NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT

MICHAEL A. REYNOLDS
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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The questions in this transcript were asked during an oral history session with Dr. Michael A. Reynolds. Dr. Reynolds has amended his answers. As a result, this transcript does not exactly match the audio recording.

ROSS-NAZZAL: Today is March 2nd, 2005. This interview with Michael Reynolds is being conducted for the NASA Johnson Space Center Oral History Project in his home in McKinney, Texas. The interviewer is Jennifer Ross-Nazzal, assisted by Rebecca Wright.

Thanks so much for letting us come see you this afternoon. We really appreciate it.

REYNOLDS: I'm glad to be here.

ROSS-NAZZAL: Great. I'd like it if you could begin by telling us about your educational background, training, and work with the military before you came to work for NASA.

REYNOLDS: Well, I'm from a small town in Illinois, and I was the first person in my family to graduate from college. My father had a sixth-grade education, and my mother had an eighth. I graduated from high school, and I was a football player. I was, you know, a really big football player. I was five-foot-six; weighed 145 pounds; but I thought I was tough as nails.

So I had a chance to go to Western Illinois State Teachers College [Macomb, Illinois] to play football, so I went down there with the idea that—my whole background was that I was

going to be a high school football coach. When I got down there, I was so unprepared for what they asked me. They said, "What do you want to major in?"

I said, "Major? I'm going to college." And I didn't realize that there was such a thing as a major. Well, the course that I liked the most when I was in high school was chemistry, so I said, "Well, I'm going to be a chemistry major."

So, to make a long story short, I became a chemistry major. I graduated from there, and when I graduated from Western, it was during the Korean conflict. I got drafted, and I went to Germany. I was stationed in Leipheim, Germany, which was between Stuttgart and Munich, and I was in the Tank Corps there. I had a lot of fun. That was a wonderful thing. I met the toughest people in the world. Tankers are tough. [Laughs]

I spent my two years in Germany. I came back. All during that time I was corresponding with my wife-to-be and on my return I got married. I then went back to Western and got a master's degree in education so that I could eventually—my whole idea was eventually I was going to be a football coach in high school in Illinois. Then I was going to be so darn successful they were going to make me the principal of the high school, because that's the way things happened in Illinois at the time.

I went to Pekin, Illinois, which, by the way, one of the big astronauts in the space program now—I can't remember his name right offhand—is a Pekin boy, which I didn't know. I taught chemistry there. I was very fortunate when I was teaching chemistry. I had nothing but the best students at Pekin, and there were 2,800 kids, so I had a lot of young men and women who were very good students, and I worked the heck out of them.

I really liked teaching so I decided what I really wanted to do was get a Ph.D. in chemistry so that I could go to a school like Western Illinois and teach the kids who were coming

out to be teachers in science some of the things that I had learned, because I felt like when I started teaching, there were a lot of things that they didn't teach me in college, about high school kids. I wanted all these kids to realize that, if they were going to be teachers, the one thing that you learned was that a good 10, 15 percent of the kids were smarter than you. You had maturity on them, and you had background, but they were brilliant kids.

I had one boy that missed one question all year; one question all year, and by the way, he was a football player, an all-state football player, and now he's a doctor. But he was just brilliant, and I had all these other kids, brilliant. All I was doing was staying ahead of them, you know, because they were really good, really good. [Laughs]

So I wanted to go back and get an advanced degree, and so I started applying for schools, and I thought about going to the University of Illinois [Urbana-Champaign, Illinois], and the University of Illinois told me that they would require some courses additional to getting my doctor's degree. I was getting old, and had a family, I was afraid my daughter would be in the same classes with me if I didn't get at it real quick like.

So I looked around and I got involved with the University of Arkansas [Fayetteville, Arkansas], and that was a wonderful thing for me. At the University of Arkansas, I had a professor by the name of Paul [K.] Kuroda. Dr. Kuroda was one of the first three scientists from Japan that the Americans brought back to America after WWII, and he was one nice guy.

So I stayed at Arkansas for three and a half years. I shared an office in chemistry with another student who had applied for a job at NASA because NASA was going to go to the Moon and they were going to bring back Moon rocks. At the University of Arkansas, I was doing research on meteorites looking at rare gas analysis. This research was similar to research

analysis that was planned for study on the lunar samples which were expected to be something like meteorites.

I decided I'd write NASA. I was still working on my degree, and by golly, NASA called me up and hired me, and I came to NASA prior to Apollo 11, without my Ph.D. While I was working in the Apollo program, I was writing my Ph.D. dissertation. To make a long story short, I completed my Ph.D. requirements while working at NASA.

On Apollo 11, I worked in the Lunar Receiving Laboratory, and I can tell you that every professor or every person that I had studied or every scientist that had a name in the United States was in the Lunar Receiving Laboratory. It was just unbelievable because that's where the action was, and that's where everybody was going. That was a lot of fun. That was really a lot of fun, and those days were sixteen to eighteen-hours.

We in the sciences got to look forward to the next mission, because by the next mission, we had to get lunar samples out of the glove boxes so they could clean them up for the next mission. The scientists were from all over the United States—this was the first time they had a chance to do research on lunar samples, and they were excited. They wanted to stay twenty-four hours a day, seven days a week. [Laughs] And it was just wearing us out.

I'd go to work every morning at seven o'clock, and if I was lucky, I'd get home at seven o'clock at night. Sometimes it would be ten, eleven o'clock at night, because I had to support the scientific community. That was really interesting.

ROSS-NAZZAL: Can you give us some examples of what you mean by supporting the scientific community?

REYNOLDS: Well, the scientific community would come in, and they would have permission to do something with the rock. We had a preliminary examination team. We'd take a rock, and we did certain things on a rock. We did radioactive counting on the rocks. We wanted to know the level of radioactivity. We did chemical analysis on the rocks. We looked at thin sections of the rock so we could start talking about the—you know what a thin section is? They take a rock and they cut it down until it's porous where they can put light through it, and they look at the minerals, etc. So they studied all that, and when they studied all that, they said, "Oh, look at that. We should be able to do this and should be able to do that."

Then they had a series of scientists who would sit there and say, "Ooh, that rock is interesting. So-and-so at the University of California, Berkeley [California], should get a piece of that one, and the University of Wisconsin [Madison, Wisconsin] should get it, and the University of Mississippi [Oxford, Mississippi] ought to get it." So they would say, "Okay, that's what we need to do."

So they would tell us at the Manned Spacecraft Center [later renamed the Johnson Space Center], "This rock has to have—you need to look at the rock; you need to break it up; you need to cut it up or you need to chip it off, and you need to chip it off in this way, and you send this piece to them, and that piece to them, and that piece to them." So we would get these rocks, and we'd process them in the Lunar Receiving Laboratory.

Now, the real problem when we got to the Lunar Receiving Laboratory, the theory was that when they picked up the rocks, some people said, "Oh, they may break out and burn." It was the first time we were bringing anything from another area outside of our atmosphere and back to Earth. The Lunar Receiving Laboratory was designed to protect the Earth atmosphere from the rocks. So we'd bring the rocks into the laboratory. We brought it into what we called

the F-201. The F-201 was a huge vacuum system, and we'd put the rocks in there in a box, and by the way, the box we brought them in was an aluminum container that was sealed, because when we brought them back, it had to have a perfect seal, because we didn't know what the lunar material consisted of.

We brought them back in this sealed container, and we'd put them in this big F-201 vacuum chamber, opened up the sealed container, and processed the lunar samples. Well, can you imagine that every scientist in the world wanted to examine the lunar samples? There's a window in the F-201 about two by two, and only two people can look at it, the guy that was working in there and the guy that was looking over his shoulders. We had a camera, and we'd show the sample on a TV monitor. There was a monitor inside the lab and one outside the lab where scientists could watch the technician working on the lunar samples. So there was always pressure on those technicians.

The technicians were well trained and they did all the early work on the samples. I was just a scientist so I did not do that kind of activity. The scientists would support the technicians by standing over their shoulder and giving directions. They would sometimes work twenty hours a day because it was such an important project and had never been done before. In addition we had another flight scheduled in four months and we had to get the samples processed as quickly as possible in order to support the next mission.

One of the things I like to tell people is that we had a series of rubber gloves that were used to work in the vacuum system, and these rubber gloves were the only thing that we had in the Lunar Receiving Laboratory that was top secret. We got them from the Air Force. They were designed like this [demonstrates], and you put your hands in there. Now, you're going to work in the vacuum, and you put your hands in there. Now, you had to open up your fingers to

do anything, and if you put your hand like this, and put your arm like this and put pressure on it like this and open up your hand, you can feel your muscles. Here, like this. [Demonstrates] And these guys that go in there, and they work for about ten minutes, and they say, "Oh, my arms are tired."

