happy the first time we reported in to them that we were still there, coming down. I deployed the air data probes around Mach 5, and we started to pick up air data. We started to pick up TACANS [Tactical Air Control and Navigation System] to use to update our navigation system. And we could see the coast of California. We came in over the San Joaquin Valley, which I'd flown over many times, and I could see Tehachapi, which is the little pass between San Joaquin and the Mojave Desert. You could see Edwards, and you could look out and see Three Sisters, which are three dry lakebeds out there. It was just like I was coming home. I'd been there lots of times. I did remark over the radio that, "What a way to come to California," because it was a bit different than all of my previous trips there.

John went in and out of autopilot, somewhere from Mach 7 down to around Mach 1, and then he took it over manually at that time and started our big turn around what we call our heading alignment circle. We came over Edwards at around 40,000 feet and set up to land on the lakebed out there. Lakebed 22 was the runway. As we were turning, I could see all these cars out there on the lakebed. I thought it was a big crowd out there. Anyway, but we were primarily focused on making sure that the thing was doing what it was supposed to do.

My primary job was to get the landing gear down, which I did, and John did a beautiful job of touching down. The vehicle had more lift or less drag than we had predicted, so we floated for a longer period than what we'd expected, which was one of the reasons we were using the lakebed. But John greased it on.

Jon [A.] McBride was our chase pilot in the T-38. I remember him saying, "Welcome home, Skipper," talking to John. After we touched down, John was—you know, he was feeling good. Joe [Joseph P.] Allen was the capcom at the time, and John said, "Want me to take it up into the hangar, Joe?" Because it was rolling nice. He wasn't using the brakes very much. Then

we got stopped, and John—now, you hardly ever see John excited. He has such a calm demeanor. But he was excited in the cockpit.

We had a number of tasks that we needed to do, shutting down the APUs, etc., in the cockpit, and we're supposed to stay in there and make sure everything was right—we were still working with the Mission Control—until we got the support crew on board. There were some astronauts that were coming on board to take over those functions.

But John unstrapped; climbed down the ladder to the middeck; climbed back up again; climbed back down again. He couldn't sit still, and I thought he was going to open up the hatch before the ground did, and of course, they wanted to go around and sniff the vehicle and make sure that there weren't any bad fumes around there so you wouldn't inhale them. But they finally opened up the hatch, and John popped out. Meanwhile I'm still up there, doing my job, but I will never forget how excited John was. I completed my task and went out and joined him a while later, but he was that excited all the way home on the flight from Houston, too.

WRIGHT: And you got to spend a few minutes with the *Columbia* all by yourself, sitting in it. It's a chance to do that.

CRIPPEN: Oh yes. Yes.

WRIGHT: So you were talking about John Young. I'd like to ask you, you were a rookie. You trained with him for many years, especially those last three years before going in. What did you learn from him that you took to share with your upcoming crews?

CRIPPEN: Well, when you're a rookie going on a test flight like this, you want to go with an old pro, and John was our old pro. He had four previous flights, including going to the Moon, and John is not only an excellent pilot, he's an excellent engineer. I learned early on that if John was worried about something, I should be worried about it as well. This was primarily applying to things that we were looking into preflight. So I guess it's important for the commander to sort of set the tone for the rest of the crew as to what you ought to focus on, what you ought to worry about, and what you shouldn't worry about. I think that's the main thing I got out of John.

But one thing I do regret is, in all those years, John—John is about the funniest man I know. He's got a dry wit that a lot of people don't appreciate fully at first, but he has got so many one-liners. If I had just kept a log of all of John's one-liners during those three years of training, I could have published a book, and he and I could have retired a long time ago. He really is a great guy.

WRIGHT: You also did, I guess, some traveling together, in the fact that there were so many public appearances before and after, and then including some with the White House, and I know on the flight you got a phone call from the Vice President. Talk about that aspect of being an astronaut, and, as a pilot, you are so attuned to doing the engineering and the flying phase, and now you're going out and doing all this other. So tell us about all those experiences.

CRIPPEN: Well, that sort of comes with the territory. I don't think most of the astronauts sign up for the fame aspect of it. I might mention, just to put it in perspective, that President [Ronald W.] Reagan was shot two weeks prior to our flight. So that was why the Vice President called, as opposed to the President. The Vice President—at that time Vice President [George H. W.]

Bush—had also come to visit us at the Cape. It was sometime prior to flight, but we had him up in the cockpit of *Columbia* and looked around; went out jogging a few miles with him. So we felt like we had a personal rapport with him, and so when we got a call from the Vice President, it was like talking to an old friend.

The PR [Public Relations] that followed the flight I think was somewhat overwhelming, at least for me. John was maybe used to some of it, since he had been through the previous flights. But, we went everywhere. We did everything.

Right after the flight we did this appearance out in Los Angeles [California] that ABC was holding a big conference, I guess, of all their TV stations at a big hotel in Los [Angeles], and somehow they'd conned us into coming. They went through all this, and then they, all of a sudden, they did this grandiose announcement, and you would have thought that a couple of big heroes or something were walking out. They were showing all this stuff, and they introduced John. We walk out, and there's two thousand people out there, and they're all standing up and applauding. It was overwhelming.

But we got to go see a lot of places around the world. Did Europe. Got to go to Australia; neat place. In fact, I had sort of cheated on that. I kept a tape of "Waltzing Matilda" and played it as we were coming over one of the Australian ground stations, just hoping that maybe somebody would give us an invite to go to Australia, since I'd never been there. But that was fun.

WRIGHT: And that worked, huh?

CRIPPEN: It worked. [Laughter]

WRIGHT: How soon after your return from STS-1 did you learn that you'd be commanding your own flight?

CRIPPEN: Well, it seemed like those postflight appearances went on almost a year, but maybe not that long, but it seemed that way. I think it was about a year prior to the next flight. It was sometime in '82 that, again, Abbey asked me how I'd like to command [STS-]7, and 7 was going to be the first that—up through STS-6 were going to be commanded by people that had been there previously. Every one of them—except Joe [Joseph H.] Engle had flown before; Joe commanded the second flight. But we had Jack Lousma, Ken [Thomas K.] Mattingly, then Vance [D.] Brand and then Paul [J.] Weitz that had command of the [sixth] flight. So 7 was the first one that [us new guys] got an opportunity to start commanding.

WRIGHT: The appearances afterwards certainly brought you into all this attention, but it also must have impressed on you the importance of the Shuttle Program to not just the United States, but to the world. Can you share with us, as you were meeting all these people and hearing all this information—because now you were past that inaugural flight, and you were going to get ready to do your own flight—what you took in from that and what you would hope to share with your crew about how important this next flight was?

CRIPPEN: Before we did STS-1, there had been some, I guess, things going on in the States that—the morale of the United States, I don't think, was very high. We'd essentially lost the

Vietnam War. We had the hostages held in Iran. The President had just been shot. I think people were wondering whether we could do anything right.

It was truly a morale booster for the United States, and I was pleasantly surprised to find that it was welcomed by what I would call our allies abroad. So it was obvious that it was a big deal. It was a big deal to the military in the United States, because we planned to use the vehicle to fly military payloads. So it was something that was important. I feel, still feel, that the Space Shuttle is important. I don't know that I had to impress that on any of my crews. I think they saw it for themselves, that what they were doing was important work that needed to be done.

WRIGHT: Well, your first command also drew a lot of attention because it was the first time the United States was going to fly a female. How much influence did you have on the selection of that crew?

CRIPPEN: Well, I essentially helped pick the crew, with John and George, so I would say I had a great deal of influence. And yes, the crew was "Sally [K.] Ride and the others," which was just right for us. [Laughter]

WRIGHT: It's appropriate we talk about her today; it's her birthday. Well, share with us, if you can, some of the discussions that you had, why this was the mission to begin this new tradition in space flight for the United States.

CRIPPEN: Well, when we selected the thirty-five folks in '78, we did have—what was it—six females, I guess, that were selected in that. This flight, STS-7, was going to be the first one that

would be crewed by those thirty-five new guys, besides myself. I know John felt that way, and I know George felt that way, that it was time that we ought to have a woman on board. I was certainly for it, and they were, so it wasn't a hard sell. I think NASA management on up the chain just felt like it was time; it was the right thing to do.

WRIGHT: Any reasons that Sally was the first of the six that you picked?

CRIPPEN: Well, they were all good, and any of them could have been the first one. I thought Sally was the right person for that flight for a number of reasons. She was one of our experts on the Remote Manipulator System [RMS], which was critical to what we were doing on this mission. I liked her demeanor, the way she behaved. She fit right in with everybody, as all of them did, but we just got along well, and I thought that's really important when you've got a crew, because you've got to work together. I knew that she would integrate well with the other crew members that we were going to have on board, which initially was just going to be "Rick" [Frederick H.] Hauck and John [M.] Fabian and myself. We later added Norm [Norman E.] Thagard to that flight as well. But she was just the right person to do it at the time.

WRIGHT: You did have four that trained together, and then you added Thagard. How did that impact what you had already done, and how did the roles and responsibilities have to become a little bit more flexible? Share with us how all that came about.

CRIPPEN: Yes. Actually, we were very—NASA was concerned about this space adaptation syndrome or upchucking in space, and we wanted to learn more about it. We had some

physicians in this thirty-five group, and we figured, "Well, we've only got four of us on board. There's room for more. Why don't we pick a doc [medical doctor], and let that individual go through and see if they can figure out this problem a little bit more?"

We concluded that Norm would be the right guy to do that, and Norm and the docs put together a series of experiments that were looking at what caused space adaptation syndrome. So he was primarily focused on that. The only thing was that he was wanting some of us to participate in the experiments, so the only thing it impacted the rest of what we were doing was that it would—when some of [them] weren't really occupied with things, then we planned on going down there and seeing whether Norm could make us sick or not, which he worked very hard at. [Laughs] So it wasn't a big impact on the flight at all.

In fact, Norm was also a very sharp guy, and I almost got in a little bit of trouble when I concluded that the easiest way to train people to use things on orbit was while they were on orbit, as opposed to on the ground. So we had an opportunity that we needed to capture this satellite that we were flying, after we'd already done it several times. So we had Norm come up with the remote manipulator and work it and capture the satellite. He hadn't been trained for that, but we were watching what he was doing. He wasn't going to get into any problems with it. But some of the folks on the ground weren't exactly happy that we had somebody that hadn't been certified do the capture.

