NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY 2 TRANSCRIPT

FREDERICK D. GREGORY
INTERVIEWED BY JENNIFER ROSS-NAZZAL
WASHINGTON, D.C. – 14 MARCH 2005

ROSS-NAZZAL: Today is March 14th, 2005. This oral history with Fred Gregory is being conducted for the Johnson Space Center Oral History Project. Jennifer Ross-Nazzal is the interviewer. Mr. Gregory currently serves as NASA's Acting Administrator, and I am talking to him today in his office at NASA Headquarters in Washington, D.C. This is his second oral history session.

Thank you so much for joining with me today. I really appreciate you taking the time and all the patience that you've had today. I'd like to begin where you stopped last time during your oral history interview, and that's with your first mission, STS 51-B. You were actually the crew pilot on that mission. Can you tell me a little bit about your job duties during that mission?

GREGORY: The pilot on a Shuttle flight is second-in-command, but is responsible for primarily the systems; not the primary thrust or guidance, but all the support systems that keep the Orbiter functioning once you are on orbit. On that particular mission, we had two shifts, and I was the shift commander for the silver shift. I had Norm [Norman E.] Thagard and Lodewijk van den Berg on my shift. Lodewijk was interested in crystal growing. Norm and I had respective jobs on board, but we, in essence, were the folks who supported the science of the payload specialists.

I believe it was a seven-day mission. Bob [Robert F.] Overmyer was the commander. On his shift he had Don [L.] Lind, [and] Taylor [G.] Wang. So, again, we worked twenty-four hours, two twelve-hour shifts, and we were in a high-inclination orbit, fifty-seven and a half

degrees, and so it gave us an excellent view of a great part of the Earth. Since as a pilot, I was responsible for the maintenance of the capabilities of the Orbiter to support the science payload activities going on in the Spacelab, but during that mission, there were very few problems, and those that we had were very minor. So not only did I monitor the Shuttle, but I also had a great deal of time to learn about the Earth, and then spent a lot of time looking into deep space.

ROSS-NAZZAL: You mentioned that you and Norm Thagard provided science support. Did you actually work with any of the experiments in the Spacelab module itself?

GREGORY: I didn't, but Norm probably did. I was very seldom in the space laboratory, because my work was primarily monitoring the Orbiter systems. But he and I actually did some cleanup work. There was a food and waste escape from the monkey-holding facilities there, and we were trying to figure out how—the ground was trying to figure out how to capture that. So Norm and I—we called it the "evening shift"—we went in there, and we put masks on, and we used the little vacuum sweeper and used that to gather the debris, and then transferred it from the bag within the vacuum sweeper into a closed bag and sealed it off.

So the next time that we gained ground communication, we told them that we had already done it, and they seemed very relieved, because I think they were coming up with a pretty complex procedure, so Norm and I had done it in a very easy way, and everybody sounded very satisfied. But other than that, I spent very, very little time in the space laboratory.

ROSS-NAZZAL: Did the escape of those particulates have any sort of negative impact on any of the experiments or the Space Shuttle itself?

GREGORY: No, I don't believe they did. The later analysis was that primarily it was food, though there may have been some contaminants on it. Other than interest in watching it being ejected from the holding facility, I think it was just interest. Since it had to be reported to mission control, the interest in cleanup, I think, was primarily on the ground, though on orbit it was a passing issue, not something that would have caused any disruption in the current activities.

ROSS-NAZZAL: I wonder if you can describe the flying characteristics of the Orbiter, since you were the pilot on the crew.

GREGORY: On ascent, I think it would be fairly typical of a rocket, a lot of acceleration. The G is sustained. Because it is sustained, it tends to take your breath away. The G is not that high, but since it is sustained, it poses a great deal of problems to move your arm or to precisely place your arm on one of the many, many switches that are in the vicinity of the pilot and commander seat up there. On my first mission, we wore a flying suit, and so that reduced significantly the bulkiness of that which you were exposed to. Next missions I flew, we had launch and entry suits, which were much more cumbersome, especially with the gloves that you wore.

But in this particular case, there's a lot of—probably two and a half Gs or so on your back. You ride it for eight minutes, eight and a half minutes. Then the main engines cut off, and you're suddenly exposed to weightlessness, which is a kind of a drastic—from three Gs to weightlessness is quite a drastic change.

On reentry, it is entirely different. Though it takes eight and a half minutes to get up to orbit, it takes more than an hour to reenter, and it feels very similar to an airplane ride that most people have been on. You get an excellent view of the Earth. If it's night when you reenter the atmosphere, then you see a kind of a rolling plasma over the windows, the forward windows and the overhead windows. But other than the onset of G that occurs at less than 400,000 feet above the Earth, it is like flying in an airplane. The sensations that you have are very similar to a normal domestic airplane flight. You're going pretty fast, but you are not aware of it because you're so high.