We thought, "Oh, you big candies," you know. We thought they were kidding us, you know.

Then you'd put your hand in there, and you say, "Ooh, my goodness. Yeah, I'll let you guys go ahead and do it."

So we had to keep changing people all the time, and that took time. And we wanted to do it right, so we took our time. The guys who were doing it were technicians. Scientists were looking over their shoulders or looking at the cameras, and they said, "Ooh, we want to look at it this way. We want to look at it that way." So it took us a long time to do that, and by the way, there was an observation area right outside the laboratory where the technicians were working.

You'd be sitting there, and you'd say, "Hey, John, don't feel bad. Guess who's watching you today?"

"Yeah, who's watching me?"

"How about the President of the United States?"

"What do you mean? You're kidding me."

"No, no, no."

"Well, the hell with him. I didn't vote for him." [Laughter] You know, because you had to have a sense of humor. And you'd do that all day long. It was just all day long.

It was a job that you didn't mind going to work, and it didn't matter how long it took you. I mean, you were doing something exciting, and I can honestly say that—there was only two or

three scientists working in the lab; the rest were all technicians contracted through Brown & Root-[Northrop]. They were all good. The scientists were there, and they'd get to, "Oh, we want to see the rocks," so the technicians would back out and the scientists would get in there and they'd want to look at this, and they'd want to do this, and they'd want to take a chip of this, and they'd want to get a chip of that.

Now, maybe I ought to go back a little bit. You must realize that when we brought the rocks back, we had a decree or something—I don't know how to say this. We had to protect the Earth from the rocks. Our job was to maintain the rocks in a facility that they could not get out and contaminate the Earth. So that's what this was all for. Because of that, we took our time in doing everything. We had the F-201 vacuum chamber in a building and—I think it's Building 10. Isn't that Building 10 still down there? That was the only building on-site that was self-contained. It had its own air system. It had its own air-conditioning system. It was a system that if something happened, they could close off and keep it from contaminating the rest of the buildings.

To get access, you had to have a special reason for going in there. It wasn't you say, "Well, I want to go look at the rocks." The answer was, "If you don't have anything that you need to do, you don't go inside the building." So it was a limited access, and all the guys that worked in that building worked for Brown & Root-[Northrop]. Brown & Root-[Northrop] was the one who had the contract to do that. And I'll say this much about Brown & Root-[Northrop]. They sent us their aces, because those guys were good. The nice thing about it was, too, that when you wanted something, the guy would say, "Oh, I know somebody in Brown & Root-[Northrop] that's got that," so we always got what we needed. So it was a fun thing. It was a fun thing.

When I got there, I got there prior to Apollo 11, and as I said, I had worked with meteorites at the University of Arkansas. I was just finishing up my degree. I still had my dissertation to write but my major professor wanted me to come to the space center, because as he said to me, "Mike, it's going to be an honor for you to do that, but it also will be an honor for me, because you are my student."

So I got there, and when I got there, I had a very, very bad cold. They gave me the best physical I've ever had, because they wanted to make sure that if anything happened to us, they'd know before and after because we did not know what to expect with the lunar samples in terms of possible contamination.

Every time we had a break in the system—a piece of glove opened up like that [imitates drum sound], it'd hit the drum. The doors would lock, lock you inside there, and whatever you were doing, if you were doing something in the cabinet and the glove caught, you got out, and you sat down and you waited till the [imitates drum sound] that was clear. So they completely closed that building off.

It had its own air-conditioning system, its own air handling system, own exhaust system. All the exhaust went through burners, and they didn't push the air outside, they pushed the air through an exhaust system, and they used that air to burn it up so that they had nothing to the outside. They had done a lot of unique things in the design of the Lunar Receiving Laboratory. We called it the LRL.

My project was that I became the Contamination Control Officer on the Moon rocks. Basically I tell everybody my job was to protect the rocks from the Earth. We didn't want to put anything on the rocks. We didn't want to put something on the rocks that when we sent a lunar

sample to a principal investigator, no matter where he was, that he'd say, "Oh, my goodness gracious, look at that. We found this."

And I'd have to say, "Ooh, be careful. We might have put it there." This was to insure that the data that was coming from the sample analysis was as good as we could get from the rocks. What it turned out to be was a very, very difficult project, because people had a lot of ideas about what they wanted to do with the lunar samples.

You know, you get—well, I don't know, but when you go to a meeting—you young ladies go to a meeting. There are ten, fifteen people at a meeting, and they discuss how they want to do something; they've got about fifteen different ideas of how to do it. Well, can you imagine fifteen guys or twenty guys, Ph.D.'s from Caltech [California Institute of Technology, Pasadena, California], [University of] Chicago [Chicago, Illinois], MIT [Massachusetts Institute of Technology, Cambridge, Massachusetts], Harvard [University, Cambridge, Massachusetts]. It was unbelievable.

For example, one of the things I like to tell people, the first day I get there, I'm sitting in my office and I don't know what I'm going to be doing. This older guy comes into my office, and he says, "Hi, I'm Harold Uri." He says, "Who are you?"

And I said, "My name is Mike Reynolds."

Another guy I shared an office with was Bill [William A.] Parkan. He was an engineer, and I was a scientist.

And he said, "And what do you do?"

And Parkan told him what he did, and I told him what I did, and he stood there and he said, "You know what? NASA is really smart. They don't want old guys like me. They want young guys like you in this job." He walked out the door.

Parkan looked at me, and he said, "Who's that, Mike?"

I told him his name. I said, "He is a Nobel Prize winner!"

God, he was the smartest guy I'd ever been around, and here he's telling us, oh, NASA's smart for hiring us. [Laughs] He was an expert on the age of the elements. He was brilliant. Harold Uri. God, he was a nice guy. Nice guy.

Okay, so now where am I?

ROSS-NAZZAL: You were talking about your first day.

REYNOLDS: Okay.

ROSS-NAZZAL: When did you find out what you would be doing?

REYNOLDS: What happened is that my dissertation was looking at the rare gases of a meteorite, and NASA was going to do that on the lunar samples. They hired me, and I came in to do that, but they also had another guy doing it and what they really wanted me to do was go work with the organic principal investigators.

NASA had a brand-new, high-resolution organic mass spectrometer. It was a Japanese-made Hitachi. There were three of them in the world. One was at MIT; one was at the University of California, Berkeley; and the other one was here at the Manned Spacecraft Center.

The guy at MIT and the guy at the University of California, Berkeley, they were going to run the one at the Manned Spacecraft Center. The guy from MIT, he was a world-renowned mass spectrometist. The guy at the University of California, Berkeley, was his former student

and had trained under him. They came to Manned Spacecraft Center. They had a hell of a time getting along together. They were just different personalities.

I had to try to get that machine going as well as get ready for the next mission. They'd come and tell me what they wanted done, and they would leave, but they always left some of their Ph.D. students with me to do the work. The first time they did that, this guy said, "Well, we really need to do it this way."

And this guy said, "Well, I really need to do it this way."

And I'm saying to myself, "Somebody tell me which way you want it done." I mean, it was a tough time. The principal investigators would leave some of their students, the first time I can still visualize that. I said, "Okay, let's have a meeting," and they got in there and went in the meeting. And I said, "Now—."

And they said, "Mike, relax. We'll work it all out together." [Laughs]

And I sat there, and they said, "Well, why don't you do this, and why don't you do that." They got it all worked out, and they said, "We got it worked out. We'll write it up and give it to you, Mike, and then you can present it to our bosses."

I presented it to the bosses. "Oh, yeah, that's great. Great, great." Thank God they were graduate students. So it was an interesting time.

The first part of my job at the Manned Spacecraft Center was the Organic Contamination Control Officer of the Moon rocks. I controlled looking at the organic portion of it, because the organic was—what we were trying to do was age everything. As we got in a little farther, the other scientists realized that they needed the same kind of care for the samples, and so I became the Contamination Control Officer of the Moon rocks.

I controlled the materials that came in contact with the samples. I didn't control what was happening to them or everything else, but if a professor came in and said, "I want to look at these rocks," and he had permission from the Lunar Sample Application Planning Team—we called it LSAPT. They would give permission for people to come in and look at the rocks. My job was to make sure that they got what they needed in the rock, and then my job was also to tell them, "How are you going to do the work on the rock, and what materials are you going to use?"

And they'd say, "Well, I'm going to do this."

And then I'd say, "I'm sorry, but you can't do that, because it may affect the integrity of the lunar sample and therefore, is prohibited."

"But Mike—."

And I'd say, "Don't—." I was smart enough to say, "Hey, your guys are telling me what to do. I'm the policeman. I'm telling you, you just can't do that. All you need to do is go get this guy's signature, and you can do anything you want. But until you get his signature, you're going to do it this way."