WRIGHT: Let's talk about the real capture. It was the first mission, the flight test, the ability to do last stages of the rendezvous and fly the Shuttle very close to another object when both are going 17,000 miles an hour. So talk to us about the experiences and what your part was with this proximity operation for this flight.

CRIPPEN: Well, the proximity operations, as we call it, were working with another orbiting body close to the Shuttle. It was my primary function up on STS-7 to worry about doing all the flying and going through the simulations that we thought how it would behave. So it was a big focus. What we did was we had a satellite that we had in the cargo bay. It was picked up with the remote manipulator, taken out, released, and then we would recapture it. We backed off from it about a thousand feet, flew around it, came back in and did a capture again like we had been rendezvousing with it.

While we were headed out, a guy by the name of Bill [William B.] Green that works up at [NASA] Headquarters [Washington, D.C.] had come up with the idea of putting a camera on board this Shuttle Pallet Satellite is what SPAS stands for. So we actually remotely took pictures of the Shuttle from the satellite when it was about a thousand feet away, which gave us some unique shots when we returned back. But it was a big deal, and we wanted to make sure that we could rendezvous with satellites; could come back up in and grab them; when we did so, that we didn't impact them with our reaction control jets.

It turned out that it all went extremely well. It was a little bit different, in that what we called the digital autopilot, or the DAP—which is the way the computer fires the various jets—when we got in close to the satellite, I found that when you tried to slow down sometimes, the attitude control thrusters would also start going, and it kept walking you in when you didn't want to go in. So we ended up learning a few things about how the autopilot worked that we corrected subsequently and makes it very nice for rendezvous today, which is extremely important on things like working with the Station. But it all really worked very well.

I let Rick Hauck fly one of those as well, to give him the experience of doing it so he could use it on subsequent flights. Both John Fabian and Sally had gone through—both of them were experts on the arm, and they had grabbed the satellite and whatever. So that was when we threw Norm into the equation there to get him off the middeck, working with those medical experiments. He ought to come see a little bit of what was going on outside. But we were very pleased with it, and it sort of gave us an initial building block for subsequent things we did with flying with satellites.

WRIGHT: This mission also produced the first full photo of the Orbiter in space. Quite an accomplishment. Was this something that was planned for the mission planning, or was this something that you surprised the control room with?

CRIPPEN: No, no, no. It was planned. I mentioned already that Bill Green, who is a gentleman that works in Headquarters, had come up with the idea to put a camera on the satellite. So it was all planned and part of the script.

The only thing that wasn't part of the script was we were STS-7, and on our mission patch, we had had the Orbiter with the arm up in the shape of a 7. So we concluded that, hey, we might as well do that. So we had practiced this on the ground by ourselves, and so I think it was Sally put the arm in that configuration, so when we took the picture, it almost looked like the patch. However, Mission Control had not seen the arm go into this particular position before, and they were worried that we were getting it into some limits that it shouldn't be in. It wasn't, but it did cause some consternation on the ground, I think.

WRIGHT: How different was it for you for training for this mission, compared to the first one?

CRIPPEN: Well, first, I was the commander now, so I was going to get to look out the window more. [Laughter] I had all these other folks to do all this work. But my primary focus, again, that was different was this prox [proximity] ops operation, flying in the vicinity of the satellite, being able to get the Orbiter in close enough to do the rendezvous or to do a capture. So I spent a good portion of my training looking at that.

Of course, I was sitting in a different seat, and I wanted to make sure my crew knew what their jobs were. So part of being commander is to make sure everybody is focused on what they need to be focused on. So it was a little bit of an organization thing, but you didn't need to organize this group. They were as sharp as they come, so I could sit back and let them do it without really worrying about it.

WRIGHT: Any special words of wisdom that you gave to them before you left, as you were on your way to launch, or while you were up in space?

CRIPPEN: Enjoy it. Enjoy it. You never know whether you're going to get a second flight or whatever, so take advantage of when you go up, to really savor it. I had ended up with four flights, and I still remember them today, and every bit of it was enjoyable. The only times—I've found that on subsequent flights when I had people EVA, that used to give me a headache, because I was so worried about them. But other than that, it was all great fun.

WRIGHT: Your flight got extended a day because the landing sites got changed. Tell us your thoughts about here you are, you're on your first landing, and the first thing that happens is you're not landing where you thought.

CRIPPEN: Well, I knew getting into Kennedy Space Center, their runway, the first time was also going to be a challenge. My friend John Young believed that we ought to be landing out there on the lakebed, where you've got lots of opportunity to correct for problems because you've got so many places that you can land. So I didn't think that landing at KSC was going to be that easy.

John was the weather checker in our Shuttle Training Airplane at Kennedy, and he saw some weather, which it can develop very rapidly, which he and I both know. So he properly waved us off on that first time, and we elected to wait another day and try it. And sure enough, that didn't work out, either, and we ended up coming into Edwards.

But truthfully, that extra day we got on orbit was a free day. There wasn't any real work to be done, so all of us had an opportunity to sit back and enjoy, and maybe play a little bit while we were on orbit.

WRIGHT: I understand you had some organized events. Want to talk to us about the first round of Space Olympics?

CRIPPEN: [Laughs] It was hard to keep this crew under control sometimes. But you can end up with a loop going from the flight deck down through one hatch into the middeck, back up through another hatch into the flight deck, and we did have what we called a Space Flight Olympics, of seeing who could get around the fastest.

WRIGHT: I understand awards were given. What award did you take home?

CRIPPEN: There were awards. I think I took the "Most Dangerous." I bumped my side against something, a ladder or something I shouldn't have.

WRIGHT: It's a good thing you all had a good time. Well, how different was the landing for you this time?

CRIPPEN: Well, I had hold of the stick this time. [Laughs] We, again, landed on a lakebed out at Edwards, I believe on 18. It was pretty much like I'd practiced in the Shuttle Training Airplane. I felt like I had done it before, so it's like John taught me, that practice, practice, practice makes perfect, and that's the way it was. So we landed out there. Didn't have a big crowd this time, because people had been planning on us going the other way, but it was good, and we enjoyed it.

WRIGHT: How did you feel after this mission, compared to your first one? This one was longer. It was six days, compared to just two. Physically, emotionally, how did you take it?

CRIPPEN: From a physical standpoint, I couldn't tell the difference. I felt good after the first one. Felt good after this one. Back in that period of my life, I ran a lot for exercise, and the day after I landed on each of them I did about three or four miles. So physically I couldn't see that it took anything away from me.

Emotionally, anytime you work hard to do something and it comes out well, you can't help but feel good, and that's the way I felt with this. I felt my crew had done a superb job. We had accomplished all the mission objectives. We'd made the proximity operations look good. We had deployed a couple of communication satellites, and everything worked. So that gives you a nice high. We got to do the postflight things this time, only [with] Sally being the star, which was good. I think primarily our job was to make sure that Sally didn't get overwhelmed with all of the stuff that was going on with her. But she was a big hero as we went around, and everybody wanted to meet Sally.

WRIGHT: Did you have to run any interference for her prior to the mission, when you were training? Did you find that?

CRIPPEN: Yes. There were so many people trying to get after her or get to her, for whatever reason, that part of the commander's job was to make sure that she was protected from that, without being overprotective; just whatever she wanted to make sure that she didn't get overwhelmed by it.

WRIGHT: There had been five other flights between your first flight and this flight. Did you know of any other new changes that had been made to the spacecraft or anything to the hardware or software that you had to adjust to, compared to the first time?

CRIPPEN: Well, the second flight was on the [Space Shuttle] *Challenger*. First flight was on the *Columbia*. The vehicles [are] essentially look the same, except the *Challenger* doesn't have as

large a structure back in the rear end as the *Columbia* did, because the *Columbia* was built before we had done a lot of the structural tests. So it felt a little bit different on ascent, in the way it shook and whatever, but just a little bit. But other than that, they were very similar.

Now, on the first flight, John and I, to communicate, had to wear headsets with a wire connected to the console, and it felt like you were in a pit of snakes or something. There were wires going everywhere, even with just the two of us, and they were very cumbersome to get around with. Thank goodness we'd finally gotten wireless mikes that you didn't have to stay plugged in, so it was a lot easier to get around the cockpit, especially having five on board, that made it a lot easier. But other than that, the vehicle is very similar. It didn't have many changes that I can recall right now that we didn't have on *Columbia*.

WRIGHT: And the ejection seats were now gone.

CRIPPEN: Oh, yes, the ejection seats were gone, so we had a lot more room up on the flight deck.

WRIGHT: Well, within a year you were scheduled to do another one, go to [STS] 41-C. You were going to leave in April 1984, and now you had another mission and a longer mission, again back on *Challenger*. Were you told prior to the STS-7 flight that you would have another command so quick?

CRIPPEN: No, but I was told shortly after I landed that I was going to get one. I think what they were trying to do was to build on the experience that I had from doing the proximity operations. The next, 41-C, was going to do our first rendezvous. We had a satellite that was disabled that

they needed repaired, so it was similar to what I'd done before, only an extension of it. So maybe that's why I got picked to fly it. Of course, I mentioned it was 41-C that originally it was STS-13, and my friend Jim [James M.] Beggs, who was the Administrator of NASA, had triskaidekaphobia, and he said, "There's not going to be [another] Apollo 13 or a Shuttle 13, so come up with a new numbering system." So we did come up with this complex system for numbering the Shuttles during that period of time. So that was different as well.

WRIGHT: This was also a time where crew members that were assigned to flights didn't get attached to their Orbiter for very long because there was a lot of movement and flexibility. How did this affect the commanders, to know as you're approaching your mission that at some point things might get a little rearranged due to slippage or payload changes or Orbiter changes?

CRIPPEN: I didn't see that that much during that phase. Our mission was so specialized that when we were going up to get Solar Max [satellite] on 41-C, that it was not reasonable that we could change it. We were also deploying a Large Duration Exposure Facility, or LDEF, which is like a bus in the [payload bay], and it would have been very difficult to take that flight, I think, and put it on another Orbiter; but not impossible, but a bit more difficult. So from my perspective, at least my recollections, I don't recall that we were worried about shifting payloads and that kind of thing at the time.

WRIGHT: You had a very interesting crew that included [Francis R.] Scobee, one of the best pilots of the class, and Terry [J.] Hart, one of the best RMS operators, and George [D.] Nelson

and James [D. A.] van Hoften, two of the best EVA astronauts. So you had a very unique, great group.