But it's an amazing vehicle, because you always know where you are in altitude and distance from your runway. You know you have a certain amount of energy and velocity, and so you also know what velocity you're supposed to land, and you can watch this amazing electric vehicle calculate and then compensate and adjust as necessary to put you in a good position to land. We normally allow the automatic system to execute all the maneuvers for ascent and for reentry, but as we proceed through Mach 1, slowing down for landing, it is customary for the pilot, the commander, to take command of the Orbiter and actually fly it in, using the typical airplane controls.

But, you know, as I look at it, the ascent is very dramatic. It's very fast, a lot of movement, but quick. The entry is more civilized, but exposes the Orbiter to actually a greater danger than the ascent, as far as the influence of the atmosphere on the Orbiter. The temperatures on the outside of the Orbiter really get hot on reentry, and that's not the case on ascent. So it's a kind of a trade between the two.

ROSS-NAZZAL: Did you get a chance to fly the Orbiter while you were in Earth orbit?

GREGORY: On Earth orbit the only flying would be attitude adjustments, and those are generally keypunched in and then executed. In our training, however, we would simulate failures where you had to do that maneuver, flying it by hand, and it was quite possible to do it; certainly not as efficient as the automatic systems. So I don't recall manually flying any of the maneuvers on orbit, and I don't recall Bob Overmyer doing it, either. I think the only time we really put our hand on the stick was in the less-than-the-speed-of-sound descending for landing. Other than that, I believe everything was done by inputting parameters and then executing.

ROSS-NAZZAL: Your crew actually had two shifts, as you pointed out. Was there any sort of competition between the two teams?

GREGORY: I don't think there was competition, because the two shifts did two different kinds of science. Taylor Wang, as an example, did a lot of drop dynamics, fluid dynamics. Lodewijk van den Berg did crystal growing, and—I'm sorry, I missed Bill [William E.] Thornton. Bill Thornton was the seventh person on board. He was a NASA mission specialist, but he spent a lot of time working with the animals, the rats and the monkeys. So each shift had its own area of interest, and so there was really no competition between the two of them. Each shift would pick up any unclosed item from the shift preceding them, would close them out, but would very quickly transition to the activities on orbit.

There were really about four hours a day there was an interaction between the two. It would be the two-hour postsleep transition, when one is just waking up. A shift is waking up, and they are picking up the ball, so to speak, from the other shift. The other shift then prepares

to go to bed, and then the next about twelve hours later when the roles were reversed. During that time, it would just be a kind of a status brief on Orbiter problems or issues, any review of notes that had come up from mission control, some deviation to the anticipated checklist that we had.

We had a couple of problems with a couple of the devices on board. Taylor Wang's fluid dynamics apparatus didn't work initially, and he spent a lot of time fixing it. But when he was asleep, there was no assistance on our shift to try to correct it, since he had built it. The only other real problem was the escape of some of the food from the bins. But as I recall, it was a fairly routine mission, and I believe that all of the science objectives were complete, and all of us landed safely. [Laughs]

ROSS-NAZZAL: During those few hours that you actually spent time with the other crew members, did you ever eat dinner or lunch or breakfast together?

GREGORY: I think on that particular mission, and I think on the subsequent missions, though it may have been anticipated that we would prepare a meal and that everyone would eat at the same time, in reality that's not what actually happened. I called it almost grazing. You would go down and perhaps get a package of beefsteak or something like that, and you would heat it and cut it open and eat it.

You may stay on the middeck, or you may go back up to the flight deck, or you would go back into the laboratory, and you would eat as you were doing your other routine duties. But then you would come—and, of course, this was during a handover, and so there were discussions that were going on at the same time. Then you would come back and get something else and

heat it and take it with you. There were trays provided, but I very seldom saw anybody actually use the trays. The trays would hold multiple items, in addition to having a magnet on there for your knife, spoon—or I guess fork and spoon; we very seldom used knives there.

But the only time I really had a crew in one place eating would have been on some of my later flights, where I spent two consecutive—well, a Thanksgiving, and then two years later, a Thanksgiving on orbit, and all of us had our Thanksgiving meal together, with all the food prepared on the trays. But typically it would have been one at a time. We'd come in, and maybe several were heating at the same time, but once they came out of the ovens, we kind of separated, did our thing, and then came back and heated some more.

ROSS-NAZZAL: Are there any interesting anecdotes or stories that you remember from this flight that you'd like to share?

GREGORY: Yes, there are lots of them. Most of them I can't share. [Laughs]

ROSS-NAZZAL: I understand that. [Laughter]

GREGORY: The one that I will always remember—and Bill Thornton, please forgive me for this—these rhesus monkeys that we had were extremely spoiled. I think that the environment that they had come from before they came on the Orbiter was a place where they received a lot of attention from the caregivers there. Norm and I would look back into the Spacelab, and we would see Bill Thornton attempting to get these monkeys to do things, like touch the little trigger

that would release the food pellets. And I could tell that—I think, you know, watching them—that they expected Bill to do that for them, though Bill was outside looking in.