So the way I like to say it, I controlled whatever the Moon rocks were exposed to. When you went in there, I could control it. For example, my first real enlightenment was, they said, "We want to use some stainless steel right here, Mike."

I said, "Okay."

They said, "But we want it nonmagnetic." They wanted everything nonmagnetic.

I said, "Okay. Okay." Then I said, "You want stainless steel, and you want it nonmagnetic."

They said, "Yeah."

And I said, "Well, I'm sorry, but the only thing I have ever known is magnetic."

And the guy said, "Oh. Well, let me tell you." So he tells me this story about this nonmagnetic stainless steel. I'm serious. I think he's pulling my leg. He gives me a name at Dupont [Corporation].

I call this guy up at Dupont, and I said, "Now, I'm going to tell you something. I got your name, bah, bah, bah, bah, bah. I understand you make a nonmagnetic stainless steel."

He says, "Yeah, that's right."

I said, "Come on, now. Are you kidding me?"

He said, "Do you want me to send you some?"

"Yeah." He sent me a piece of the nonmagnetic stainless steel. I got a piece like this. [Demonstrates] I walked around showing the engineers, and I had more fun.

"Hi. Well, here's that nonmagnetic stainless steel."

"Here, try it."

"Holy cow, it is." It was the process used in making the stainless steel, and it was nonmagnetic.

I'll tell you, what happened is that the Lunar Receiving Laboratory was completed when I got there. The LRL had real good engineers working on the design, and here comes this young kid from the University of Arkansas. I'm going in there and asking them what they're doing, and then I'm asking them not to do it that way and to do it another way, and they did not take that very kindly at first.

That, what I just told you, gave me some credibility with those design engineers. They said, "Hey, this guy knows what he's talking about." And I was lucky. So after that when I'd go in and I'd say, "Hey, I want you to do this, and I want you to do it this way, because of this."

They'd say, "Okay."

So it became that the entire operation of the Lunar Receiving Laboratory came under the control of the scientists. I'm not going to say here that, "Oh, Mike Reynolds was the person responsible for that because I got a lot of input from the outside scientific community." I used to sit there, and they'd say, "Mike, I need to do it this way."

I would say, "You need to do it this way." And I'd say, "Okay. I'll make sure it is done that way." I had guys from the University of Chicago, MIT, Caltech, University of Wisconsin, all giving me input, you know, professors who had gone through all this. All I was doing is grabbing all the information and trying to satisfy this principal investigator and trying to satisfy this principal investigator, and after a little while, you learn how to get things done and keep them all happy. At least I thought I had them happy, and they didn't complain to anybody, so I guess they were satisfied.

So that was the kind of things that we worked on early in the program. Once we got past that particular phase, the principal investigators/scientists were in control. Now, understand that up until Apollo 11 and during Apollo 11, the engineers were in control of everything, because they built everything; they did everything; and there were no scientists around to talk to them.

Well, once the scientists came in, the first thing they did was complain. And in the case of one of the projects I worked on, and I'll save that for a little later, and I'll show you. I'll tell you a real—this is an honest-to-goodness story. But maybe I'll tell it to you right now.

We had the world's most renowned scientists working on aging of the lunar samples. He was one of those guys who was a real gentleman, and he came in and he said, "Mike, I want to do some sampling, and here's my problems." He sat down, and taught me a few things about contamination control because of the rocks and the way he wanted things cleaned for his research.

At the Manned Spacecraft Center we had to clean all the materials. Everything that the samples came in contact with, the plates, the screwdrivers, everything was cleaned. We controlled the type of materials the tools were made out of so that if you found something in the samples, it could be identified and determined where it came from. So we controlled everything. We wanted it clean, and we wanted it cleaned to have less than one-tenth of one nanogram per square centimeter of total organic hydrocarbons from C_8 to C_{30}. Now, what I'm really saying is that everything you see is organic, and we wanted to control it, and it had to have less than one nanogram per square centimeter. We had to try to develop that process.

Well, the Manned Spacecraft Center had a facility at White Sands, New Mexico [White Sands Test Facility, Las Cruces, New Mexico], that had a cleaning facility that we thought could handle the cleaning processes. They had been doing the cleaning there for us and sending it back. I got some of those cleaned hardware pieces, and I sent some of those pieces to one of our principal investigators, who was one of the world's renowned guys in age dating. He called me up at four o'clock in the morning—

ROSS-NAZZAL: Oh, my goodness.

REYNOLDS: —to tell me it was all screwed up. One of the things you learn about scientists, they really have strange hours. [Laughs] But anyway, so to make a long story short, he and I went to White Sands, New Mexico, and we went through their whole cleaning process, and he gave them a lesson in contamination control that—I mean, he was really great. So we initiated even tighter controls on the lunar tools that were being cleaned so as not to contaminate the lunar samples. We were particularly concerned about lead because he wanted to do age dating.

I don't know whether this is the time to tell you a story or not, but we had a lot of problems with lead contamination. Because of the lead contamination, we had to be more careful about the cleaning processes. We had problems with the engineers wondering why we had to do the required cleaning at that higher level.

The principal investigator asked, "Would you run something for me? Let's run something." I ran a blank so that he could get results from it, and I sent it to him special delivery.

We had a special delivery system in which I'd take a package, and I'd process it, and the girls at the Manned Spacecraft Center would say, "Oh, okay, Mike. I'll get it out by ten o'clock this morning." I mean, you know, it was just, it was wonderful.

I sent it to the principal investigator, and he called me up one morning—again about five o'clock in the morning—and he told me the sample was just absolutely terrible, that it was just full of lead. It was full of lead, and so—you must understand, now, that everything at the Manned Spacecraft Center was under the oversight of the engineers, and I'm the outsider coming in to talk to the engineers, and the engineers are looking at me and saying, "Yeah, yeah, yeah." You know, they're giving me lip service.

He calls me up in the morning. He said to me, "Mike, it's just filthy. There's so much lead in there, you might have destroyed my laboratory." So he starts telling me what he wants me to do.

He said, "Can you do this?"

"Yes. I can do this."

He says, "All right. You're going to get it done."

I said, "All I've told you is I could do it. I don't have the permission to do it. I mean, I'm just a little man in the big picture. I can go ask."

He said, "What do you mean, you're going to ask?" He says, "What's wrong?"

So I said, "Hey, listen. My name is Mike Reynolds. I'm the Contamination Control Officer. I don't work for any of those engineers, and so if I don't work for them, they don't have to do anything. I have to go in and plead with them, please do this."

So he says, "I'll call up the head of MSC." He says, "How about that?"

I said, "That's okay."

He says, "What do you mean?"

I said "These guys work for him. What do you think he is going to do? He's going to stick with them. He's not going to stick with me."

He says, "Well, I'll take care of that, then. I'll call up the Vice President of the United States.

This is three o'clock in the morning. And I said, "You're going to call up who?" I says, "How in the hell are you even going to get his number?"

"Mike, he was my roommate in college."

I said, "What?"

He said, "Yeah." He says, "And I owe him, anyway." He says, "Every time he gets a question on science, and it's four o'clock in the morning, he calls me up. I'm going to call him up right now."

I go back to bed, and I tell my wife, "Oh, my god." So I tell my wife this story. [Laughs].

So I get there in the morning, and my boss is in charge of all the rocks. He's having a group meeting of all his troops, and I walk in his office, and I said, "I need to talk to you."

He says, "When, I'm done with this meeting."

"I need to talk to you now."

He says, "Is it that important?"

I said, "Yes."

He said, "Well, let's go ahead and discuss it now."

I said, "No, I need these guys out of the room. I need to talk to you in private."

So I told him what was happening, that the principal investigator was going to go to the Vice President of the United States. And my boss said, "Oh, no. He isn't going to do that."

I said, "You know him better than I. I'm just telling you, this is what he told me." We were discussing it. Knock on the door. The secretary came in and said, "The head of NASA MSC just called, and he wanted to know if you were in, and I said yes. He told me he didn't care what you were doing, to get over to his office immediately."

My boss said to me, "Well, tell me the rest of the story as we walk over. You're coming with me." [Laughs]

We walked over, and we went to the top floor of the building, and we walked in there, and here were these guys sitting there. Now, you have to understand that I've been in this game now for a long period of time, and so I've gotten clever, too. They sat there like this [demonstrates], and they said, "What in the world is going on?"

My boss said, "Well, I brought Mike Reynolds over here to tell you."

I told them what the principal investigator had told me about calling the Vice President of the United States.

Now, these engineers are sitting there, and the head of NASA MSC said, "He called up the Vice President?"

I said, "Yeah." I said, "They're buddies." Everything went quiet.