CRIPPEN: A great group. I got to help pick that one, too.

WRIGHT: Well, talk to us about the fact that you were called the "Ace Satellite Repair Company" and how that came about, and then, of course, about doing the satellite repair.

CRIPPEN: Well, the mission was to go repair the satellite, and the "Ace" thing had come along earlier, actually prior to the Shuttle flying. We lost one of our pilots out at Flight Ops, not one of the astronauts. Good friend. Not too long after that his wife needed to move, so we formed the Ace Moving Company, and our motto was "We move single women anywhere and husbands out." [Laughs] It was mostly a social thing, but we started that and then sort of built on it. Prior to our flight—I believe it was STS-5—they also used the Ace Moving Company sign, because they were deploying satellites on that [mission]. So it was sort of an extension of those earlier days to call ourselves the Ace Satellite Repair, because that was our job to go up and repair the satellite.

WRIGHT: I want to talk more about that, but you mentioned about helping to pick this crew. What did you look for in a crew member?

CRIPPEN: Again, people that were compatible, that could work together well, and people that had the talents that I thought were necessary to go do this particular task, which was going to be a

challenging one, especially the EVA part of it. "Ox," or Jim van Hoften, and George, or "Pinky," Nelson were both great guys and hardworking folks, and they needed to be to do this job.

WRIGHT: When you were told that you were going to have this command, when George Abbey explained it to you, were all these components already there? How did your command come about? Was the command connected with these operations, or did you get this command of the next Shuttle mission and then this information was attached to it later?

CRIPPEN: Well, when I was picked to command the flight, the fact that we were going to do a satellite repair was known. So we started talking then about, okay, who are the right people to put together to go execute this mission.

WRIGHT: It was a complicated mission, because you had not only just your work with your crew, but you had to work with the ground crews at Houston and at [NASA] Goddard [Space Flight Center, Greenbelt, Maryland]. Tell us how all that worked together and how it worked together so well.

CRIPPEN: Well, the Goddard folks were the ones that had put together the concept of doing a repair for Solar Max, and when Solar Max had launched initially, they had attached a grapple fixture so that the RMS could grab it. So it had been launched aboard an expendable booster, but the people had thought about the Shuttle coming so that it could potentially service it. The main

problem was the rate gyros on board, most of them had been lost, so it was hard to stabilize the satellite, which was designed to study the sun.

So they were going through all of [this] trying to come up with what could be done, what couldn't be done, and Ox and Pinky essentially picked that up. They were the ones that went up there and worked with the people to figure out what they could do EVA and what they couldn't do. To my surprise, they ended up electing that they could go undo some small electrical connectors, which are very difficult to handle with big EVA gloves, to change out a couple of boxes. So I would say that Ox and Pinky kind of took care of what was going on at Goddard.

The other big deal was the LDEF. [NASA] Langley [Research Center, Hampton, Virginia], I believe, had put that together. The big deal on it, it was a big, dumb satellite, because it didn't actively do anything. It was primarily covered with material that would detect how it erodes or corrodes or deteriorates while it's on orbit. But it was so big, it was a real critical fit inside the Shuttle bay. So deploying it to make sure that you didn't bang something was extremely important. Terry Hart, or "T. J.," was the guy that primarily worked that, and I worked closely with him on it.

The other aspect was this was going to be a flight using maneuvering units. That had been done once before without a real task, and this one we wanted to have Pinky go out and actually capture this satellite. So he spent a lot of time working with the maneuvering units, which came from Martin out at Denver at the time. So we were doing quite a bit of flying around various parts of the country to make sure that we were bringing the mission together right. And we had a year to do that, so we did it [right].

WRIGHT: The training went well, but you had a couple of snafus when you went out to capture it.

CRIPPEN: Right. Well, as I said, Pinky was to go out in a maneuvering unit. He had a device that would be in front of him that was designed to grab hold of a sort of a post that was sticking out of the Solar Max. It wasn't put there thinking about this; it was just there, so they were trying to take advantage of it. So he was going to fly up to it, hook onto that, and stop the satellite from moving so that we could then get the Orbiter to come in so that Terry could grab hold of it.

We had also practiced, in case something went wrong with that, having Terry grab it while it was still rotating, which was a little bit of a challenge, but we had practiced it and thought we potentially could do that.

Turned out when Pinky flew out about three hundred feet away from the Orbiter, and he came up and did his task perfectly to grab this little fixture, it didn't capture. He sort of bounced off. He tried again and bounced off. I think he hit it in all about three times. About that time the satellite—it was rotating prior to this around its long axis, but then it started to tumble.

So we backed Pinky off, and I was worried that, hey, we'd spent all this time training for this, and we were just about to lose it. So we went up closer, mainly first to get Pinky, make sure he was back connected to the Orbiter, and then I thought, "Well, we'll try a rotating capture and have Terry see if he can grab it." But we hadn't planned on a tumble, and the tumble made it a lot worse, me trying to keep the position so that the satellite didn't hit the Orbiter, and Terry trying to get the arm in there so he didn't get the arm hit by part of the satellite.

We flailed around in there for a while, using up lots of gas, and then finally the ground told us, well, they thought maybe they could stabilize it again with a slow rotation, so they asked us to back away. We did so, and ended up backing away entirely so that we'd have to do a re-rendezvous with it. Truthfully, at that time I thought we'd lost it. I could see myself spending the next six months in Washington [D.C.] explaining why we didn't grab that satellite.

But the ground had a trick up their sleeve that we weren't aware of, the folks at Goddard did, and they were able to stabilize the satellite so that it had a slow rotation around its long axis. So the next day we came in for another rendezvous, came up to the satellite, and it was just like we'd trained in the simulator. We went up, and Terry did a neat job of grabbing hold of it, so we captured it. Our fuel had gotten, especially up on the forward RCS [reaction control system], had gotten pretty low. It turned out that we had a red line that we were working toward, but it turned out that we had 13 percent remaining, and I said, "It's STS-13 now." [Laughs] But we had it.

So then Ox and Pinky went out and did their thing of repairing the satellite; worked like champs. They did a couple of EVAs, and sure enough, every time they'd—the first day when they came back in and took their gloves off, all the tips of their fingers were bloody from having to go in and do that fine work. But I guess they ended up doing—we had like three EVAs on that. On the last one, when they'd finished up all the work, we let Ox take one of the maneuvering units and do a little free flight in [the] payload bay. So it was a fun mission, after we captured the satellite.

WRIGHT: How would you explain how the Shuttle reacted to your manual controls of having to manipulate, because you had—did you have a concern, the fact that you had an astronaut out

there between you and this satellite, and how you were going to be able to keep him safe and keep the Shuttle safe?

CRIPPEN: That's where I got the headache. [Laughter] Well, we knew that we had the digital autopilot set up [to clear an] area up above the payload bay. We weren't going to impinge a jet on the satellite or anybody else that was in between there, so that really wasn't that much of a problem. But anytime you've got somebody out there free-flying, you don't want to lose them. So the first thing I wanted to do when we decided we couldn't do it with the tumbling thing was to get Pinky back.

Oh, I might mention one thing. I came up with another dumb idea there why it was tumbling. It has solar arrays on it, and so I asked Pinky if he thought if he could grab hold of one of the solar arrays with his hands, whether he could stabilize it or not. Turned out he couldn't. He tried, but it didn't work, and probably shouldn't even have bothered with that, since I didn't know physically what was on those solar arrays, whether that would have hurt his glove or not or something of that nature.

WRIGHT: You also had an opportunity to work with IMAX—

CRIPPEN: Oh yes.

WRIGHT: —the IMAX camera systems, and took some great shots that was used in *The Dream Is Alive* [movie], including one of the sunrises. T. J. Hart says that it was your idea to try to

capture that. Do you remember that moment of finding that perfect picture to share with everyone else?

CRIPPEN: Well, Solar Max, I thought it was great that somebody came over to IMAX, which is a camera that uses a seventy-millimeter format. I was somewhat worried about taking pictures with it, because it was so big. It is something like that. [Gestures] I didn't want to lose focus. Our job was to get the satellite.

So I gave Scobee the task of primarily dealing with the camera and making sure that it didn't interfere with what we were doing. So it was a little bit difficult working some of those things out, but it was a great camera. I'd seen scenes from what it could do, and sunrises and sunsets are one of the most awe-inspiring things that you can see in orbit. So it seemed to me like we ought to at least try to capture one, and it came out better than I actually had anticipated. "Scobe" did a super job of working the IMAX and got some great, great film. As you mentioned, it's used in *The Dream Is Alive*, and it's also some of the film used in the subsequent IMAX movie, too.

WRIGHT: Well, we thank you for that. This was also the first time that direct ascent trajectory for the Shuttle had been used. Tell us how that was different from what you had experienced before.

CRIPPEN: Yes, what we'd used previously and what we'd set up for STS-1 and the subsequent missions was two maneuvers of the OMS engines to establish our orbit. That meant that we'd cut off the main engines so that we were somewhat short of the apogee or the high point of the

orbit that we wanted. Then we did—shortly after the engines [cut off] and we shut down the APUs—we did a burn of the orbital maneuvering engines to get the apogee up at the right altitude. Then we flew around to the apogee and fired the engines again to get the perigee up.

People looking at flight design came up with, "Hey, we can do that by just using the main engines to get the apogee at the right point so that you don't need that first burn." It's a much easier task from a crew standpoint, because you're pretty busy there right after main engine cutoff, and this took away some work, so it was a neat thing to try. We were going up pretty high on that one, too, so it worked out good from my perspective.

WRIGHT: So was it your recommendation to continue?

CRIPPEN: Oh yes, after that I said, "Hey, this is a nice way to fly," and I believe it's still being used today, to the best of my knowledge.

WRIGHT: You had trained for an EVA and never used it. Did you get to train for an MMU [Manned Maneuvering Unit] and didn't get to use that, either?

CRIPPEN: [Laughs] No. No, we talked about an MMU also on that first flight to repair tiles. We looked at that. I had worked on the predecessor to the MMU back in the Skylab days, which they used to fly around inside the Skylab vehicle, so I got a chance to do a lot of simulations with it, but no, I didn't have any chance to use it. So one of the bad [things] about being commander, you don't get to go outside and do a space walk.

WRIGHT: But you get to look out the window a lot.

CRIPPEN: You get to look out the window a lot.

WRIGHT: Well, you brought another one home to Edwards, another Shuttle you landed there.