So we looked back there one time, and we could see that kind of the roles were reversed, that Bill was actually doing antics on the outside of the cage and the monkeys were watching. We almost joked sometimes that they started laughing, and they went back and ate, because they were [laughs]—but it was an interesting dynamic to watch Bill Thornton wrestle with or react with the monkeys. It was quite an act back there.

There was a lot of enthusiasm on board. There were conditions that developed that took the entire crew to kind of sit back and think about how you solve an issue or a problem, but the crews did that very willingly and with great thought, no rash decisions. All in all, I think that was an excellent mission. I know all the PIs [Principal Investigators], all the scientists, were very satisfied with it, and during our debriefs, technically and process-wise, I think we did very well on it.

ROSS-NAZZAL: What are your memories of landing? Do you have anything that stands out?

GREGORY: Well, we had practiced as the commander and the pilot practice approaches, using a simulation airplane, and we had participated in, in my particular case, maybe 5[00] to 700 landing approaches. And Bob Overmyer, I'm sure, had 4[00] or 500 more than that. They are flown using the same profile, the same speed, the same sensation of very high sync rates, with a flare about a mile from the end of the runway.

On orbit, as we reentered, it looked very similar to it, and so I was not surprised at the terminal part of the landing. The only difference was that we actually touched down with the

Shuttle, and we did not touch down in the simulation. We had a simulated touchdown, but the main gear on this airplane was still about fifteen feet in the air.

But I think that the training and the awareness that was given to us, we picked it up before we flew. Other than the sensations, such as going weightless when the main engines cut off on ascent, I think that the simulations that we had probably gave us 95 percent of that which we would have seen on orbit. Obviously it could not do the weightless part of it, and it was amazing when I first released my seatbelt. But it took about a half a day, twelve hours or so, to adapt to no gravity, microgravity, and then it was not an issue anymore.

So the body very quickly adapted to this new environment, and it began to change. You could sense it when you were on orbit. You learned that your physical attitude in relation to things that looked familiar to you, like walls and floors and things like that, didn't count anymore, and you translated floors and ceilings and walls to your head is always up and your feet are always down. That was a subconscious change in your response; it was an adjustment that occurred up there.

You also learned that you didn't go fast, that you could get from one place to the other quickly, but you didn't have to do it in a speedy way. You always knew that when you started, you had to have a destination, and you had to have something that you could grab onto when you got there. But, again, this was a transition that occurred, perhaps subtly, but over a very short period of time. I can remember we all kind of joked up there that we had become space things, and we were no longer Earth things anymore. The first couple of days, a lot of bloated faces, because there was no gravity settling of the liquids. But after a couple of days, you lost that liquid in your body, and you looked quite normal.

So it was a fascinating experience. I think it was surprising to us how quickly we adapted to this microgravity environment. But we were, as far as our preparation before we launched, there were no surprises on orbit during the ascent or entry that we were not at least aware of or had practiced during the training.

ROSS-NAZZAL: After you landed, did you have any sort of period of readjustment?

GREGORY: Oh, certainly. As you became a space person, when you landed, you had to become an Earth person again. When you are on orbit, the only attitude referencing system that you have are your eyes. So you can establish—you can look out and you can look at something and establish it as a reference that you use. You lose your receptors, those sensations in your body when you lean forward that would primarily be in the legs, the ankle area, the foot area. But also your cues that you had normally on Earth of velocity and acceleration caused by the inner ear, all of that disappears on orbit, because there is no gravity, and each of these other sensations are caused by gravity, or are a result of gravity.

When you come back, first of all, you have had a lot of muscle atrophy, and so there is no particular reason for you to have the great muscles to do walking or chin-ups or any of those things on orbit. But when you come back, you are now subjected to gravity again, and your sense of balance is being redeveloped in that you've got to relearn the sensations you feel from the receptors in your body. The head movement, again, immediately after your return, gives you a sense of disorientation. If you close your eyes, there's a pretty good chance that you will stumble, at least stagger. But you quickly recover; I'd say within five hours, six hours, you feel comfortable enough to go out and jog. When you go to sleep, however—I remember that I had a

kind of a tumbling feeling in lying in bed with my eyes closed, but this was just one night; the next night, no problem at all.

So the body—I'm still so amazed at how quickly the body adapts to these different environments and then quickly recovers when re-exposed to something that it has remembered. As a matter of fact, in my next several flights, each person—let me start off by saying each person has a sensation or several sensations when they are exposed to weightlessness. Mine was more a lower back pain or discomfort. Some have stomach nausea, some vomiting, sometimes headaches, but everybody seems to have a unique set of adaptation—they call it space adaptation syndrome, SAS, but everybody tends to have something you can put in that category.