He says, "Thank you." [Laughs]

Also present at that meeting was the head of Space and Life Sciences and he said, "Whew! Mike, they're going to be kind of careful for a while now." And the problems were solved. The problems were solved, because we went back into our office, and about two hours later the head of NASA MSC called us back into his office.

He said, "I know you've got a problem here." This is where I learned how big management works. "We wanted this problem worked." The head of NASA MSC told my two bosses he was putting me in charge of this project.

"Oh," they said, "wonderful." And I walked out, and they were, "Wonderful," and they said, "Hey, Mike, you're in charge of the project."

I said, "If it screws up now, fellows, we have no griping to do. If I screw it up, you guys can just shut up."

They looked at me, and they said, "Yeah, you know, you're right."

And I said, "That's standard operating procedure when you get into a position where you don't know what to do and you keep getting complaints."

He said, 'Well, hell, do it.'"

I said, "He just pushed it off on me." But I was lucky.

The one thing I learned when I was at the Manned Spacecraft Center is that when I started out we had to clean all kinds of equipment, cups, saws, knives, plastic bags, and all those

kind of items that were flown. We had to clean them, and the one thing I learned was that when I walked into a group, the first thing I said to them is, "I need this cleaned."

And they'd say, "Well, how do you want it, Doctor?"

And I said, "If I knew how I wanted it, I would tell you. Now you tell me what you can do, and I'll tell you what I don't like."

My father was a plater, and my dad used to always complain about his bosses coming down and telling him what the hell to do when they had never done it and he'd been doing it for forty years, and I remembered my dad, and one of the first times I did that, I said, "Dad, I bet you're proud of me." [Laughs]

Those guys would come in there, and they'd say, "Well, we could do it this way."

And I'd say, "Well, I don't like that, but what about that?"

"Oh, that would do it. That would do it." So I got my input, but I also got all their experience. Some of the guys had thirty, forty years in their fields of expertise. Everybody was on the same team. They all took pride in their work. It was a fun thing.

During the early phases of Apollo—just another project that I worked on— they wanted to measure the temperature of the lunar surface. So what they did is they decided that they were going to drill a hole and put a thermometer down and measure. So that's what they did. They drilled a hole and measured temperature. But what they used were about twelve-inch tubes made out of titanium, and they drilled into the surface of the Moon. They'd get back the temperature readings. The temperature on the surface was one reading, and the temperature below the surface was another, and that was important data that the geologists wanted to have.

Well, some of the scientists said, "Look at that. They're drilling down there. Why don't we drill and bring back core samples?"

And so it went, you know, and the next thing, "Mike, look into the drill stems." So I go in and I try to find the guys on-site who know about the drill stems, and I can't think of the guy's name. Without him, we'd never done anything. We found out about the drill stems and we collected the core samples on Apollo 16 and 17.

One of the things we had to do when they drilled the cores was to keep the core samples in order as they were drilled. They put them in a bag, and they'd say, "That's one, and that's two, et cetera." So we could tell. They were twenty inches long. When we got them back, of course, the principal investigator at Caltech wanted a sample, and he was on my back all the time. He had gotten permission to get a sample.

I got the core sample, and I said to the guys, "Clean the cabinet out. The principal investigator was calling me every other day so we prepared the sample, and I sent it special delivery. I called him up, and I said, "It's there, baby. It's coming."

Two days later, about three o'clock in the morning, he called me and informed me that the core sample had lead contamination in it.

Boy, that's just what I needed to hear. He was very upset, and to make a long story short, it came to the point where we worked it through the system. The drill stem had a coating on it. We could not use oil because that has organics in it so we had used another type of coating to put on it. The coating we used was Xylan 1010 but the way the coating was applied turned out to be the problem.

I called up the president of the company that did the coatings and I said, "This is Mike Reynolds at the Manned Spacecraft Center."

He says, "Yes, Mike." I tell him what my problem is.

I said, "We've got lead contamination on the drill stems."

He says, “Yes, I put it there.”

I said, “You what?”

He said, “The procedure they used to put the coatings on the drill stems included the use of lead electrodes. You didn’t tell us that lead was a contaminant.”

I said, “I didn’t tell you anything.”

He said, “I know that, but nobody told me lead was a contaminant. If you had told me, I would have done it a different way. But nobody told me.”

Then we get to Apollo 17. So you can imagine who’s in charge of those tubes, don’t you? On 17 it’s me. That’s the way the system works, and if you’ve been in the system, you realize the guy who complains the most always gets the work to do, because then they can shut him up. If it screws up, it’s his fault. I have a meeting with the contractor for the coatings and I want you to know they went overboard on resolving the problem. I could not thank them enough for their cooperation.

I can still hear the president of the company that was responsible for the application of the coatings saying to me, “Mike, this is the greatest thing that’s happened to us in our lifetime, and damn it, I am going to be part of it, and I am going to be a contributor to it.” I mean, he was really proud.

I told him, I said, “My concern is the kind of materials you’re using. I need to know the cleanliness of your materials.” You can buy an acid, and it has a certain purity level. You can buy another acid and it is even better. We need to use the best acid with the least amount of contaminants.

Now, he’s in a factory, and, you know, in a factory, if you’ve ever been in a factory, a glove factory or anything factory, they’ve got all kinds of things working. I go in and I see his

operation and I say to him, "I'm concerned about all the rest of the stuff around the work area." I want you to know that he went out and bought a new tub. He bought himself a tent. He put air-conditioners in the tent, so he controlled the air. So he had one of his processing tubs inside a tent with air-conditioning going in it, with HEPA [High Efficiency Particulate Air] filters, to protect it to do the coating job.

I brought the flight hardware to his factory and he processed the drill stems. When it came out, it was like this. [Demonstrates] They were looking at it. They kept looking at it and I thought, "Oh, god. I just screwed up their system." Actually, they were just admiring the job they did. The president told me that was the best coating job they had ever done. Everything came out extremely well.

This was an example of the kinds of problems that we encountered during the Apollo Program. In the thirty years I worked at JSC, I can honestly say that the outside scientific community and the contractors were so happy to be working with us. They wanted to be a contributor, and they'd bend over backwards to help you, because they wanted to be—I mean, I feel very fortunate to be part of a program that took us to a new level. I mean, really, it just was unbelievable.

ROSS-NAZZAL: Dr. Reynolds, what sort of materials could come in contact with the samples? You've mentioned some items that necessarily couldn't come in contact with them, but what could?

REYNOLDS: Stainless steel. Stainless steel. Stainless steel. All nonmagnetic! [Laughs]

ROSS-NAZZAL: That's it, huh? A short list.

REYNOLDS: I mean, that's what we would say to them, "Stainless steel." And it was a nonmagnetic stainless steel. When they told me that—I think I told you the story. It was just that it had to be nonmagnetic, and so we used it all the time.

Then we developed a cleaning procedure that would take everything off that sample, and we'd get down to less than one nanogram that was defined as from C_6 to C_{12}. Those were the volatile ones. If we didn't see the volatile ones, we didn't worry about the heavy ones, because we could control them because we could see them. It was the ones you couldn't see all the time. We had fun, by the way, doing it.

That was one of the projects that I was real proud of. I felt like I really contributed. That and being the Contamination Control Officer of the lunar samples and protecting the lunar samples. That's what I used to say. "We're protecting the samples from the Earth."

The reason we did that is because if you take a sample and you give it to somebody who's looking for elements and he finds one, he starts making suppositions. He's got to be careful that we don't put certain components on the samples. There were certain elements, like potassium, that they were looking for and so we made sure that we looked very carefully at those and made sure none of those elements were present.

In regard to organics, we looked for lightweight organics because, "Hey, if we find lightweight organics, that must mean there was life on the Moon." That was what everybody was looking for. They wanted to know if there was life on the Moon. We tried to do that, and by the way, it was kind of interesting. None of the samples we ran in the LRL showed any lightweight organics. As the technician used to say, "Ooh, what a good blank that would be."

We used a mass spectrometer in our research and operations on the lunar samples and by blanks, when you run a mass spectrometer, you put something in there as a blank to run to see what kind of background it has. If you get a lot of background, you say, "Ooh, if I get something real, am I going to see it?" They'd put something in there, and there'd be no background. It would be [imitates sound], and they said, "Boy, that would make a hell of a blank." Because there was just nothing there. There was just nothing there.

I'm going to tell you something. I was privileged. I was very, very lucky to work on a program like that, and then— to get the kind of responsibilities that I had.

Then I got out of the lunar program, I went into the Medical Operations Branch on Space Shuttle and worked on the medical facility that was to be on Space Station.

One morning a young doctor, M.D., walked into my office. He said, "We're going to go into space, and I have to build a medical facility. I've asked around, who do I need, and they all said, 'Get Reynolds, because he knows everybody.'" And he said, "Would you come and work for me?" I did just that and I want you to know that was another fun job.