CRIPPEN: Got waved off again. [Laughs] Seemed like I was having a hard time getting back into the Kennedy Space Center. But again we came out and landed out at Edwards, and that worked great. Another weather problem, which is quite common at KSC.

WRIGHT: While you were preparing for 41-C, you were also assigned as commander of [STS] 41-G. How did you handle the training for back-to-back missions, and how did the situation impact the crew and you?

CRIPPEN: That was somewhat unusual. It was when I was training for this, George [Abbey] asked me if I could do this other mission.

I said, "Well, it's kind of soon." I said, "Why are we—," because we had some other people ready to fly, too.

He said, well, he wanted to see how fast we could actually turn people around.

So who am I to turn down a space flight? So I said, "Sure, but, you know, I'm not going to get to spend as much time training with the crew, so I'd like to make sure I've got somebody there, especially for the ascent portion, that knows how I like to fly the missions." On STS-7 Sally Ride had been what I called the Flight Engineer position, which sits just aft of the

commander and the pilot, and is looking at all the same displays and has got the checklist in her hand, helping us deal with malfunctions. I said, "If Sally can fly that position, and she can be training with the crews while I'm not available, then I think it would work out." So that's what we ended up doing.

WRIGHT: Also a unique aspect of this mission was, during the training, Henry S. F. Cooper [Jr.] was allowed to be a shadow to a lot of what was going on, as he was writing a book called *Before Lift-off*. When did you learn about this, and what was your reaction, and how did you feel about the whole precedent of allowing someone into the training area?

CRIPPEN: Well, I was a little bit negative initially when it was suggested, mainly because it's a distraction, as you indicate. But I sat down and talked to Henry, and I told him, if we could establish some ground rules about what he could and couldn't do, and that he couldn't interfere in any way, but he could observe, that I could get comfortable with that. So we ended up agreeing to it, and he did it, I thought, and he did a reasonable job in the book. I haven't read that in a long time. I might need to go back and read it again.

WRIGHT: Remind you of some things? Your first command had the first female, and now this command had two women, and one was going to be doing an EVA. Compare and contrast the media attention, not just because of the two women, but because of where the flight was. Now this was another flight. Was the attention for the flights and the missions starting to wane in the American public? Were people starting to think this was routine and so forth? So just kind of

give us an idea of what the time period was and how people were starting to feel about the flights.

CRIPPEN: It certainly didn't have the media attention that STS-7 did. Judy [Judith A.] Resnik had also flown prior to that time, so we'd had a couple of women go fly. So I think the media is easily bored if it's not something that's brand-new. The new thing on this was there was going to be a woman do a space walk. What was unusual is as soon as we named her to do it, the Russians put up a woman and had her do a space walk just so she could beat Kathy [Kathryn D.] Sullivan, who was going to do ours. But, in recollection, I don't recall having to deal with anything like what we had seen on STS-7 or STS-1. STS 41-C, we didn't see much, either, at least from my perspective.

WRIGHT: Also, it was the first time that, for you, you were going to have a crew with payload specialists. This was a different concept. First you were having to deal with mission specialists that weren't pilots, and now you were dealing with payload specialists that weren't astronauts. Tell us how you worked with them and how that affected the crew, with these people coming in later than how they had trained.

CRIPPEN: Yes, we ended up bringing the payload specialists in like three months prior to flight, somewhere on that order. Marc Garneau was a Canadian. Marc was Canadian Navy and military, so I had no problem with Marc coming on board. He had his own set of experiments. I told him, "Hey, stay on the middeck till I tell you it's okay to come on the flight deck, and do your thing," and all of his experiments could be accomplished down there.

Then we added Paul [D.] Scully-Power, an Australian that worked for the United States Navy. We'd worked with Paul a lot before on doing Earth observations, or ocean observations, and so I knew Paul, or "P. S. P." we called him. He was a little bit of a loose cannon, and I knew that about him. But again, I sat down and explained to him, "Hey, we'd love to have you up there." Now, his mission, he needed to be on the flight deck, looking out the windows. So we had to pick out periods of time where that was going to be acceptable, and it ended up working out just fine.

I still think you can take payload specialists if it's recognized that flying a Shuttle, again, is a dangerous business, and there are certain rules that they'll go by. Then you can fly people. It doesn't take that long to—if they don't have to operate the vehicle itself—to train them how to use the potty, how to make food, etc., etc.

WRIGHT: Well, this was a complex mission, too. This wasn't a simple one.

CRIPPEN: Yes, that's right.

WRIGHT: You had these proximity operations to do, and I believe one of the lines in Mr. Cooper's book is that it was cited to "have more anomalies, glitches, nits, and malfs [malfunctions] than almost any previous mission. It was reminiscent of a long film." Is that your recollection as well?

CRIPPEN: [Laughs] I think we used that phrase ourselves. We had lots of problems, nothing earthshaking or dangerous from that standpoint. But we had a big synthetic aperture radar,

which is a large antenna that opens up in the payload bay. Fantastic things that it can do, looking at the Earth, but it's covered by this fabric, and when we got ready to close it, it wouldn't close properly. The fabric had inflated. So we ended up pushing it down with the RMS to get it closed. We got a big Ku-band antenna that we used for communications and television, and when we got it deployed, which is outside the payload bay envelope, it wouldn't retract. So we ended up having to cut some wires inside and rewire things and have Kathy do some work out in the payload bay to get it back in and stowed. And there were several other malfunctions now that—I'm not sure I can remember all of them—that occurred that certainly kept us busy.

But I felt like, even though none of the malfunctions that we ended up dealing with were things specifically we had trained for, we had trained for doing a numerous set of in-flight maintenance kinds of things that prepared us to deal with what we actually encountered.

One of the neat experiments that we did was people were looking at being able to refuel satellites with the Shuttle, and that was the EVA that Dave [David C.] Leestma and Kathy Sullivan went out and actually moved some hoses, connected them, and transferred hydrazine from one tank to another just to see whether that was feasible. I worried about that one a little bit, because the last thing I wanted was a hydrazine leak in the payload bay with getting that on the crew's suits. You can't have them come in the cockpit with that hydrazine on them, so having to deal with all that and make sure they didn't get anything was somewhat of a concern to me. But it ended up working out great.

WRIGHT: Yes, I can understand why you said you get headaches with the EVAs. Maybe we can come back and talk just a few more minutes about 41-G, but we're going to stop and let them change the tape out so we don't miss anything.

CRIPPEN: Okay. Sounds good.

WRIGHT: Give you a break, too.

[pause]

WRIGHT: We'd like to switch gears on this second half of the interview and before we go back and talk some more about missions and other assignments that you had with the Space Center, I'd like to ask you a couple of questions that are kind of general in nature, but certainly fit all the career aspects that you did, and lend us some of your insight.

For instance, we all know that STS-1 set the foundation for a whole new era of exploration and exceeded expectations, and it returned the nation to space after the close of the Apollo Program. You and John Young were obviously associated with the success of the mission, but you've also stated in many interviews that the credit for success belongs to the thousands and thousands of people who work behind the operation. Would you share with us what your thoughts are about how valuable these contributions of these workers are?

CRIPPEN: Sure. I mentioned earlier that the Space Shuttle is a pretty complicated vehicle, and certainly it was breaking some new frontiers, which, John and I being test pilots, it was a great mission for us. But when you have something that complicated that it takes—literally, hundreds of thousands of people made STS-1 possible. You have to be depending on those folks doing their job right, because you can't check everything yourself.

John and I spent a lot of time going to the various contractors and subcontractors, if nothing else, to try to put a human face on the mission; that we were flying it, and we appreciated all the work that they were doing. Everywhere we went, the people really felt in their heart that they were doing something important for the nation, and that's what John and I wanted them to feel, because that's what they were doing. It doesn't take but one person to do something wrong that can cost you a mission and cost lives. We try to put checks and balances into the system so that there's always two sets of eyeballs and so forth. But it's always subject to human error, and especially a vehicle that's as complicated as the Shuttle.

So when John and I climbed aboard the vehicle to go fly, we had been eyeball to eyeball with, I would say, thousands—maybe not all hundred thousand, but we had been eyeball to eyeball with thousands of folks. We knew the vehicle pretty good. We knew its risks, but we also knew that it had a great deal to offer if it was successful. So when we climbed aboard, I think both of us felt very confident that the vehicle would fly and fly well. We didn't know that we wouldn't run into some contingency where we were necessary on board to do whatever malfunction procedure was required. And we did run into a few problems, but nothing serious.

So when I say that we literally rode on the shoulders of hundreds of thousands of people, that's what we did, and I felt good about it. That was, besides trying to make them understand how important this was and how important the job was, I think there was positive feedback from our perspective of having an opportunity to see them, see what they're doing, and grow more confident in their abilities.

WRIGHT: You continued with missions as commander for three more missions, and along with you came these workers. If you had had an opportunity to meet more of them, what could you

have told them that—this is someone who had such a simple task, but it was such an important task for you—how could you have conveyed to them how important that task really is?

CRIPPEN: Well, I did have the opportunity after the first mission to go around again and thank a lot of the people that made the mission a success. Signed lots of autographs; signed a lot, and did those kinds of things, to hopefully make them feel good about the work they had done. That continues today with the program of Space Flight Awareness, because it's important that they get feedback about how important their work is. We still give out [Silver] Snoopy [Award] pins. We still bring selected people to the Cape to watch launches, all of which I feel good about. I'm not sure I can convey anything to them except we're proud of what they're doing, and what they're doing is something great for the nation, and not only the nation, for the world, in my perspective.

WRIGHT: When people travel and they have a NASA shirt on, and they're in the midst of a crowd of people that aren't NASA-related, that emblem reflects such a pride that we've even noticed that people will ask questions. Do you have that same feeling, or did you have that same feeling when you would go places? People might not recognize you as Bob Crippen, the astronaut, but yet they might see a NASA shirt, or that you would be associated with these other people. Do you feel like NASA carries that reflected pride wherever you go?

CRIPPEN: A great many of the people in the United States still believe in the space program. Some think it's too expensive. Perspective-wise, it's not that expensive, but I believe that most of the people that have come in contact with the space program come away with a very positive

feeling. Sometimes if they have only seen it on TV, maybe they don't really understand it, and there are some negative vibes out there from some individuals, but most people, certainly the majority, I think, think that we're doing something right, and it's something that we should be doing, something that's for the future, something that's for the future of the United States and mankind.