The next time you fly, the second time you fly, you still have those same sensations, so I don't recall having anything different the second flight than I did on the first one; and the third flight, the same thing. But I think I was fully prepared for it, and so if you ask me, did I have those sensations on the second and third flight, I'd have to actually think about it and say, yes, I probably did have something like that.

But it was interesting the way that it appeared as though the brain remembered what it had sensed the time before, even though there may be several years in between, and then how quickly it soothed anxiety that you might have. It was really a fascinating experience.

ROSS-NAZZAL: Let's take a break for just a sec. Let me turn this over.

[Tape change]

ROSS-NAZZAL: You served as a CapCom [Capsule Communicator] for three flights. Can you talk to me about your experiences as a CapCom?

GREGORY: Capsule Communicator was a role I don't think I appreciated until I entered mission control for the first time and realized that there was quite a lot to it. I had imagined that it was just a role that you played during an actual mission, but I think that when I got into mission control and saw the different skills represented at each of the stations in mission control, and then began my interaction with the Flight Director, I realized that as a crewmember, though you thought everything centered around the five or six or seven people on the crew, the real strength of a mission's success was the team supporting it, and mission control was part of that team. It was essential and vital for the training and preparation for each of the missions. It gave you a sense of the interaction between the respective systems, the very complex systems on the Orbiter. It gave you, I think, a very thorough understanding of the individual systems, and then how each of them reacted and worked with and interfaced with the others.

It also gave you a very strong sense of teamwork, because though there were multiple stations in mission control, with different skills, such as communication, guidance and navigation control, propulsion and things of that nature, all of it had to be digested and then a very coherent summary of it had to be passed to the crew so that they would understand what was being seen on the ground in respect to the series of failures, and to be there, to listen to the crew, to observe and respond to what they were seeing on board. So it was really a very fascinating job, where, though things were coming in to the Flight Director, as a CapCom, you would listen to all of it. The Flight Director would turn to the CapCom and tell you to tell the crew this.

In the meantime, you have taken all of this stuff, you've integrated it, and as the Flight Director is talking to you, you are almost simultaneously translating the technical jargon into a series of very concise steps, at the same time not demonstrating or showing any anxiety, always staying very cool, even though there may be four or five very serious failures that the simulator supervisor had intentionally injected. I think that flying and being in mission control was a vital part to the success that I had on the future flights that I had.

ROSS-NAZZAL: How much time did you actually spend training with the crews?

GREGORY: As a CapCom?

ROSS-NAZZAL: Yes.

GREGORY: Well, I think when they began what we called integrated simulation, we spent as much time, maybe more time than the crew, supporting the crew. In that I mean that we would arrive an hour before the simulation would begin, ensure that all the people were there. We'd go through the scripts. In some cases we'd go through the scripts to see what specifically—what this particular mission was, and prepare ourselves such that when the crew got in the simulator, we would be in place and ready to support.

Now, the integrated simulations were probably a third of the total simulation time that the crews spent in preparation. I'm not sure about that number, but that sounds about right. But it was not a single crew, and so there would be several crews in preparation. So the mission control team was there for quite a long time, because they would just move from crew to crew to

crew. Eventually you would know that you were working on a specific crew, and you would devote most of your time in preparation of that particular crew. I remember spending long hours in mission control, but coming out each time just feeling refreshed. It was very exciting. It was very exciting to do it, working with the teams and working with the Flight Directors.

ROSS-NAZZAL: What shifts did you typically work on while you were CapCom?

GREGORY: On the first one I was ascent or entry; I did not do on-orbit. Then I believe that after that, I was the Lead CapCom, so I was responsible for all phases of flight, but still would generally only work the ascent and entry.

ROSS-NAZZAL: Did you help train anyone while you were serving as the Lead CapCom?

GREGORY: Oh yes, sure. Yes. A lot of folks would come through, learning. The group is so smart, you know, that I didn't really need to teach them anything. I would just help them out. If there was a confusing set of issues that were being discussed, I would just make certain that the CapCom in training had captured all of it, and in some very rare cases, after a transmission, I would say, "Had you considered this?" or "You did not say this, and it may have been important to them," so most of it was more of a suggestion as opposed to a demand, a lecture. [Laughs]

But it was fascinating. On the *Challenger* accident, I was sitting in the position as Lead CapCom, and Dick [Richard O.] Covey was the speaker, was the actual communicator, and so that role I spent as gathering all of the weather information that was coming in from the distant sites. We had people in Europe and Africa, and they would report weather back to me. On the

West Coast, at Edwards [Air Force Base, California], we had people there, too. Then if there were any things that came up that were not directly involved in the preparation for the ascent, for the liftoff, then I would do that, also. So I was kind of a gofer, but at the same time, just kind of monitoring the procedures and make certain that we captured everything. It was kind of like the second set of eyes there.