ROSS-NAZZAL: Did you get a chance to work with any of the astronauts when you were working in the LRL?

REYNOLDS: Yes, Harrison H. Schmitt, but Harrison was also a scientist. I worked some with— oh, who was the second man on the Moon's surface?

WRIGHT: Edwin E. "Buzz" Aldrin Jr.

REYNOLDS: Harrison Schmitt. You know who Harrison Schmitt was? Well, whether you realize this or not, he was the first non-pilot to fly in space, and he can thank the scientific community. He's a geologist. That's what he was, he was a geologist, and the scientific community started talking to NASA, saying, "What the hell is this, you're sending no geologists and yet you are collecting Moon rocks. We need a geologist up there rather than a pilot."

So the scientific community pushed him into being on that committee. But let me tell you something, he was good as well as being a very nice guy. And by the way, all the astronauts are nice guys. I don't know how they get them in charm school or nothing, but they were all okay.

The Apollo Program was a wonderful program. I was very blessed to become part of it, and I got really lucky in that I became the Contamination Control Officer of the lunar samples. It was a fun time. It was so much fun. I know it's hard for you to realize this, but you know where the Lunar Receiving Laboratory is at the Johnson Space Center? It's down back in that corner, Building 37, I think it is, or 31; I can't remember. My office was in one building, and the LRL sits next to it. During Apollo 11, you'd get out of the LRL at maybe three o'clock in the morning. We had ropes around it. Guess what, people standing there, wanting to see an astronaut. I'm serious. You'd walk out and you see these people, and the first thing you say is, "Nope, I'm not an astronaut." [Laughs]

"Well, what do you do?" And sometimes we would say to the astronauts inside to just go over to the window and wave to those "fans" standing outside so that maybe they would leave. It was really interesting. The Lunar Receiving Laboratory was interesting.

You know, I tell people that—"Do you know, in the Lunar Receiving Laboratory there's a Low Level Radiation Counting Laboratory? It's in the Lunar Receiving Laboratory, and it's thirty feet below the surface." Most people don't realize that. It's thirty feet below the surface, and it was not behind the biological barrier, and the reason it wasn't behind the biological barrier is that one of the guys who was in charge of building the building was a scientist who knew he wouldn't pass the physical, so he made sure they'd build on the outside, because it was his lab. They took whole samples of rocks and everything and brought them down there and did the radiological analysis of them.

As a matter of fact, when I joined the space center, that's what I thought I was going to do. My Ph.D. was with meteorites, and I radiation-counted meteorites at the University of Arkansas, and did rare gas analysis. I thought I was coming down for that, and then when I got down for that, no they said they wanted me to become the Contamination Control Officer. I said, "What the hell is that?" I didn't know anything. I mean, nobody had ever done this. But those scientists and those engineers taught me very quickly.

I don't know if I could have done that job when I was young. I mean, the pressure was so bad. But when I got here I was—when did the space program start, about '58? Let's see. I was born in '32, so I was in my thirties, so I was not a young kid anymore.

The interesting thing was—I don't want you to think I'm bragging, but my father was a grunt. When I got my degree, my father used to say to me, "Son, remember, you're still a man, and those workers down in the trenches may not have your degree, but if they've been doing it for a little while, they know more than you. You may know the theory, but they know how to get things done."

So I always would—when I would go talk to these guys, and so I was very, very popular with the troops. So if you were a scientist, and you were going up there to do something, and you got permission to do it—I could not give you permission to do it, but I could set up for you to do it—but I knew what you were supposed to do. I'd be sitting in my office, and you'd walk by and say, "Mike, you better get up there. Dr. so-and-so is screwing you up."

"My goodness." And I'd walk up and I'd say, "What in the hell are you doing? You're not authorized to do that. Shut down. Shut him down," I'd say.

And he said, "Well, I—."

"Shut down right now or I'll go get Security."

And it got around, not only the scientists, but the guys who were supposed to be cleaning things. It got around, and they said, "That is the luckiest guy." They didn't realize that their cohorts were telling me things that were happening, and it was because I talked to everybody. I talked to everybody.

I want you to know that that was the fun part. I mean, it was tremendous pressure and everything, but it was fun, and I would really—how do I want to say this? I was blessed.

ROSS-NAZZAL: This might be a good time for us to stop. We need to stop and change the tape.

[Tape change]

ROSS-NAZZAL: Walk us through the process of protecting the samples from the minute splashdown occurred until they were moved to the curatorial facilities.

REYNOLDS: Okay. I can tell you to the best of my knowledge what happened. Basically, the astronauts were trained on the type of lunar samples to collect. They had a suitcase type container about maybe twenty inches wide, about twenty-four inches long, and about this deep [demonstrates], maybe six, eight inches deep, and they were made out of aluminum. We surrounded the top and the bottom of the suitcase with stainless steel mesh. What I'm really talking about is if you look at a Brillo pad, they looked sort of like that, but they were made out of stainless steel.

When they put the rocks in the suitcase, they didn't want them next to the outer surface of the container because of impacts, et cetera, they wanted to have a little cushion so they chose stainless steel. Another reason we made the mesh out of stainless steel was that it could be cleaned to a high level of cleanliness. They put the samples in these containers. We called them, Apollo Lunar Sample Return Containers (ALSRC) and we had numbers on them.

During the development of the containers and the seals, when we went in to test the air inside the container, it was contaminated. The rubber seals were outgassing. You know how you buy something; you buy a new pair of shoes, rubber shoes, and you bring them home. You know how—you smell them? Well, that's outgassing, and those seals were outgassing, and those outgases were organic compounds

So we worked on that problem, and at that time there was a new product coming out by a company. It was called Teflon. So we contacted the company and they sent us some samples of the Teflon. We tested the Teflon for outgassing and selected it to make our gaskets or seals for the lunar sample containers. That was a big thing that the science community put right in early in the system.

So they had these containers like suitcases made out of aluminum. Now, they weren't very big. Have you seen one?

ROSS-NAZZAL: I think I have, in the mockups.

REYNOLDS: The aluminum had been analyzed to make sure that it didn't have any contaminants that we were really looking for. I can't remember exactly, but some guy said the aluminum they got was from some specific company because it was the purest. Then they made these suitcase type containers. The Manned Spacecraft Center had six. Then we tested these containers for leakage and they all passed.

Then they got them on the lunar surface, collected samples in them and brought them back. They all leaked. What happened is that now, say this here is the container, and this is the edge. They had built in a piece of a Teflon sheet, and the astronauts went like this—. [Demonstrates] They took the sheet like this and put it here to protect the seal. Then when they went to close it, they pushed the sheet back up into the container and closed the container. The first thing they did when they brought them in, the ALSRCs, they brought them to the F-201 vacuum system. None of the containers had sealed properly, they all had some very small leakage.

So that was the way the contamination controls of the ALRSC's was handled for Apollo 11, Apollo 12 and Apollo 14. Of, course we did not get anything back for Apollo 13. But after that, the scientific community made a decision that there was no contamination concerns from the lunar surface.

The question was we couldn't bring back something that would destroy the Earth. The scientific community decided they were no longer concerned about that problem. After that we got lots of samples. They brought them back in the suitcase container, and in bags; they had them everyplace. If you ever listen to some of the mission conversations, I think it was David R. Scott or James B. Irwin who said, "Oh, my goodness gracious, I got *the* rock!" The astronauts were trained by geologists to look for certain kinds of rocks.

Who was the first nonmilitary man to go to the Moon?

ROSS-NAZZAL: I thought it was Neil A. Armstrong.

REYNOLDS: That's right. It was Armstrong. The first man on the Moon was Armstrong, and by the way, the story told to me was, "Okay, when you land on the surface of the Moon, what are you going to do?"

Armstrong said, "I'll check this. We'll check this," and they had a check-off list. "I'll check this and make sure it's reading this, and I'll report and so on through the check-off list."

"Okay. Buzz, what are you doing to do?"

"Well, while he's doing all that, I'll just put on my uniform. When he gets done, I'll just go on out."

And a guy told me, "Mike, there's about two hundred engineers sitting there. And Aldrin says, 'Well, when Armstrong gets done, I'll open up and I'll egress.'" He said it went absolutely quiet.

Armstrong looked around, and he said, "Buzz, I'll be the first one out." That was the end of the question. What people don't realize is that these guys were all military, all but Armstrong,

and they understood the chain of command. More than one guy told me that story, so I believe it's true.

Then, of course, Armstrong made that famous speech that I think was just perfect. "That's one small step for man, one giant leap for mankind."

ROSS-NAZZAL: What are your memories of Apollo 15 when they found the "genesis rock"? What was the reaction at the LRL?

REYNOLDS: Well, we were all excited as always, because that's what we were looking for. I mean, as I said, these guys were trained to look for the "genesis rock" and, of course, when they came back, everybody wanted to look at that rock.