WRIGHT: As part of the nation's new Vision for [Space] Exploration, the Orbiters are scheduled to be retired in 2010. Collectively, they've flown over 114 flights and collected a tremendous number of accomplishments. Overall what do you view as the Shuttle's legacy, and what should be remembered as the best from this program?

CRIPPEN: Well, the Shuttle has done a lot in the missions that it's flown. We've had two tragedies, but a lot of positives. Early on we put up communication satellites, and we could have continued to do that, but it was decreed from on high that we wouldn't do that after we lost the *Challenger*. Also, military satellites. We put a large number of military satellites, and again after *Challenger* it was decided that they would find another vehicle for that. Personally, I believe that the Shuttle has contributed to us winning the Cold War. It's all classified, so we can't talk about it, again, but it made a very positive contribution, and I was extremely disappointed to see that aspect of the program go away.

But then if you look at the other things we've done, Ulysses, that flew around the poles of the sun, we put up. Magellan, that we sent to Venus; that was the first time that—actually, we had a more accurate surface map of Venus than we did of the Earth for a while because of that satellite. Galileo, that's gone to Jupiter and explored all the moons there and has got people very

excited about the potential life on Europa under all the ice, and looking at all the volcanic activities on Io. They continue on and on, and then we move into the great telescopes, from Hubble [Space Telescope], Compton [Gamma-Ray Observatory], Chandra [X-Ray Observatory], that has revolutionized what we know about astronomy. All that was made possible by the Shuttle, but more important, it was made possible by the people that built and continue to sustain the Shuttle. So it's a great legacy.

I've got mixed emotions about the 2010 retirement. Certainly I feel we need to complete the International Space Station, and we couldn't have done what we've done on Station without the Shuttle. Another vehicle, unless it was something extremely different from what I've heard of, it would be impossible to construct something like the International Space Station we've put together, and we need the Shuttle to complete that construction. So I'm not sure—I know 2010 is the date that's been laid out, but I certainly hope we continue with the Shuttle however long it is that's necessary to complete the Station.

The Shuttle is a complicated vehicle. I've said that earlier. It's one that requires a lot of TLC, or tender, loving care. It's not very forgiving of mistakes. We've proven that, like I said, twice. So it does require people to be very diligent when they're flying it, but I personally think, given the correct scrutiny, that we can continue to fly safely. Not without risk; risk is going to be with us in human space flight for as far out into the future as I can see. And I really want us to go back to the Moon and on to Mars, and that's going to be risky as well. We can't be a risk-averse nation and be a great nation.

So we need to continue to press frontiers. The Shuttle was a monumental step in that, and I think it will be long remembered. I truly, even after [it's] retired, expect to see in the future something that has similar capabilities, where we can come back and land on a runway. It's not

going to be the CEV [Crew Exploration Vehicle] that we're talking about, but we still need a way to get to Earth orbit and return a lot easier than what we have forecast right now. So I'm proud of the Shuttle. I'm proud to have been a part of it since almost its inception. Had a chance to work [on] it in several capacities in management after I left the Astronaut Office, and I think all the people that have been part of it ought to be proud of the job they've done.

WRIGHT: At a very early point in your career, you chose aerospace engineering as your major. What do you personally feel the importance of exploration is?

CRIPPEN: Well, I think it's an innate thing within all humans, that we need to continue to look over the next hill and see what's there. I think that truly is what has made America a great country, why we continued to spread from the East Coast to the West Coast, because we were always wanting to see strike out and see what was over that next hill. That's what going into space is about. My friend John Young says, "One-planet species do not survive," and I think that he's right. That's what all the history that we know about says. So I would like to see our species survive, so we need to be able to get off this planet and learn to live and work in other areas.

WRIGHT: Well, it's been a great adventure for you to be able to take your passion for exploration and your desire for engineering and combine that into your career. We were talking earlier about doing training and simulations and your computer contributions that you did. It made us think earlier about asking you to give us a little bit more of a defined experience about your STS, the first moments of the mission, of the launch, how it actually did reflect what your simulations

were like. And if you could, when you're talking about that, I know that you mentioned a couple of things about what you've brought back to that launch environment for the simulations. If you could, just tell us what it was like, how close was it, and did it meet your expectation?

CRIPPEN: Well, of course, again, I had a chance to train with John for three years, and he told me about riding on the Gemini and riding on the Command Module—which he'd done two of each of those—and gave me some sense of what ascent was going to be like, what main engine cutoff was going to be like. But the Shuttle is different than those vehicles. I know when the main engines lit off, it was obvious that they had in the cockpit, not only from the instruments, but you could hear and essentially feel the vehicle start to shake a little bit. When the solids light, there was no doubt we were headed someplace; we were just hoping it was in the right direction.

It's a nice kick in the pants; not violent. The thing that I have likened it to being a naval aviator, is it's similar to a catapult shot coming off an aircraft carrier. You really get up and scoot, coming off the pad. The roll program, which we all knew was there and it was in the simulation, I know—I think it excited some of the spectators because they didn't know that we were going to roll, and truthfully, all of the previous launch vehicles had rolled, too. It's just that it's not very obvious when you don't have wings sticking out there like the Shuttle does. All that was very comfortable.

As we started to accelerate, there was a little vibration in the cockpit; not so violent that you couldn't read your checklist. About the time we were approaching going supersonic, I've likened it to driving my pickup down an old country washboard road. It was that kind of shaking, but nothing too dramatic, and it didn't sound to me, or it didn't feel, as significant as what I'd heard John talk about out [on] the Saturn V.

When we got to two minutes into flight when the SRBs came off, that was enlightening, in that the big separation motors that push the solids away, the ones up forward actually you could see the fire come over the forward windows. I didn't know that I was going to see that, but it was there, and it actually put a thin coat across the windows that sort of obscured the view a little bit, but not bad. But the main thing when they came off, it had been noisy. We had been experiencing three Gs, or three times the weight of gravity, and all of a sudden it was almost like there was no acceleration, and it got very quiet. It was about as quiet as it is in this room, and there was no shaking. It's about like us sitting here in this chair.

I thought for sure all the engines had quit. Rapidly checked my instruments, and they said no, we were still going. It was a big, dramatic thing, for me, at least. I didn't expect that much. The G-level dropped off to like half a G, because the three main engines at that point are putting out about a million and a half pounds of thrust, but you're still pretty heavy. All the noise, I guess, that had been coming back through the solids, was gone. You're up above most of the atmosphere, and it was just a very dramatic thing for me. It will always stick out [in my memory].

Also, during ascent we had a display on one of the cathode ray tubes that was sort of tracking what our trajectory should be as we went uphill, to give us some sense as to whether we were flying nominally or not, and we were flying above it, significantly above it. So it was obvious that something was different than what our training had said, but it was better to be above it than be below it, so we were on the right side. It was no concern, but again, it turned out the vehicle had more lift than what we had predicted.

We also later learned that at liftoff from the solids, we had broken a strut up in the nose of the vehicle that held the reaction control jet fuel tanks. That was caused by the shock wave of

the solids against the Mobile Launch Platform ricocheting back up and hitting the vehicle. John and I, I don't think, realized that at the time; in fact, I know we didn't. But it was something we had to solve with some water trough that we put in there to make sure it didn't happen on subsequent flights.

So that first stage had some surprises, somewhat, going up. Then we continued on, and it was pretty much nominal. The flash evaporators started to work cooling as they were supposed to, and you accelerated on up again to three Gs. The engines throttled like they were supposed to, and then [at] eight and a half minutes, we had engine cutoff. In the Saturn, I guess they really had a sense of being pitched forward. So, John having told me that, both of us were sitting there with our hands on the windscreen in front of us, holding onto it so we didn't feel that pitch. I never felt it. I don't think John did, either. So it didn't seem as pronounced, I guess, as it had in the Saturn V.

We were strapped tightly into the seats, so you didn't really feel the zero-G aspect immediately, but the checklists started to float around, and debris that was in the cockpit started to float around. Even though the ground crews had worked very hard to get it clean, on that first flight there was lots of extraneous material in the cockpit that needed to be dealt with. But it was a ride. You know, eight and a half minutes from sitting on the pad, to be going 17,500 miles an hour is a ride like no other. It was a great experience.

I was going to go back to the simulations. So we did change the motion-based, which can't really simulate what the flight is like, but to make it seem like a little bit more of a kick when you lifted off. We did make the separation boosters coming over the windscreen; we put that in the visual so that was there. We changed the shaking on that first stage somewhat so that it was at least more true to what the real flight was like. Then I mentioned earlier that after we

got the main engine cutoff and the reaction control jets started firing, we changed that noise to make sure it got everybody's attention so that they wouldn't be surprised by that. So those are some of the things that we looked at and modified on the simulator when we came back.

WRIGHT: Let me ask you, we talked a little bit about being a commander and the difference of being a commander and a pilot. We talked about what you look for in a crew member. How important to the success of the mission is the crew's relationship with each other?

CRIPPEN: Oh, extremely. The missions the Shuttle flies in general are on the order of a week, so probably anybody can put up with anybody for a week. However, you have to put up with everybody for a year, training for that, which is probably even more stressful. Now with the International Space Station, where they're up there for much longer, hopefully when we'll have people on the Moon and maybe eventually when they're going to Mars, they're going to be together a lot longer, so compatibility is something that is extremely important. The Navy pays attention to it in things like submarines and other vehicles where you've got a close confinement.

In general, the people that get selected in the Astronaut Office are—even though I don't know that we do a test for it; in fact, I know we don't do a test for it—you get a sense, sitting down with people, to see how people oriented they are, how well they interface with other folks, so most of the people that we bring into the office are of that nature. But even with that mixture you find some people work better together than others. So when you're selecting a crew, it's important to at least pay attention to that aspect of it, because it is important in my mind as much as their technical capabilities.

WRIGHT: How well do they adapt to you as the commander? How much is that important? As we were looking for some information about the missions, we found that there were some strong opinions about you and your leadership skills. For one, Sally Ride had made the remark that she admired the way that you think through problems and you make decisions and you interact so well with people.

One of the trainer's in Cooper's book made the comment that you were a strong believer that the entire crew should take meals together, steer away from any kind of activity at mealtime. An hour before bedtime should be time off. You had some pretty specific ways of wanting things done. What brought that knowledge and wisdom to you that you knew this is how you wanted your crew to be?