ROSS-NAZZAL: You mentioned *Challenger*, and of course that was the *Challenger* accident—the day you were serving in mission control. Can you give us a sense of what it was like that day in mission control?

GREGORY: Well, up to liftoff, everything was normal. We had normal communication with the crew. We knew it was a little chilly, a little cold down there, but the ice team had gone out and surveyed and had not discovered anything that would have been a hazard to the vehicle.

Liftoff was normal. Again, Dick Covey was the one talking, communicating, and Jay [H.] Greene was the Flight Director. As I was positioned, I was to Covey's right, and the Flight Director was even further to my left. Behind the Flight Director was a monitor, and so I was watching the displays, but also every now and then look over and look at Jay Greene and then glance at the monitor. And I saw what appeared to be the solid rocket booster motor's explosive devices—what I thought—blew the solid rocket boosters away from the tank, and I was really surprised, because I'd never seen it with such resolution before, clarity before. Then I suddenly realized that what I was intellectualizing was something that would occur about a minute later, and I realized that a terrible thing had just happened.

It was interesting, because the data that we received was data that was not actually real-time; there was about a four- or five-second delay. I'm not sure of that number. I mean, it could have been less, but there was a delay in the display versus what was real.

Sitting right behind us was a Public Affairs person, and the Public Affairs person was continuing a dialogue, which caused a lot of confusion in our minds, because I had seen the accident occur on the monitor. I was watching data come in, but I saw the data then freeze, but I still heard the commentary about a normal flight coming from the Public Affairs person, who then, seconds later, stopped talking.

So there was just kind of stunned silence in mission control. I remember Jay Greene saying something like, "Okay, everybody stay in their seats. Let's look at your displays to see if you can determine what may have happened." At this point, no one had realized that we had lost the Orbiter. Many, I'm sure, thought that this thing was still flying and that we had just lost radio signals with it. But it became—I'm talking about something—I think all of these things were kind of running through our minds in the first five to ten seconds, and then everybody realized what was going on.

So we then pulled out our contingency books to begin a kind of an orderly process to freeze the data, to lock the doors to prevent people from coming in or people from going out. Then we did a very systematic review of what we had seen, playing it over and over and over again, looking to see if there was something that we should have seen that we may have—that may have resulted in the avoidance of the accident.

Well, we didn't see anything at all. In fact, there was no real hint, even when we relooked at—ran the launch back, the video. So we were all just totally unknowledgeable about what had occurred. It wasn't until later that we realized what had happened. It was the cold

weather and the effect that it had on the O-ring and the field joints on the solid rocket booster. So that was that day. It was not a good day.

ROSS-NAZZAL: I can imagine. After you left mission control, what did you do? Did you go to the Astronaut Office?

GREGORY: I don't know what I did. I think that we had been in mission control for so long that day—I would bet that we had been there for eleven or twelve hours, because I know after the accident, we were there for another six hours or so reviewing data. I may have gone back over to the Astronaut Office, but I think what I really did was to go home, because there were families at home, or the families were coming home. The families had all been down at the Kennedy Space Center [Florida] for the liftoff, and they were coming back home.

"Dick" [Francis R.] Scobee, who was the commander, lived within a door or two of me. And when I got home, [I] actually preceded the families getting home, I remember that. But they had the television remote facilities already set up outside of the Scobees' house, and it was disturbing to me, and so I went over and, in fact, invited some of those [reporters] over to my house, and I just talked about absolutely nothing to get them away from the house, so that when June Scobee and the kids got back to the house, they wouldn't have to go through this gauntlet.

I think then Barbara and I, my wife and I, just spent the rest of the several days, three, four, five days—I don't recall—protecting the families. I know that Dick Scobee's parents came. There was such a mess over there that Barbara and I took the parents and just moved them into our house, and they must have stayed there for about four or five days. Then June Scobee, in fact, came over and stayed, and during that time is when she developed this concept for the

Challenger Center. She always gives me credit for being the one who encouraged her to pursue it, but that's not true. She was going to do it, and it was the right thing to do.

I don't recall much more than that, though I'm sure I went to work. I just don't know what I did when I went over there. I think I spent most of the time with the Scobees and the Onizukas [family of Ellison S. Onizuka] and the Smiths, Mike [Michael J.] Smith's kids. It was a tough time, because—it was a horrible time, because I had spent a lot of time with Christa [Sharon Christa] McAuliffe and Barbara [R.] Morgan, and the reason was because I had teachers in my family. On my father's side, about four or five generations; on my mother's side, a couple of generations. My mother was elementary school, and my dad was more in the high school.

But Christa and I and Barbara talked about how important it was, what she was doing, and then what she was going to do, and then how—what she was going to do on orbit and how it would be translated down to the kids, but then what she was going to do once she returned, since she was a single person. So it was traumatic for me, because not only had I lost these longtime friends, with Judy [Judith A.] Resnik and Onizuka and Ron [Ronald E.] McNair and Scobee, and then Mike Smith, who was a class behind us, but I had lost this link to education when we lost Christa. And all of the reaction to losing Christa; I was thinking to myself, "We will never, ever be able to do this again."