Then, of course, we had a cadre, I imagine about eight or ten geologists, that worked for NASA. But these were—how I want to say this? A chemist is a chemist; a geologist is a geologist. But geologists are two types. There's the type that go out and pick up rocks and then there's the kind that spend their time in the laboratories. The guys that were at the Manned Spacecraft Center were rock geologists. These guys went out and picked up rocks. They were hired because that's the kind of stuff they were doing when NASA started.

I can't think of the guy's name, the guy that was in charge of that. You'd pick up a rock and throw it at him. I picked up a rock one day—I won't tell you what it was—I picked it up, and I threw it at him, and I said, "What's that?"

He looked at it, and he said, "That's a meteorite. It looks like this one."

I said, "How the hell do you know that?"

He said, "Because clowns like you keep asking me." [Laughter] And it was, it was a meteorite. It was Keyes meteorite, and by the way, that's what they did a lot of studying on early in the program, was with meteorites. As a matter of fact, they went out—if a meteorite fell, you can bet that the astronauts were going to be there the next day, because they wanted to get them out there to see if they could find the meteorite, because the meteorite looks a little different than a regular rock, because it doesn't have the wear and tear of the air, water, and all that kind of stuff on it. It still has some really distinct features. It's not rounded and things of that sort.

ROSS-NAZZAL: Did you have any specific duties when a mission was up?

REYNOLDS: Yes.

ROSS-NAZZAL: What were those duties?

REYNOLDS: Make sure that damn place was ready when they came back. I mean, NASA was a goal-oriented facility. If your job was to produce six of these and put them in the spacecraft, and that was an item, "Six diet cokes," what would your answer be? You got them on. Yes, okay, good. They went down a checklist, and I'll tell you what, when they called your name off, you better say, "Ready." If you say you didn't, "What's wrong?" And they jumped and they hollered, and then everybody jumped in. "Why are you not this, and why are you not that? Why are you not this?"

Because everybody said yes or they didn't fly, so that was the thing that was really very, very hard. You had to make sure you were sticking there and sticking right tight with them. For

me, I had to produce—in the last three missions, I had to make sure we got the required hand tools that they were looking at, and I had to make sure that the containers were approved. I'd look at the data and say, "Yeah, it's okay," because it's what the science community wanted. We had time frames for the work.

I used to tell people that, and they'd say, "Well, it's not going for a week."

And I'd say, "But they have to package everything." They'd package all the materials. And if your items were not there, you slowed up the system. And boy, that was when they—I mean, it scared you, it really did scare you. On those kinds of things, it would scare you.

I only had a few things I had to do, and so it was easy for me to get them done, and I didn't have to go to all kinds of meetings. I'd just say, "Okay, I'll get it done." I'd go to a meeting, and they'd say, "Okay, the tubes. Reynolds?"

"I'm in good shape. I'll be ready to go."

"What's that mean?"

"You want them tomorrow?"

"You got them done already?"

"Yes, sir."

"Oh, okay. Good, good." Then they'd say, "Okay, bring them over here by this date at this time, and give them to us." And I'd bring them over and they would sign a little sheet of paper saying "Received them." Then you had your system to go. But NASA was very, very well organized on that thing. They had to be, because they had so many little things.

And by the way, they all had pieces like that, and they were all in the shop. Before the mission started, it was all there, so the astronauts knew, "Well, I need this. Open this door, and

there it is." They never looked for anything. They were very, very good. They were really organized. Whew, yes.

ROSS-NAZZAL: Can you tell us about the tools for the last three flights?

REYNOLDS: Well, the tools and the flights, They picked up the rocks like they usually did and we asked them to put some Teflon over the rubber gloves so that it would kind of protect so that we didn't get the rubber contamination from the gloves. By the way, have you ever seen the Apollo gloves?

WRIGHT: No.

REYNOLDS: You haven't ever seen the Apollo gloves? I want you to take your hand, this hand here, that's right. Now, the gloves are designed like this, okay? Designed like this. All right, now open up your hand. Don't move your arm. Open up your hand. Move it up. Open up your hand. Open up your hand. You feel that pressure?

ROSS-NAZZAL: Yes.

REYNOLDS: Now, you put your hand like this. [Demonstrates.] All right. Now open up your hand. You feel the pressure in here?

WRIGHT: Yes.

REYNOLDS: What happened is that the gloves were the only thing that was proprietary. Nobody screwed with the gloves except the guy who was responsible for them. Those gloves were very hard to work with. When I first got in the gloves, I thought they were kidding me. They said, "Try this one."

I thought, "My goodness gracious, I might be able to do this three times and quit." That was a problem. But they had to have the gloves on because they were part of the contamination procedures.

Okay. Go ahead and ask the next question.

ROSS-NAZZAL: I think that's it for the LRL, unless you have some questions, Rebecca.

WRIGHT: No.

ROSS-NAZZAL: You had mentioned earlier that you started working on the medical facility for the Space Station. How did you move from the LRL, something that's very focused on geology, to something focused on human anatomy and those fields?

REYNOLDS: Well, I worked in the Lunar Receiving Laboratory, and I practically lived there. That's where my office was. When the Apollo Program was over, there wasn't much more to do other than routine kinds of stuff all day long, and I can honestly tell you that I used to tell my wife, "If I get there at eight o'clock, I could have all my work done by eight-fifteen." Because things were all so well organized there.

NASA decided that they were going to go into the Shuttle Program. Well, obviously, one of the real problems in going on the Shuttle is medical. There was a young doctor there and he got permission to start looking at the type of medical facility they were going to need on Space Station. He was in charge of the medical facility, and I knew that it was happening, and they had meetings going on.

He said, "You know, fellows, I need somebody to come in here and work with me, because I need to get this all organized, and I need to be able to work the system."

The guy said, "You ought to try Mike."

He came in. I knew who he was. I didn't know much about him. He introduced himself, and I said, "Hell, yes." I was getting to the point that I think I would have left the agency. So I joined the medical project. I can remember exactly what I said to them. "I know nothing about medicine. I don't know what you're even trying to do, so I don't know why you'd want me."

He says, "I want you because they have told me that if you're going to work the Johnson Space Center, you'd better get somebody that knows everybody there, and it's Mike. He knows all the key people, and they all like him, and therefore you'd better get him." And I can teach you everything you need to know about medicine."

So I joined him, and I want you to know that if there was a smarter guy at the Johnson Space Center, I don't know who the hell it was. Boy, he was brilliant, and you know, the thing about it, he was a good listener. We would go to a meeting, and I would say to him, "Now, listen to that person very carefully."

He'd say, "Why?"

I said, "Just listen to him very carefully."

We would go to make a presentation, and I'd say, "Now, you know what they are really concerned about is this."

He'd say, "Why?"

"Remember their question? That's why they asked that question. They are concerned about that."

"Okay." So he'd make a presentation, and then when he'd come up to that question, he'd talk about that concern.

He'd come out of the meeting, and he'd say, "Every time I have to make a presentation, you've got to come and talk to me."

ROSS-NAZZAL: What were some of your key responsibilities when you moved over to this field, from the LRL into this new branch?

REYNOLDS: Well, when I went from the LRL, I got into the medical area, and in the medical area, my job was really looking for medical equipment to go on Space Station. "The doctors needed a defibrillator." Do you know how many defibrillators are out there? Dozens. "Find out which defibrillator we need." So you look for quality and you look for versatility and you look for materials that meet the flight requirements.

Then, you know, "We need a blood chemistry analyzer."

I call up a guy, and I say, "I need a blood chemistry analyzer."

He said, "Oh, Mike, when do you need it?" Well, I need it then, "Oh, good, good. Call this guy at this particular company."

I call the guy up and I said, "I need a blood chemistry analyzer."

"What for? Oh. When do you need it? Oh, good." They have a blood chemistry analyzer now that would take a drop of blood on a patch and put it on the analyzer. It was just unbelievable. And for us in the space program, it was wonderful. We didn't have all that blood to worry about, and the waste and all that. So we worked with them, and they worked with us, and I think that's the one they're using on Space Station now.

A defibrillator, you know? What are you going to use for a defibrillator? Well, you're going to do this with the defibrillator; you're going to do that with the defibrillator. So we'd come out with a company, and they said, "Mike, we'll be glad to build it for you."

I said, "Well, we've got these problems."

"What don't you like, and we'll change it."

They were anxious to provide the defibrillator for the publicity to let the public know that they had a piece of equipment on the Space Station.

ROSS-NAZZAL: Did you do any work on the space adaptation syndrome, space sickness?