CRIPPEN: Not sure. I guess all the experience that we'd talked about earlier of working with many different types of individuals; having had good bosses and bad bosses. Taking things from all of that probably is built into my style. Everybody's got a little bit different style, and the things that I knew that—I talked about the compatibility issue—is such that you ought to have some social time together. So that was the idea of taking the meals together.

I think it's important that everybody know what's expected of them. I also think that you ought to pat people on the back periodically, and if you've got to use the stick approach, it ought to be done in private as opposed to public. Luckily enough, I never had that problem with any of my crews.

I always felt, from my experience in Skylab, that as I was a capcom for all that time and working with the guys that were on orbit, they needed time to themselves where the ground

wasn't bothering them, that they could just relax and enjoy themselves, as opposed to being frenzied, doing work all the time.

All of those probably went into it. The other aspect that I know I was probably a little bit tough on was given the opportunity, everybody would probably spend their sleep period looking out the windows and not resting. Rest is extremely important, especially the longer the mission is. People are biased to do what they want to do, and to look out the window is probably one of them. In fact, I know it's one of them. But I always insisted, nope, that when it comes bedtime, we're going to sleep. Some people had a hard time sleeping, and others don't, but in general, I think that most people complied with that. Maybe I was wrong to insist on it, but I personally believe it was the right thing to do.

WRIGHT: You mentioned about a commander, the number one rule is that you got to look out the window more.

CRIPPEN: But when it came sleep time, I went to sleep. [Laughter]

WRIGHT: But you also had such a great amount of responsibilities. While, in fact, we were taking the break, we were talking about 41-G when Leestma was about to do the EVA and having to deal with hydrazine. You started to talk about your concern, but you even had concerns on the ground about doing this part of the mission, wanting to make sure it was safe. Tell us about some of the directives, some of the insistences that you said, "This has to be done," so that you knew that he would be safe and that your crew would be safe.

CRIPPEN: Well, we did have one significant issue. We ended up working—I talked earlier about how you build procedures and contingencies and that sort of thing. We had some excellent displays on board to tell us what was happening with the hydrazine transfer. The ground also had some of the capabilities, of course, to monitor what was going on. We ran into an issue with what happens if we lose our displays. How much of it can we continue on with? There was a strong push from some of the people on the ground that we ought to be able to continue on, because they can monitor it for us. At that time we had pretty much total coverage through the TDRSS [Tracking and Data Relay Satellite System].

I didn't feel good about doing it if we couldn't monitor it on board as to what was happening. We ended up working out some compromises between us as to what we could and could not do, but, to me, the gain to be had from that particular experiment was not worth us putting the crew or the mission at a significant risk. So I took what I thought was probably the conservative viewpoint, and we ended up flying pretty close to what I wanted to do. Luckily enough, we never lost the display on flight, so it was a mental exercise on the ground.

WRIGHT: We mentioned earlier about this was kind of a long sim for a mission, and one of the issues that you had to deal with was high temperatures in the cabin, because ice had formed in a vent. Did, at any point in time, you thought you were going to have to cut your mission short because of this issue?

CRIPPEN: I didn't on board. Actually, that ice that formed was due to the flash evaporator, and it was due to a problem that I made happen, because the flash evaporator, when you turned it on, it's supposed to kick off and start flashing water to cool the vehicle down. In the simulator it

quite often wouldn't work, and you'd have to cycle it. And I ended up cycling it several times without consulting with the ground. I followed the procedure, but the procedure didn't say what happened if it didn't work the first or second time you did it.

But the result of all those cyclings put the water coming out of where the flash evaporator, and put an ice cone out there that we ended up having to deal with, to get rid of. In the end everything worked out okay, and it wasn't that hot in the cabin. It was kind of warm, but we were down to T-shirts and shorts.

WRIGHT: It's good you trained in Houston. [Laughter]

CRIPPEN: Right. We're used to it.

WRIGHT: Well, you got to bring this Shuttle home to Kennedy.

CRIPPEN: Finally got into KSC.

WRIGHT: Tell us about the difference in landing there.

CRIPPEN: Well, it was similar in a lot of ways, but this was a high-inclination orbit. We were at fifty-[seven] degrees, if I recall correctly. All the previous entries, because we were landing at Edwards, of course, came in pretty much over the Pacific [Ocean]. So you weren't flying over land that much of the reentry.

This one, we started up in Canada, and pretty much came across the center of the United States, headed for the peninsula of Florida, and it was a nice, clear day across all the states, and you could see everything. One effect you get, as you come lower, you actually notice the speed a lot more than you do while you're on orbit. I'm not really sure why that is, but it seems like you're going faster, when actually you really are slowing down.

I can remember I could see Jacksonville, Florida, when we were over probably in Kansas-Missouri area. I could see the whole peninsula of Florida, and shortly after I picked up Jacksonville, I could see the Cape, because it's very pronounced where it sticks out there where the Kennedy Space Center is. Then there's the Shuttle landing facility. So visually I think I picked up everything necessary to fly an entry much earlier than I did while we were coming into California.

Even though we were flying on the autopilot and doing very well, if there had been something wrong with the navigation, I felt like I had the capability to fly it on in and land. Thank goodness I didn't have to, but it worked out very well. We came in over KSC about 40,000 feet and did our big turn around the heading alignment circle and landed on the runway there. We had done it in that Shuttle Training Airplane hundreds of times, and it seemed pretty much like one of those.

I often joke that they've got a fifteen-thousand-foot runway, but they built this moat around it and filled if full of alligators to give you an incentive to stay on the runway. But it worked out well. The landing was fine. I had a habit, because of landing on lakebeds, of getting in and dragging it in a little low. So I think after that we changed to where people are flying the approach lights to make sure they stay up a little bit higher on that final glide slope than what I was doing, because my wheel height as I came over the threshold of the runway was probably

much lower than what it should have been. But it was comfortable for me because it's the way I'd been practicing landings.

WRIGHT: Well, right after that mission concluded, you were appointed as Deputy Director of Flight Crew Operations, kind of a management job. It was a newly created position under George Abbey, so what were some of your duties or responsibilities, and what were your expectations?

CRIPPEN: George's management had told him that he needed to get a Deputy because they never could get hold of him when they wanted him. [Laughter] So one night George took me out for a drink, and he says, "Crip, they tell me I got to have a Deputy, so you're it." [Laughs] So it was much like that. I was there primarily to carry the fire when the ninth floor called and George wasn't there, or even a lot of times when he was there. I got the message of what needed to be done, and so I sort of edged into management. I'd been Deputy to John Young, also, as Chief of the Astronaut Office, and had probably just started to widen my horizons a little bit. Unfortunately, that was one of the first times I had to really start working budgets, a real fun thing when you're in management.

WRIGHT: Didn't get to escape that part, huh?

CRIPPEN: Didn't get to escape that part.

WRIGHT: But at some point there you were going to do a fifth flight on STS 62-A.

CRIPPEN: Right. That was the flight out of Vandenberg [Air Force Base, California]. The Air Force built the launch site out there to do military missions which required a polar orbit, and it was a flight I wanted a lot. We talked earlier about me being on the Manned Orbiting Laboratory. Well, the launch pad we were supposed to have flown out of was SLC-6, so it was Space Launch Complex 6, and that was where the Shuttle was going to fly out of. I felt like I'd come full circle, and I really wanted that polar flight. I lobbied for it and ended up being selected, although not without some consternation. I think since this was primarily an Air Force mission, there was a big push by the Air Force to have an Air Force commander on the flight. But the powers that be ended up discussing it a lot and letting me take the lead on it.

I had a great crew. In fact, we were assigned a unique payload specialist, who was then Undersecretary of the Air Force, [Edward C.] "Pete" Aldridge, to fly on that, and we trained for it. I personally think we would have flown in the latter part of '86. We spent a lot of time out at Vandenberg making sure the launch complex was acceptable, and we had lots of inputs as to what they were doing out there, especially when it required crew interface.

Of course, we lost that mission. After *Challenger* [STS 51-L accident] the Air Force decided they didn't want to stick with the Shuttle, that they were going to go to what is now the evolved expendable launch vehicle. If I have one flying regret in my life, it was that I never had an opportunity to do that Vandenberg mission.

WRIGHT: What Orbiter were you going to be using?

CRIPPEN: [Space Shuttle] *Discovery*. We actually took the [Space Shuttle] *Enterprise* out there and used it to run through where they had to move it to stack it, and they actually had an external tank and some not real solid rockets out there that—so we mounted it all up, and I've got pictures of the vehicle sitting on the launch pad like it's ready to fly, but it was the *Enterprise*, as opposed to the *Discovery*. We were also going to use filament-wound solid rockets, whereas the solid rockets that we fly on board the Shuttle have steel cases.

That was one of the things, I think, that made a lot of people nervous after—we needed the filament-wounds to get the performance, the thrust-to-weight ratio that we needed flying out of Vandenberg. So they used the filament-wound to take the weight out. After we had the joint problem on the solids with *Challenger*, most people just couldn't get comfortable with the filament-wound case, so that was one of the aspects of why they ended up canceling it.

WRIGHT: The *Challenger* has changed so much for the Agency and for the nation. Where were you that day, and how did you learn about the accident?

CRIPPEN: Well, I actually had the 62-A crew at Los Alamos in New Mexico, and we were going through one of the experiments that we were going to be flying on the flight. We knew when it was supposed to lift off, so we managed to get ahold of a TV and watched the liftoff, but as was common during that period of time, as soon as it cleared the pad, they broke to something else. We tried to find another station, which we didn't, and then we started to go off, and Dale [A.] Gardner, who was on the crew, said, "Well, let's try one more time." He turned it on, and it had come apart in that time. We could see it, which was devastating for everybody.

WRIGHT: What was the next step for you and your crew?

CRIPPEN: Well, we obviously knew that there was no reason to continue with the training that we were doing, and so our intent was to head back to Houston. They had flown us to Los Alamos in a small plane, and so they took us back to Albuquerque [New Mexico], where we had our T-38s, and we flew back to Houston.

WRIGHT: You became part of a Mishap Review Board. How soon did that happen after the accident that you were called to work with that?

CRIPPEN: It was almost immediately. I think it was the day we got back that George called me in and said that they were putting together a NASA Mishap Report, and that J. R. Thompson was going to lead it up. J. R. had been the guy that headed the development of the Shuttle Main Engines. He no longer worked for NASA at that time, but they brought him back in to lead it, and they asked me to be his Deputy for that. So shortly, maybe within a day, I got in a T-38 and headed to Kennedy Space Center, and started to work the cause of the accident and the recovery of the vehicle and the crew remains.