So I kind of decided that, at that point, I was going to make it happen again, and in fact, we have made significant progress, with Barbara Morgan in the program and then three educator astronauts in the program, and the association of ourselves with the [NASA] Explorer Schools, and the partnership between NASA and education. So I'm sure that eventually we would have done something like that in NASA, but it's almost—from my point of view—almost a legacy created by the unfortunate death of Christa.

ROSS-NAZZAL: You've given me a sense of really how the accident impacted you, but how do you think that the accident impacted the Astronaut Office as a whole?

GREGORY: I think that my reaction was probably the same, of disbelief, and then running through all of the phases. But I think that what you had was a group of folks who realized at that moment that space flight was dangerous. We had started the program. The first four missions, we called test flights, and then on the fifth mission, we declared ourselves operational. We were thinking of flying journalists, and we had "Pete" [Edward C.] Aldridge [Jr.], who was the Secretary of the Air Force. I mean, we were thinking of ourselves as almost like an airline at that point.

As we look back, though you didn't realize it at the time, it came back safely. Everything was okay, even though there may have been multiple failures or things that had degraded. When we looked back, we saw that, in fact, we had had this erosion of those primary and secondary O-rings, but since it was a successful mission and we came back, it was dismissed almost summarily.

I think there was a realization that we were vulnerable, and that this was not an airliner, flying to space was risky, and that we were going to have to change the approach that we had taken in the past. So there were some pretty dramatic changes, certainly not to the same extent as after the *Columbia* accident, but there were some significant changes that occurred.

ROSS-NAZZAL: Did you ever think that you might retire from the astronaut corps as a result?

GREGORY: Oh no, no, no, no. No, in the business that I was in and had been, tragedy was part of just the environment that I lived in, and that it was not a reason to reevaluate and do something else. [Laughs] No, I was going to stick that out, because I wanted to fly again. I had flown the same Orbiter and flown *Challenger* on its seventh mission in the late spring the year before, and so the *Challenger* flew twice more before the accident in January. It was a good bird. It was really a good bird, and obviously that was not the cause of the accident.

No, I think all of us sat there and said, "It's horrible, but this is something that we have to do," and the majority of us stayed there.

ROSS-NAZZAL: Did you have any role in the investigation?

GREGORY: Not in the investigation, though I was sent up to Washington [D.C., NASA Headquarters] in '86, and I spent fourteen months in Washington, developing an operational safety program. A lot of it was put in place, and it was the way that we worked between the return to flight and up to *Columbia*.

ROSS-NAZZAL: Can you tell us about that operational safety program that you put in place?

GREGORY: There were lots and lots of pieces and parts to it. One of the things was an improvement in communication. So what I developed with—and also an astronaut, Hank [Henry W.] Hartsfield [Jr.], was something called the NASA Safety Reporting System, the NSRS. It was mimicked, it was copied from the Aviation Safety Reporting System that the FAA [Federal Aviation Administration] uses, but it was an attempt to create an anonymous, voluntary,

confidential reporting system if the person felt uncomfortable talking to a supervisor. Since it was anonymous, if the person did not want anyone to know that he or she had given the report, we'd protect that privilege that the folks had.

So I worked primarily to improve communication. I worked on the contingency plan that pre-identified the accident investigation board, who the board would be; not the individual person, but the position that would have been identified as a position where you could get an expert, pulling them out and being a member of the accident investigation board. In fact, we did that for *Columbia*, and it worked extremely well.

We began looking at how safety was conducted with the Air Force and Navy, and so we began to incorporate some of the procedures, many of the procedures, that the military used. We began looking at risk management, risk assessment, how you quantify risk, how you do your trades, your risk trades. We began looking at process; if you evaluate a process, can you make a determination whether it will be successful or not.

A lot of the stuff that I did in that year was concept; trying to get an approval of some of the things that I was suggesting. It was a very busy year, but it would be difficult to sit back and actually quantify all of the many ideas that we had. A lot of it was done in collaboration with folks in the Astronaut Office, and then the experts at Headquarters and the other Centers.

It was a lot of coercing, trying to convince them that this was a good approach to take. You had to get people out of denial about the legacy, and how the legacy may not be what we would want in the future; there was a lot of that. But I think we really created an environment that allowed some changes later, without the hesitation or the possible threat to them. It was an interesting fourteen months that I spent up here, but I was glad to get back to Houston [Texas] and get on the next—

ROSS-NAZZAL: Get on the next flight.

GREGORY: Get on the next flight. [Laughter]

ROSS-NAZZAL: Let me just ask you one more question about this position up here at Headquarters. Following the accident, the Rogers Commission actually recommended that astronauts be moved up into sort of management positions in D.C., and yours was one of those positions.