REYNOLDS: No, I never did anything. The only thing I did was provide the—if they said, "Hey, Mike, we need this," then we made sure they got that. A lot of that stuff was handled by outside doctors, by the way, at least from my viewpoint, because the medical center at Houston provided a lot of doctors. If they thought there was a problem, they brought in the expertise of those doctors.

ROSS-NAZZAL: Did you get a chance to work with any of the M.D.'s that came in as astronauts?

REYNOLDS: Yes. Dave Wolfe and Bernard A. Harris, Jr. You know who Bernard Harris is?

ROSS-NAZZAL: Yes.

REYNOLDS: He went up on the Shuttle. He's very smart and very nice. He's a real gentleman. I worked with him. I worked with some of the astronauts because of the scientific experiments. If there was an experiment going on the flight and I happened to be in charge of it, I'd have to go in and set them up and say, "This is what we want. Are there any questions?"

They'd look it over and say, "No, we're in good shape. Thanks, Mike."

So that was basically it. But the original astronauts, I never had to work with the original astronauts. I never had anything to do with the training portion. The geologists had to do all the geological training and since I was part of geology, I'd get a lot of stories from them.

ROSS-NAZZAL: What were some of the experiments that you worked on for the Space Shuttle Program?

REYNOLDS: Let's see. Boy, the Shuttle Program. Oh, I can't remember anything we did on the Shuttle Program. Anything that flew from the Space and Life Sciences Directorate that was medical, I had something to do with it, but exactly what it was, I—a lot of them were testing medical pieces of equipment. We would take a piece of equipment up there and try to see if it would work without major overhauling.

Medical equipment, the sensitivity of medical equipment, is when they put it on the market, they have spent lots and lots of money proving that the data that they get is right,

because they've got to be right. When it flies, sometimes you have to make changes because it just won't work in space. When you do that, then you almost wonder whether the data is going to be correct. But I don't have anything specific that I can think of right offhand.

That portion of the testing for the Space Station was about the time I was deciding that I was going to leave the agency. I felt like I had lost my usefulness of getting things done, because we got new medical—you know, new troops, new faces. I was the old dinosaur, but I was the one that could get things done because I knew the system.

A guy would come in and say, "You know, Mike, I need this."

I'd say, "What do you need?"

They'd say, "I need this."

I'd say, "Come on." We'd walk over to the shop. Whether you realize it, Johnson Space Center has got a big machine shop there. I'd walk over there, and I'd say to the supervisor, "Bill, I'm going to go talk to so-and-so."

They'd say, "Okay." That's the boss.

And I'd go down there, and I'd say, "Hey, this is what needs to be done. Can you do it?"

"Oh, yeah. Come on, let's go over here." [Imitates machine sounds.] Got it done, and we'd walk out.

The guy would say, "How do you get those things done?"

And I said, "Twenty years, you know." I'm sure you girls get the same kind of thing. There are certain people you can go to to get things done. That was the system. I was not a scientist that worked in the laboratory. I was a scientist that worked for the system, and there's a difference. So I had a lot of different kinds of JSC people who supported me.

ROSS-NAZZAL: Before you left, you were working on the health maintenance facility for the Space Station Freedom. Can you share a little bit of detail about that?

REYNOLDS: Well, what happened with the health maintenance facility is that the medical group was very cognizant of the fact that when you have people in space, and you're going to keep them for a longer time than the times we'd been flying, what did we need up there to maintain their health? So you start talking about when you get sick, what do you do? You go to the doctor, and what does the doctor do? He diagnoses and treats you.

What if you have breathing problems; what do you need? You need a ventilator that will work in space. "I want to get this ventilator," and it's approved by the American Medical Association, but you still have to go through a hell of a lot of testing. Changes are made to meet our requirements—I used to call it "flabberdize" it and get it ready to go.

By "flabberdizing," I'd say, "Well, this is made out of this kind of plastic, and that plastic is not acceptable. Can you make it out of this plastic?"

"Oh, yeah. It doesn't matter. We make it with this one, and it's cheaper, and it still does the job." So, you know, I mean, that kind of stuff.

So you'd work on those kinds of things. For example, one of the problems we had that we worked on very hard was they wanted to do blood tests. When you get sick, what do they do? They take your blood and they test it. So we wanted to do a blood analysis. I'm afraid I can't remember the name; I might think of it now. But they were developing a blood analysis machine that used a 35-millimeter slide. Kodak was working on a box that you could store six months of blood test slides.

So we tried to work on that and that system with the idea that it only took about one shot of it to get the analysis.

You'd look at defibrillators or you would look at other pieces of equipment and you did not like the metal or other materials,

And the company would say, "Well, we'll build it differently." Because you know what they wanted to say? "When the astronauts are up there and they get in trouble, we're going to be there." [Imitates voice.] I mean, that's what they were looking for.

Then the question is what do we do if a guy has a heart attack? Well, what do you think we're going to do? We're going to try to save him, so we're going to have a defibrillator up there. So we get the simplest defibrillator we can, because we have to be sure it works and somebody knows how to use it.

We have both of those kinds of problems, so you look at those things and then you have to worry about the materials in it. The materials, are they going to outgas and give odors to the system, or are they going to crack because of the humidity in the system, and those are the kinds of things that the engineers had to look at.

But the question turns out to be what medical equipment did we really have to have on Space Station and a lot of that knowledge was built on our experiences. The difference was that now you may have people in space for long periods of time.

ROSS-NAZZAL: Looking back over your career, what do you think has been your most significant accomplishment while working for NASA?

REYNOLDS: Well, let's see. I don't know. I worked in different programs. You know where the Moon rocks are stored on-site, in that building?

ROSS-NAZZAL: Yes.

REYNOLDS: Every piece of equipment, paint, plastic, floors, I had to approve. The air going in there, I approved. The pieces of equipment that held the rocks came through my group. We built that facility so that people years from now, if they had a good idea for research and they needed a lunar sample in pristine condition, they could find one there. That was a project that was very interesting to build. As an example, we wanted a limited amount of radiation in there. We told them that they could not have more than a certain level of radiation in the building slab. The contractor got the sand for the slab from someplace near New Orleans [Louisiana]. We tested it for radiation levels and it was unacceptable. We told the contractor to tear it out so they tore the slab out. After that we got everything we wanted.

In my estimation, that was a really big step in building the facility in accordance with our requirements.

We controlled the materials that went into it, and that was very important. That facility, which is sitting right next to Building 37. By the way, that building is designed to withstand hurricane force winds. If one of those hurricanes comes through the Johnson Space Center we know the building will stand. It has three feet of concrete walls in places. There's no windows in it. It's built to withstand torrential rains. Why? Because we built it to maintain those lunar samples. If everything else is gone, that thing is going to be standing there. That was what we told the engineers we wanted.

They literally had to get the concrete that we needed brought in from Louisiana. They brought truckloads in there because they couldn't get the stones that met our level of radiation.

But that made me very proud, because I know that when I left there, I left the lunar samples in good hands. I can tell you that I went over—I spent many a day working on procedures to protect those rocks. That was a very, very important part of my job.

Building the medical facility was also very important. I've been very, very blessed. and working with really nice guys, too.

ROSS-NAZZAL: Some of the lunar rocks were actually stored out in San Antonio [Texas] in a facility [Brooks Air Force Base].

REYNOLDS: Yes.

ROSS-NAZZAL: Did you play any part in that?

REYNOLDS: Yes. We moved some of the rocks temporarily to San Antonio, but we also moved a representative sample of the rocks to White Sands Test Facility. There was a concern with having all the samples in one facility, which at that time was JSC. I moved them there. What happened was that a small tropical storm came in on the Texas Coast and all at once everybody woke up. They said, "You know what? If a hurricane came in, there is a possibility that it could destroy our whole collection of lunar samples." So the Lunar Sample Application Planning Team said we needed to consider other facilities to store representative samples of the lunar collection. So they said, "Mike, give us an inventory of the entire lunar collection." So we got all that

together, and we gave them a list of our inventory. They then made a list of representative samples from every mission and gave it to the curator's office. While this was all going on, we started looking for an offsite storage facility.

We went to Brooks Air Force Base in San Antonio and found a building that the Air Force was willing to loan us. I sent three of my lab technicians there. The building was about this size. [Demonstrates] I walked in there and I said, "You know what your job is?" They were to water pressure all surfaces and clean the entire building to ready it for painting. We were advised by one of the principal investigators on what kind of paint we could use.

After we got it cleaned up and painted. I said, "I am concerned about this building."

They said, "Why are you concerned about this building?"

"I'm concerned because it's sitting there, and there's nothing behind it. There's nothing to the left, and there's nothing to the right."

They said, "Well, what is your concern?"

"My concern is what if somebody breaks in?"

"We'll put an alarm in there."

I said, "Okay. But if someone breaks in there, how long is it going to take for security to get there?"