WRIGHT: How did that organization of that effort come to be? Did you have outside people helping you, or were you one of the instrumental people that started putting what you needed to accomplish, what you needed—

CRIPPEN: Some of both. I'm not sure who came down with—hey, we obviously had to put together an investigation team, and somehow George got me involved with it, which he was good at, at getting what he wanted. So we actually took several astronauts and brought them down there with us to work in various capacities. Bob Overmyer was the guy we brought down to primarily work the recovery of the vehicle parts and crew remains, but we had probably half a dozen astronauts that were there. We brought in the Navy salvage group, who were the likely ones to go in and pick up debris off the ocean. So some of it was being directed; some of it was J. R. and I sitting down and saying what we needed.

WRIGHT: How long did this period of action last in your life?

CRIPPEN: Seemed like several years, but weeks, I guess, until we got enough data to show that the problem was the solids at that joint. Shortly, about that time, the President formed the Rogers Commission, which was the official investigative team to look at it, and so the team J. R. and I had put together was sort of a subteam to the Rogers Commission, feeding data back into them. Then we were staying at the crew quarters there at the Cape, and not going into town or doing anything but working the accident, and seemed like it went on for a long time. After we discovered the cause, from what we'd seen on the video, we wanted to track and get the piece of the solid rocket where the hole had been burned so that we had some definitive evidence of what we could visually see. So we spent a lot of time using radar tracks and those kinds of things to track where we thought it had landed in the ocean; had people going out and searching.

Somewhere about that time that we discovered—at least, to my surprise, the actual cockpit of the *Challenger* had come off and was pretty much intact, free-falling into the ocean.

So we pinpointed that and sent people out looking for where it impacted, and they ended up finding it, and that was where we recovered the remains of the crew. A very sad time for all of us.

WRIGHT: You were at the time Deputy Director of Flight Crew Operations. You were also doing this. Were you involved at all, or how much were you involved, with the astronaut corps in trying to also keep their spirits up and helping the leadership of their morale?

CRIPPEN: Essentially, I dropped any Deputy FCOD [Flight Crew Operations Directorate] operations at that time and had a contingent of astronauts working with me there at the Kennedy Space Center. Probably my morale or personal morale was about as low as it could possibly get. I'm not sure I did much to enhance the morale of any of the rest of us, but we were all working very hard, and that was the best medicine for us, I think, to stay focused on trying to make sure we could find the problem and fix it and go fly again, because I think that's what all of us felt the crew would want us to do.

WRIGHT: Well, your role did change in '87 to become the Deputy Director of Shuttle Operations, and part of the time that you were there, we returned to flight. So tell us about how that transition happened, from moving to the Review Board into this new management position and then you helping to get the nation back.

CRIPPEN: Well, when we pretty much wrapped up the cause of the accident and the recovery of the stuff, debris, Dick Truly had been brought in back into NASA. He was a Navy Admiral that

was running the Navy Space Command at the time, and they brought him in as the Associate Administrator for the Office of Space Flight. Dick asked me if I would come up and help him implement some of the recommendations from the Rogers Report.

So I went to Washington and spent probably the next seven to eight months in D.C., going through what they recommended and trying to conclude what we ought to do as a response to it. Part of that was I was asked to put together a team to look at the management structure for the Shuttle, and so I had Dick [Richard H.] Kohrs, within Deputy Program Manager for the Shuttle; and Walt [Walter C.] Williams [Jr.], former—I guess back in the Mercury days he was like the head operations guy.

So the three of us sat together looking at what the Rogers Commission had said was wrong, and we went and interviewed a large number of people that were in various management positions, both within NASA and without, to try to determine how we ought to restructure our management. Put together a report with some recommendations. In one of those reports was that we needed to get more operational people involved in the Space Shuttle, in the program management of it. When I took that recommendation to Truly, he said, "Crip, if you really believe that, you'll hang up your flying boots and come take that position." Since I really felt that, that's what I did.

Part of that recommendation was that that position should be located at the Kennedy Space Center and be the final authority for launch. So I ended up putting together an office structure both at the KSC and one here at Johnson and one at [NASA] Marshall [Space Flight Center, Huntsville, Alabama] to support me in that; small operations. Dick Kohrs was the Deputy Program Manager for Engineering, if you will, so he and I worked very closely together

with Arnie [Arnold D.] Aldrich, who was the Director of the Shuttle Program, which we put in Washington because we thought it needed that Headquarters focus.

So the three of us worked very hard to correct the problems that we had with the Shuttle Program, not only those that caused the accident, but some other things that we thought needed to be corrected. Truthfully, one of the most difficult jobs I ever encountered. However, when I look back at it, the fact that we were successful and did get us back flying again, it probably was one of the more rewarding jobs that I ever had. So I spent quite a bit of the time down at Kennedy Space Center during that period.

WRIGHT: Talk about return to flight and what that meant to you, especially Rick Hauck commanding that, he was your pilot, and how that all came together.

CRIPPEN: Well, we in management, I guess, I know Truly and I and several other people, had talked about who ought to command the next flight, because we knew it was going to have a lot of scrutiny. Rick seemed like an obvious choice for several reasons, and he then went and worked and picked out his total crew.

Again, my focus primarily was on the process that we would use, to put together the way we were going to run the Flight Readiness Reviews, who was going to chair those, put together a mission management team that was going to handle the L-minus-2 review and that would be sitting in the firing room for launch, and how we were going to operate that. Worked with the Kennedy folks on coming up with all the launch commit criteria and what we would use to say it was go and what we would use to say it was no go and how we'd do it.

Put together a new weather-monitoring scheme that brought in some NASA folks to help us with the weather. Also, the Air Force, who does an excellent job of it, but the nature of the Air Force is they rotate people every two to three years for their career, and we worked to get a permanent civil servant in the weather office there at the Cape Canaveral Air Force Station. Brought in an astronaut, Mike [Michael J.] McCulley, to sit beside me during the launch countdown in the mission management team, to stay abreast of what the weather was doing so that I had firsthand knowledge of it when I was making decisions about whether it was time to go fly or not go fly.

So I was pretty busy at that time, and it was tough. Getting back to fly, we had a lot more people telling us why we shouldn't go fly than we had why we should fly, something I know that we're encountering today after the loss of the *Columbia*.

WRIGHT: Did you ever feel that you had lost the confidence of the American people, or did you always feel that the people wanted the nation to return?

CRIPPEN: I thought the larger percentage of the people wanted us to go fly, but I think their confidence was certainly [diminished]. Too many people looked to the Shuttle lifting off regularly, putting payload specialists on board, putting a teacher, if you will; looking at whether we were going to go fly a journalist. Too many people had lost the perspective of that it was still a test vehicle and would always be a test vehicle, and that it had inherent danger associated with it. I know, or at least I feel I know, that the professional astronauts that were flying, I believe most of them understood that. I'm not sure that some of the payload specialists that were coming on board really fully appreciated it as much as those of us that were intimately involved with it.

WRIGHT: You were Director at Kennedy Space Center next, and you served there for—

CRIPPEN: Well, actually, Arnie Aldrich, who was the Director of the Shuttle Program up in Washington, got selected to become Associate Administrator for Aeronautics, and Truly asked me if I would come up and be Director of the Shuttle Program in Washington. So I brought in Brewster [H.] Shaw [Jr.] to take up the position I had held there at Kennedy, to be the Deputy Director for Operations, and I transferred to Washington as Director of the program, and spent two years doing that.

Probably 1990 was one of the worst summers I ever spent, because we ran into a series of hydrogen leaks that we could never really find what the problem was, and they were causing us launch scrubs, sitting out on the pad. It was a tough time, but we finally licked the problem and got it back flying again.

After two years of that I had had about all of Washington I could take—it's not exactly a fun place to work, from my perspective—and was looking around for something new, and the potential came up to take over the Kennedy Space Center, which is one of the best jobs, other than sitting in the cockpit, that I know about here at NASA.

So I did that, and that was a great job. We had lots of successful Shuttle missions during that period of time. I was there for three years until I decided it was time to retire and go out into the commercial industry.

WRIGHT: You went to Kennedy about the same time the agency got a new Administrator.

CRIPPEN: That's true. Dick Truly was the Administrator when I was actually assigned there, but it was probably within three months or so after I was there, I got this phone call that Dick wanted to have a teleconference with all of the Center Directors. He did so and told us he was leaving, and it wasn't long thereafter that Dan [Daniel S.] Goldin was announced as the new Administrator for NASA.

WRIGHT: A new job and a new boss.

CRIPPEN: A new job and a new boss, you're right.

WRIGHT: Being in charge of a Center is so much more responsibility than being part of an office or even in command of a mission. Those three years, were you able to make some changes and to feel that when you left there, you left it a place that was stronger and on the right track?

CRIPPEN: I think so. You probably need to go ask some of the people that were working there, too. I had learned KSC pretty well from the time that I was there as the Deputy Director for Shuttle Operations. But also I had spent a lot of time at KSC, starting with the Skylab Program. I was the original what we now call the "Cape Crusader." I went to KSC every time I had an opportunity, so I felt like I knew the Center pretty well.

Large organizations are interesting to manage, because, again, it's kind of like when you're sitting on top of the Shuttle. You're very dependent on the people under you, that they do the right thing. So what you have to do is to try to communicate to them what is the right thing

from your perspective, and let them loose. Hopefully they do the right thing, and if they don't, then you redirect them.

This was the period of time when we were having to cut money back again. We had boosted up—we kind of threw money at the Shuttle to get it back flying again. "Threw money" is probably a loose connotation of what we did, but we put money where we thought we needed it to go and to boost certain things back up. But obviously we didn't need to continue to operate with those kind of budgets, so we needed to figure out how we could bring them back down, and people were nervous about doing that, cutting budgets again, going to compromise safety. So we had to make sure that we weren't compromising safety.

Total Quality Management was very popular about that time, which is just another set of buzz words for doing more efficient work. We put in some of those processes while I was there, and were able to bring back the budget somewhat, and I thought we did a pretty good job. When I left they were still wanting to bring it back more, and I was not all that comfortable with some of the things that I could see on the horizon, though.

WRIGHT: Those ten years, almost ten years, from *Challenger* to the time you left, you worked in some positions that had some strong changes and made some tremendous accomplishments, but you were also having to follow so many things that were coming after these recommendations that came after *Challenger*. What do you feel was some of the major recommendations and the major accomplishments, other than returning to flight, after *Challenger*? What do you think are some of the good changes that have affected the space program since that tragedy that benefited the Agency and the personnel?