GREGORY: No, I was temporary when I came up to work for Safety Mission Assurance at that time, but there were people who moved up. Dick [Richard H.] Truly, Bill [William B.] Lenoir, Bob [Robert L. "Crip"] Crippen, I think, were the primary ones who assumed higher roles. Crip is Program Manager for the Shuttle, then Center Director. Dick Truly is responsible for Space Flight, then eventually Administrator. Bill Lenoir at one time ran the Office of Space Flight, also. There were others. They were assigned and moved immediately from the office into these new roles.

What has now evolved is that there is almost a career progression now, as people move out of the Astronaut Office. I think you will find a significant number of former astronauts who are now in management positions within the agency and outside of the agency, but they still keep in touch. I'm working with Jim [James P.] Bagian, who is working with the Veterans Affairs, and he has copied some of the safety program processes and procedures that we had in the agency, that we've incorporated in the agency. But that has evolved, and I think what we have

now is just a career progression, where they picked up talents of people, those in the Astronaut Office, and they are using those talents in a variety of areas now, and so I think it's good now. I think it is really good now.

ROSS-NAZZAL: Do you think it's beneficial from a safety standpoint to have astronauts in these management positions?

GREGORY: I think so. I think in many cases it is. Let me say—I think I will qualify it by saying that sometimes astronauts believe that they are bulletproof. What I found was that astronauts and their families will accept a much higher level of risk than a normal person will, and even when they relax, they are still at a higher level of risk acceptance that the normal person might consider almost excessive. So when an astronaut leaves the astronaut program, in one way or another, it takes a while to jack them down, because they will tend to make a decision based on their level of risk acceptance that they did in the office, and that's not necessarily what we want. We need a kind of a calmer look, a more rational look at some of the decisions that we're making.

But as I look at the astronauts who are at NASA Headquarters and those who are Center Directors, like Roy [D.] Bridges [Jr.], each of them has come down and can look in a balanced way at the risk versus the benefit, and I am very pleased with the decision-making that's going on right now.

ROSS-NAZZAL: Okay. Let's stop and I'll put in the new tape.

[Tape change]

ROSS-NAZZAL: I was looking on your NASA bio sheet, and it indicated that you were the Chief of Astronaut Training.

GREGORY: Yes.

ROSS-NAZZAL: Can you talk a little bit about that and what that entailed?

GREGORY: Yes, I was primarily the coordinator of the training that all astronauts needed before they could fly, and so I had a syllabus that described the courses. I knew the availability of the training facilities or devices, and would so schedule the astronauts into those facilities, with instructors as necessary. I think it was not a difficult role, and as such, I kept a record of the progress and would certify that training had been completed and that it had been satisfactorily completed. Though I did not have a signature that said, "And they are certified to fly," the records that I kept would so demonstrate that.

ROSS-NAZZAL: Did you work specifically with the classes that came through?

GREGORY: Yes, when a new class would come in, we would just start again with "This is a football." [Laughs] And work the welcoming, several months of teaching people the NASA acronyms, and arranging for trips for the new astronauts to see the facilities in NASA. But I was primarily responsible for the academic training and the simulation training.

ROSS-NAZZAL: So did you work in conjunction with those various offices? When a new class would come through, say, they needed training on the SMS [Shuttle Mission Simulator], or they needed to work SAIL [Shuttle Avionics Integration Laboratory]?

GREGORY: I didn't do the technical. I didn't do the technical training, which the SAIL would have been. I did the straight simulation and academic training, so these were classes that were taught. These were simulations that were single-system. They started with single-system trainers, and then they went to multisystem trainers, and then they would graduate eventually into running in the Shuttle Mission Simulator in the fixed base over there.

But I knew that they had to get from this point to this point, and they had these classes and courses and things they had to do, and all I did was schedule them and assure that they got there and that the training for that particular activity was successfully completed.

ROSS-NAZZAL: Your bio sheet also indicates that served as a member of the Orbiter Configuration Board.

GREGORY: Yes, the PRCB [Program Requirements Control Board]. That was a decision-making board run by the Program Manager, and on the board there were representatives from the multiple disciplines, and I was the astronaut representative. So any issue that came up that needed a decision would pass through this board, and so I was just the voting member from the Astronaut Office. I guess I did that for a year or maybe longer than that. It was an exciting view, from the program management point of view, of the entire system, so I saw all aspects of

the mission preparation and those things that needed to be prepared for, for a down-the-line mission. It was a pretty exciting time. I really enjoyed that.

ROSS-NAZZAL: Do you remember when you served on that board?

GREGORY: No. [Laughter] Let me see. I think it—

ROSS-NAZZAL: I'm not very good with dates, either.

GREGORY: I think it preceded *Challenger*, but I'm not certain; could have been after that.

ROSS-NAZZAL: There was another board you served on, which was the Shuttle Program Board.

GREGORY: Could be; I can't recall.