Security agreed to put the building under twenty-four-hour surveillance. When this was complete, we moved a representative sample of the rocks there as a precautionary measure so that if something major happened at the Johnson Space Center, the entire lunar collection would not be destroyed. These representative samples were stored in sample containers and included samples from every mission.

Well, we did all of that as a temporary measure. At that time, we still had a representative sample of the rocks at White Sands Test Facility. White Sands is a part of the Johnson Space Center so when I go there, I don't have to get permission to do things like I would at Brooks Air Force Base in San Antonio.

So we go to White Sands and we find a possible storage building there and we say, "Hey, this is the building we want for storing lunar samples."

They said they were going to use that building for something else.

My remark was, "Talk to Christopher C. Kraft, Jr., at JSC."

And they say, "What do you mean, Mike?"

I said, "We're going to bring in lunar samples, and we're going to put them in there."

"Why?"

"Because you have twenty-four-hour-a-day surveillance and this facility is part of NASA JSC and that is important."

We prepared that building for storing the samples. White Sands was very happy to have those samples stored on their site because it gave them an active program and therefore, some stability. There was not a lot of activity going on at White Sands at that time.

We moved representative samples of all missions to White Sands, and you know how we moved them? We flew them on a NASA airplane into an airbase in New Mexico. We picked them up there at the airbase, checked the nitrogen atmosphere in the containers and added nitrogen if needed. The lunar samples were then transferred to the glove boxes at White Sands and their job was to monitor the atmosphere in the cabinets and report to us at Johnson Space Center each day.

When we wanted to have access to the lunar samples, we had made arrangements with White Sands that we were going to come in there. We agreed to call them two days beforehand. You understand the lunar samples stored at White Sands was their responsibility at this point and under their guard so I could not just walk in there and have access to the samples. I would have to go through security at JSC and have them prepare papers signed off by them to authorize me to have access to the samples. We would fly into El Paso [Texas], drive up the freeway to White Sands and they were always there ready to support us."

"Yes, sirree."

And when we'd walk in there, everything would be ready to go. The lights would be on, the cooling would be on, and everything. You'd go in there and give them a list of samples that you wanted. They'd say, "Fine." And they'd check their list, because they were responsible for the rocks. They'd say, "Okay, will you sign here, please?"

And that's it, yes. We moved part of the samples to that secondary location (White Sands) in addition to the samples that had been placed in San Antonio. This whole process was to avoid storing all the samples in one place and so to speak, "having all our eggs in one basket." This entire process had to be approved by the Lunar Sample Application Planning Team. The White Sands facility is actually a Johnson Space Center facility so it was easier to get access to the samples that were stored there than the ones at Brooks Air Force Base.

ROSS-NAZZAL: We should stop for just a second.

[Tape change]

ROSS-NAZZAL: What do you think your most challenging milestone was while working for NASA?

REYNOLDS: Well, you know, there's a lot of things I had to do, but what I'm going to tell you may sound strange to you, but in a scientific community, there are certain universities that have a strong base of research. You know, the Big Ten, for example, and out southwest, the University of California, Berkeley, UCLA [University of California-Los Angeles, Los Angeles, California], University of Washington [Seattle, Washington]. In the East, Yale [University, New Haven, Connecticut], Harvard, and all those. All those people were involved in the program, and they thought there were some problems with NASA's lack of a broad spectrum of scientists.

In pops Mike Reynolds, Ph.D. from Arkansas. I honestly felt that they questioned my ability, and after maybe six months, that was gone. They trusted what I was doing and they trusted me, but for six months everything I did, they questioned. In retrospect, I understand that, because I was not part of their original team. They hadn't even heard of me. All at once I showed up, and I don't know.

I think I told you this before, but the first guy I met was Harold Uri. He accepted me. Caltech, Berkeley, MIT, Wisconsin, I mean, these were the big, big guys playing in this game, and they never heard of me. I was fortunate enough that they'd want to do something, and I had the ability to be able to get it done. For instance, they would want some of their graduate students involved, and I would get them involved, and then they would go back and tell their professors, "Hey, he's a good guy and he can handle it." So after a period of about I want to say six months, all that went away, and I was part of their team.

But, you know, I don't want you to think that I was happy with that, because once you're a competitor, you're always a competitor, and I was kind of upset that they didn't think I could do the job at first. Then after a while, they found out that I could do it, and when they found out I could do it, then they accepted me.

As a matter of fact, I'm telling you that I would have problems after that internally. I'd have problems with the engineers. I couldn't get the engineers to do this or I couldn't get the engineers to do that, and I was trying to work the systems and all that, and then all at once, the Lunar Sample Application Planning Team would show up and these guys were the gunners. These were the guys that had the power all the way to the President of the United States. When I first started meeting with them, they'd tell me what they wanted to do. And then all at once, it turned, and I could see it turning. I'd go in their meeting, and they'd say, "Okay, tell me what we can do for you."

That first time they said that, I said, "I don't know."

"Mike, we trust you. Now, are you having any problems?"

"Well—," and I unloaded on them. That happened maybe three months, four months, because they met every month. All at once, things changed and they got all kinds of stuff going on. I was sitting in my office. I can still see this; I can still remember this. I get a call from the head of the Space and Life Science Directorate at Johnson Space Center.

He calls me in, and he had received a note from the scientific community that the engineers were not supporting me. He said this was the third month in a row that he had received this kind of information. "Mike, have you been complaining to LSAPT about this problem? Did you tell them this stuff?"

"Yes"

"Are these the problems you're having?"

"Yes."

"Next problem you have, you come see me."

Two or three weeks go by, and I go see him about a problem.

He calls me in for a meeting and all the responsible parties showed up. I can still hear him saying, "Mike's having this problem. There'll be no more problems like that. He is in charge, and if you don't like what he's doing, I suggest you come and tell me specifically what you don't like. But right now he's doing what I want him to do, and therefore you guys give him that information." Everything went good after that.

In retrospect, at the time I think they felt that I was taking over some of their authority, and nobody wants to give up authority. All I was trying to do is run it the way I felt it had to be run, and I had the outside scientific community tell me that's the way they wanted it. Once we got past that particular point, everything went easy.

As a matter of fact, that's why I left the Lunar Receiving Laboratory because I'd get there in the morning. I'd get there at seven-thirty, eight-thirty in the morning, and I said, "What am I going to do the rest of the day?" Because I never had anything to do, because everything was running so smooth. That's when I joined the medical group. It's was just strictly that.

I tell everybody, the one thing I learned on this—if they ever went back and I was still alive, and they called me up, I would say, "You can have your committees etc., but there has to be a man in charge." Because once I was able to establish that, I kept the scientific community happy. But until that time, they thought I was stepping out of my bounds and they did not trust me.

But I want you to know that that was the best job I ever had, and the reason was that I'd get up and get to work at six-thirty in the morning and get home at eleven o'clock at night, but I had things going all the time. The other thing is, is that I had good young people working for me.

You have a glovebox from here to right behind you. It stands about this far off the ground, and it's about as wide as that. [Demonstrates.] I've got to clean that, and I've got to clean that so it has less than one nanogram of total organics per square centimeter. You know how clean that is? That is clean, clean, clean, and I've got to do that. I've got my two best guys in there, and they're spraying, and they're washing, and they're cleaning, and we're analyzing.

I'm at my wit's end. These two kids looked at me and said, "Hell, there's only one way to do that."

I said, "Okay, stars. Tell me."

"We need to get in there and scrub it down with brushes."

"Show me." One of the guys went inside the cabinet through a door opening about this size. The other guy on the outside hands him scrub brushes and they scrub the interior of the cabinet. I have other workers with air hoses, and they scrub and rinse, and they scrub and rinse that thing until it is clean, clean. We run an analysis and it passes.

The scientists who came in there and looked at that said, "Oh, that's wonderful, Mike. Your team did a good job.

So the thing is, that what I found out in this particular program, at least this is my opinion, I listened. I had a lot of people working for me that were high school graduates, and I have a Ph.D., but I listened. But I want you to know that I listened because of my father. I told you the story about my father. I listened even though I knew already in my mind what I was

going to do. I listened, so that they'd get their words in. After they had their input, they were happy to go ahead and do it. All the success I had—I'm not going to brag now, but I'm going to tell you honestly that program survived because we worked very hard. All I did was provide the leadership; the troops did the work. I made sure at all times that Brown & Root-[Northrop]. knew what a good job their technicians were doing and how pleased I and the other scientists were with their work. All I know is if you get the right guys at the right time in the right place, guess what? Everything happens right. And isn't that the truth?

WRIGHT: That is true. Well, Coach, we enjoyed the afternoon.

ROSS-NAZZAL: Yes. Thank you.

REYNOLDS: Good. I thank you, and I hope you got enough information.

[End of interview]