CRIPPEN: Well, the primary one, which I thought we had implemented after *Challenger*, was pretty simple. It was communication. I didn't feel, leading up to the *Challenger*, and I think it bore out in all the reports that came out afterwards, that between Headquarters and JSC and Marshall and Kennedy Space Center, the communication wasn't that great. Sometimes it was, but sometimes it wasn't.

I thought we put in some structure that would enhance those communications. During the time that I was still working at NASA, I thought it worked pretty well. If there was a problem that anybody saw, I felt like it was heard across the system. Now, sometimes we heard problems and after analyzing it, didn't think it was something we needed to deal with right then. But I at least had the feeling that if people were concerned about something, they could bring it forward and have it dealt with at the proper levels.

However, reading the accident report that came out of *Columbia*, it was obvious, if we had corrected some of those, then we had lost something along the way. Or maybe we thought we had corrected it, and we hadn't really done an adequate job. I would like to think that we had corrected them, and somehow time had eroded some of them.

WRIGHT: You did leave in 1995. Why did you make the decision to retire when you did?

CRIPPEN: Several reasons, but the main one being that I was looking forward to getting a little older, and concluded that if I ever wanted to be able to retire comfortably, I was not going to be able to do it by working on a government salary. So I thought it was probably time to go out and see what I could do in industry.

At the time I left, when I went in and told Dan Goldin that I was going to be leaving, I didn't have any positions lined up; had not talked to anybody, purposely had not done that. I took, I think, a couple of months off before I started job hunting, which was a good thing for me, and then I went to work doing something that was totally not space related. I went to work for Lockheed Martin [Corporation], running some of their simulation activities that were primarily there to support the military.

WRIGHT: And then your next job, you went to work in Utah for Thiokol [Propulsion Group].

CRIPPEN: Well, after we'd been with Lockheed Martin a little less than two years, I got a call from a headhunter one day that says, "Hey, I got this job out in Utah that I'd like to talk to you about."

I said, "There's no way my wife's going to go to Utah. I don't think that would work. " [Laughs]

He said, "Well, let me let you talk about it, anyhow."

So I said, "Well, I'll call you back." So I went home and talked to my wife and told her there was a real opportunity there, if she was willing to go live in a cold place for a while. After we talked about it, we decided it was worth investigating further. One thing led to another, and we ended up in Utah, and it was a great time. I really enjoyed working at Thiokol and with the people that we had out there. It was back working with the Shuttle Program, which will always be in my heart somewhere. Well, it was a little bit broader than that, but it was an excellent period of time, and at least the solid rocket motors, I felt like I could continue to make sure that we didn't screw those up, and I'm proud to say the guys continue to do that today.

WRIGHT: What are some of the major differences of working for a government agency for so many years and then switching over to a commercial atmosphere?

CRIPPEN: Well, you probably get different answers depending on who you ask, but I found there were a great many similarities. Working in management at NASA, I found that I worried about people, I worried about processes, and I worried about money. And those three elements are still there when you're working in industry. The money you look at little bit different, because there's a profit element that you've got to worry about. But you've still got a budget that you've lined up, and you've got to go out and compete for new business. Those things are somewhat new.

Going in and talking to a NASA manager when you're a contractor is a little bit different perspective, but it's the same when you're working in NASA management, you've got to worry about what your contractors think of you. So there's a give-take relationship on it. But people, processes, and money are the main elements, and there's a lot of similarities between the government and industry.

WRIGHT: Did it help that some of the people that you were interfacing with, you had interfaced with them before on a different level?

CRIPPEN: Oh, sure.

WRIGHT: Found a familiarity there?

CRIPPEN: I knew the Centers, knew most of the folks in management. I had gone through the period of time where legally—when you leave NASA in the kind of position I was in as the Director of KSC, you can't go in and interface with NASA directly for one year, and even longer than that for some contracts that you might have let. But I was past that point, so I felt Dan Goldin was still the Administrator of NASA, and I learned that when Dan was worried about something, I ought to be worried about it, too. So I spent a lot of time talking to him, and the Marshall people and all the Centers.

WRIGHT: You mentioned it here and there, but we really haven't had an opportunity yet to talk about *Columbia*. In February 2003, we lost that Orbiter and the crew. In fact, both the Shuttles that you flew are gone now. Tell us about where you were with *Columbia*. And were you involved in anyway with the Agency of helping to deal with that tragedy and bring us back to flight?

CRIPPEN: I can remember [it] was one morning, and I was in the kitchen with my wife. Got a call from my daughter Susan, who works here at JSC for United Space Alliance, and she said, "Dad, there's a problem."

WRIGHT: Yes, and then the day happened from that.

CRIPPEN: It was tough. I turned on the TV. I had hoped it was never going to happen again, although I did know the possibility was there. A lot of people were surprised that we ran into a

problem on entry. Truly, in retrospect, when you go back, the original problem occurred on ascent. But you've got to take out all that energy you put on during ascent, and it's always a dangerous time. Most people don't concentrate on it, but it is; it's a potential that you could lose it.

So I had a great deal of confidence in the people that were in the management chain at that time. I was disappointed in, from my perspective—in reading it, of course; I wasn't involved directly in the accident investigation or anything—that it did appear that we'd had communication problems again, which are deadly in dealing with this kind of a program.

I was asked to do several different things, and I declined. As I said earlier, working with *Challenger*, that was one of the tougher things that I did, and I didn't feel like I wanted to go through that again. And I knew we had some good people to do it. They didn't need me.

WRIGHT: You worked so close with the *Columbia* Orbiter itself for so many years. We had talked to many of the folks of the recovery, and especially those at KSC. The *Columbia* itself, although a hard piece of metal and a very complicated machine, was so much a part of their life. You went to the memorial service and made a remark that you felt the same way about that ship was so close to your heart.

CRIPPEN: Yes. Yes, that was one of the more tougher things that I—Roy [D.] Bridges [Jr.], who was the Center Director there, he and Jim [James W.] Kennedy, who was the Deputy at the time, called me up and asked me if I would speak at the memorial. They said they were going to have several people that would probably focus on the crew, and they asked me if I would focus a little

bit more on *Columbia*. Trying to put together remarks for something like that—it's a very emotional time—was extremely tough.

But the *Columbia* to me, and in fact, *Challenger*, also, you spend so much time with them that they almost seem like a living entity, and to the folks at KSC that work on it every day, that's certainly the case. So I just tried to voice some of that. Besides losing the crew, which was extremely painful, they felt like they'd lost a piece of themselves, the folks at KSC did, when they lost *Columbia*. And I felt the same way.

WRIGHT: In December of 2004 Sean O'Keefe announced that he was going to be leaving. You had served in the capacity of military aviator, test pilot, engineer, astronaut, manager, director, and your name was mentioned as a possible replacement. [Crippen laughs.] Did you take this seriously? Is this something that you would have liked to have done?

CRIPPEN: Well, I guess it was nice that people would think of me when they were talking about filling that position, but truly, I felt like I had done my part, and that there was lots of good people out there that could run the Agency. So, while I was never asked directly to do that, it was not a position that I would have considered, and I thought they made an excellent selection in Mike [Michael D.] Griffin, who's a great friend of mine I've known for many years. He'll watch over things.

Although, you know, I mentioned earlier when I was Director of the Shuttle Program in Washington, that it's not my favorite place to work, and it still is not. It is a political agenda, and I'm not a politician, so it's not something that I would have wanted to do.

WRIGHT: You have served so many of those other roles and your contributions are wide and vast. What do you consider to be your greatest contribution to the Space Agency?

CRIPPEN: Return to flight after *Challenger*, without a doubt.

WRIGHT: What do you consider to be your greatest challenge? You mentioned the budgets. [Laughter]

CRIPPEN: Greatest challenge. I'm not sure I could pick out one. I mentioned earlier the problem that we ran into. Communication is tough, and it's so important in any kind of an organization, whether you're flying Space Shuttle or building wickets.

So when I was involved in management at NASA, especially at KSC, and then when I ended up out at Thiokol in Utah, I felt like that was the thing that I needed to work on the most, to try to make sure that communications were flowing, and communication is two ways. It's not one-way. Making sure that people that were out there, both contractor and government, at KSC, and all my Thiokol people when I was there, knew what I was thinking, knew where I was trying to go, and that I knew what they were thinking and what kind of problems they were having. So that was probably the thing that I worked on the hardest.

WRIGHT: Well, my questions and my areas that I wanted to bring up with you are just about done. Are there some other thoughts or other areas or aspects of your career that we didn't—we touched on, but—there are so many, and I know we could talk so much longer.

CRIPPEN: Well, I think we did a good job of covering it. I mentioned earlier I had a chance to start working on the Shuttle in like 1972, '72 or '73, and except for the small period of time when I was with Lockheed Martin for about two years, I worked on it again until I retired from Thiokol in 2001. So it's been a major part of my life, and when I look back on it in retrospective, I'm saddened that we lost two vehicles and fourteen crew members, but I still think it is a marvelous flying machine and I feel good about having had an opportunity to participate in it.

WRIGHT: My final question for you, if you can explain to those of us who aren't pilots and will never be, why—I had a quote from you that you had said that flying the Shuttle was a test pilot's dream. Explain to all of us who aren't pilots and aren't going to fly in the Shuttle, why? Especially STS-1, but why? Why is the Shuttle a test pilot's dream?

CRIPPEN: Well, it's kind of hard to explain if you're not a pilot or inclined in that direction. I guess test pilots—[people] that want to be test pilots want to push the envelope, and pushing the envelope means doing something for the first time. The Space Shuttle flight on STS-1 had so many firsts associated with it, it's hard to find something else that can compete with it. Some of my test pilot buddies would probably challenge it, but to get a chance to take a winged vehicle into orbit, use solid rocket motors that have never been used previously, and then bring it back down to a landing on a runway which is much more elegant than dropping into the ocean. It's just hard to find something to beat that, and so it's something I'd dreamed about as a kid, and had a chance to do.

WRIGHT: We're so glad that you took time today to tell us all those things that you were able to do so that we could understand them and learn to much. I just appreciate your time. I know you're here for some good news in your family, and so we'll let you get back to that. Thanks again for being here.

CRIPPEN: Okay. Thank you.

[End of interview]