ROSS-NAZZAL: Well, if you'd like, we can start talking about your next mission and then pick it up next time.

GREGORY: Sure.

ROSS-NAZZAL: Okay. Do you remember where you were when you found out that you were going to be commanding your first mission?

GREGORY: I had been at Kennedy, and I'd come in late in the evening. When I arrived back at Aircraft Ops [Operations], in my little bin that I put my helmet in, there was a little message that said, "Call Don [Donald R.] Puddy," who was the Chief of Flight Crew Operations at that time. And I did, and he so informed me that I was going to be—first of all, he said, "You're going to be on the mission," and then he said, "And you're going to command it," so I was excited. So, I mean, it was very late at night, and I can remember talking to Puddy and having him tell me that.

I went home, and I don't believe that I told my wife immediately. You know, I wanted to really milk it a little bit, and I did. [Laughs] And I told her, and then the next day went in and assembled the crew and kind of gave them the vision according to Fred.

We created an amazing—it was an amazing crew. I had a pilot, Dave [S. David] Griggs, Navy pilot, who unfortunately was killed in an airplane accident, so I had the rare chance to actually pick a pilot, and I chose John [E.] Blaha as my pilot. So I had "Sonny" [Manley L.] Carter [Jr.] and Kathy [Kathryn C.] Thornton and—Sonny and Kathy and Blaha, and I'll think of the—

ROSS-NAZZAL: [F.] Story Musgrave.

GREGORY: Story. [Laughs] How could I forget Story? We had a crew that—I think it's the best crew that ever went through there. Every time it assembled, people would just come watch it, because it was like a ballet, and we had so much fun. We would get in a simulator, and our training crew, I am sure, was attempting to kill us, and we were trying to make absolute fools of them, the crew was. The team just worked so well together. I mean, from my point of view, it

was an ideal mission. It was a classified mission, so very few, if anybody, ever knew what we did, but I can tell you that we were tremendous. [Laughs]

Now, when we came back, obviously we had a lot of debriefings, and most of them were in classified environments. Our flight was very similar to—I mean as far as the sensations were concerned, the ascent, the on-orbit activities, and the reentry were very similar to the first flight that I had. So this was not my first time flying, and this was not Story's first time flying, but it was the first time for the other three, and it was amazing. As I watched them, I could see me on my first flight. You could see the light coming on, the realization that, yes, this is space, and, yes, the body does adapt, and if you let a liquid loose, it floats around. It was fascinating just kind of sitting back and watching the maturing of the space rookies on board.

ROSS-NAZZAL: I just had one more quick question before we sign off today. When you were selected for this mission, you were going to be the first African-American commander for the Space Shuttle Program.

GREGORY: I had not even considered it. Somebody told me that after the fact. [Laughs]

ROSS-NAZZAL: After the flight?

GREGORY: Yes, I mean after the fact. I mean, it wasn't something that was vaguely important to me. It was just not important to me. Somebody later told me, "You know, you were the first pilot," and then, "Oh, by the way, you were the first commander."

And it was like, "Yeah, I guess that's true," and that's as far as it went. I have never, never said it, but people always tell me. [Laughs]

ROSS-NAZZAL: So there wasn't any sort of media interest in this sort of first for the Shuttle?

GREGORY: I don't recall. I can go back and look at a lot of the news articles, but I don't recall it being in there, and if it was, I probably didn't pay any attention to it.

ROSS-NAZZAL: You were just so focused on the mission at hand.

GREGORY: Oh yes, absolutely. Yes. All of us were so focused on achieving the objectives of the mission and returning safely that I don't think we even entered into these little parochial issues that may have been important to some people. It just wasn't important to me.

We had Kathy Thornton with us, and I absolutely insisted that she be the EVA [Extravehicular Activity] person, over great protest, and I just insisted. So I don't know if Kathy even concerned herself with, "I'm a woman and I'm going to do an EVA." It was just not a big deal. On the outside they were concerned about it, but inside, Kathy, K.T., was the appropriate person to do it, so we just did it. Then she subsequently did another EVA. And I don't think—if we had not insisted, probably a person of her size would never have done something like this. Kathy [Kathryn D.] Sullivan had done it, but Kathy was a larger woman and could fit into the suits that we have. But Kathy Thornton was not, so we had to really force the issue.

But it was not an issue that we want Kathy to do this because she's a woman; it was we wanted Kathy to do it because she was the appropriate one to do it. [Laughs]

ROSS-NAZZAL: That makes sense.

GREGORY: Yes. I mean, it seemed to. [Laughs] So we had Kathy and Sonny doing that.

ROSS-NAZZAL: I want to thank you for your time today. I really appreciate your patience, first of all—

GREGORY: Oh, not a problem.

ROSS-NAZZAL: —especially with the equipment, and taking the time to spend with me.

GREGORY: Thank you. Any time.

[End of interview]