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ORAL HISTORY TRANSCRIPT

CAROLYN L. HUNTOON
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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The questions in this transcript were asked during an oral history session with Carolyn L. Huntoon. Ms. Huntoon has edited the answers for clarification purposes. As a result, this transcript does not exactly match the audio recording.

ROSS-NAZZAL: Today is April 21st, 2008. This oral history with Dr. Carolyn Huntoon is being conducted for the Johnson Space Center Oral History Project. The interviewer is Jennifer Ross-Nazzal assisted by Rebecca Wright. Thanks again for joining us this afternoon. I surely appreciate it. I'd like to begin by asking you how you became involved with the Space Shuttle Program.

HUNTOON: I was working at the Johnson Space Center at the beginning of the Apollo Program and worked through it and Skylab, becoming very involved in Skylab and the experiments on board. Then we started working on issues, that if we were to have a vehicle that could take people into space and bring them back and take off like a rocket and land like an airplane, what would be our issues with humans, beginning with the crews. My background is physiology. That was what I had been doing during the Apollo and Skylab Programs. So that was my first exposure to the fact that we were going to do the Space Shuttle. It was being designed and, as you know, built in I guess the '70s. My total involvement for a period of time was in the issues of taking care of the people on board, whether it was physiology, and then later the hygiene and safety. As I advanced in the medical program at the Center, I became the Director of Space and

Life Sciences, and so I was in charge of managing the flight medicine area that took care of astronaut health.

At the same time we were building the Shuttle, we were planning a Spacelab. It was developed in Europe, and the first Spacelab was going to have experiments both with European and US investigators. I was working with some US investigators at that time. One of my very close colleagues and friend was one of the principal investigators on Spacelab 1. Spacelab 1 kept getting postponed because the first flight of the Shuttle kept getting postponed until it was ready to launch. During that period of time Dr. [S.L.] Kimzey, who was a colleague of mine and principal investigator on Spacelab 1 died unexpectedly and I took over his experiment because it was an area that I was familiar with, and it was being conducted by our laboratories here in the JSC Medical Sciences Division. So I continued working to complete the experiment when Spacelab 1 finally did fly.

But back to the early Shuttle flights, we did quite a bit of preparation. Part of the preparation was the selection of the new group of astronauts that would fly on the Shuttle, because this was the first vehicle we were going to fly where they'd have enough room on board to have some privacy and some capability for hygiene and privacy. So when we went out to recruit that was the big issue, we were recruiting people who could fly the vehicle, pilots, and we were recruiting people who could work in the vehicle as mission specialists. At that time there were few women who were qualified to enter the pilot pool, because at that time the military had only just begun training women to fly high-performance aircraft. In later years there were some women who had been trained by the military to fly high-performance aircraft. Therefore they were in the pilot pool, recommended by their services, and we could start selecting some women to be pilots.

The announcement went out like in '76 to '77 timeframe. We did our selection in '77 and they came on board in '78. One of the things we had trouble with at that time was getting people to apply, getting women to apply particularly. I would say women and minorities, but particularly women, because we had never had any women in the Astronaut Corps. They did not expect that they'd have a chance to be selected. Even though we were saying it, it was hard. So we went out on quite a few recruiting trips to various universities and did a TV show in Chicago and around the country, talking about the selection and what they'd be expected to do, the jobs when they came here, and flying on the Shuttle, and that NASA was serious about considering women and minorities. This was a time in our country when also a lot of things changed for women, and you could no longer discriminate against women for their jobs. So it all came together at one time. We got quite a few women to apply, and we ended up selecting a half a dozen, so it was good.

But I recall thinking how difficult it was to convince women we were serious about selecting women. They would say, "Oh, sure," kind of thing. A lot of guys applied, but not that many women at first. So I worked on that also with the program. I had two different areas I was working, the human physiology and medicine, and the selection, and then some of the training for the astronauts.

As we found out, and after we flew the first few Shuttle flights, there were no big showstoppers for health reasons with the astronauts. Two things that were interesting and gave us some reason to do some work. One was the fact that we thought with reentry being in a seated position coming in as they did, in the slow reentry, that we would not have a problem with orthostatic hypotension, that is the blood pooling in the lower extremities. But we did, and the way that was exhibited was the guys felt faint when they stood up. Actually it was not the pilots

or the copilots, but a few of the backseaters had trouble being hypotensive. We dealt with it by using pressure garments and saline—drinking some salt water—because you needed to add fluid, but if you just took in regular water you wouldn't retain it as much as you would if you salt it.

The other one was a little bit more difficult to deal with, and that was the vestibular response. We just did not expect at all. A few people that we knew of, and I believe there were a few, had a vestibular response to weightlessness when we were in the Mercury, Gemini, and Apollo Programs. When we started flying the Shuttle, pretty soon we found out that people got—not everyone, but a significant percent of people got nauseated right after they reached orbit. Some of them, it would pass in a few days or maybe a few hours. Others threw up, and they didn't feel well and a "good feeling" didn't happen for the entire flight. Now the issue comes back to couldn't you give them something for it? Because if you go on a boat ride you get medication; the answer is yes, but we did not want to sedate anyone before flight, because the emergencies that may occur on the launchpad or soon after you get to orbit, you want everybody at their peak, their sharpness.

Then often it would happen, if we tried to give them something for the motion sickness after they got on orbit, they were already to the stage of throwing up. So we were caught between those two things. I'm sure you're going to interview medical people, so I don't need to get into all that. But it caused us to put a whole program in place that we had not anticipated. As it turns out, we found that—as we were flying more and more people—because at first there were two, and then there were four, and then we flew five people, then we got all the way up to seven or eight I guess at various missions—but as we flew more people, we found out that there was a pretty good percentage of people that experienced motion sickness. When we flew a few and most of them had been career people that had been exposed quite a bit to pulling Gs, we

didn't have as many reporting it as we did later on. We tried different medications or different courses, but we found out through some experimentation done in our laboratories at that time, Dr. Nitza [M.] Cintron did the work. She found that stomach absorption was changed in spaceflight. So even if someone took a pill, it might not be absorbed and distributed in the blood in time to work on the neurovestibular system.

I understand they're still to this day trying to find the combination of drugs. But at least it's under control now and they know how to deal with it. So we went at one time to patches so that it'd be absorbed through the skin, but absorption is different in different people. So you couldn't predict how it was going to be, and that was not good. Therefore [NASA Headquarters] Washington [D.C.] had to send some more money down here to deal with that, and they didn't appreciate that because they hadn't planned on it. Here at JSC, we had to undertake research and development that we had not planned.

We did form a team of people really from all over the country that were experts in vestibular physiology and motion sickness (many from the Navy) came and helped and mounted an effort to understand it. You might say, "What difference did it make?"—well, the issue comes into doing work on orbit, if you've trained and trained to undertake experiments or to go EVA [Extravehicular Activity], as an example, and you're nauseated and can't go, then you wasted that, and the program has wasted the resources. So that was one issue.

I guess the Spacelab flights were terribly important flights, and a lot of work got done, and I can't sit here and describe experiments or accomplishments to you. Books have been written about the various flights. The relationships that were formed with investigators and the Astronaut Corps, specifically the mission and payload specialists that flew, is one of the highlights. The international flight and payload specialists led to making the program successful.

We flew, as you know, quite a few international payload specialists. By this time, in my own career, I was the associate director of the Center and doing a lot of the work with Headquarters and with our international partners on the people they sent over. There were always issues. We flew a Saudi prince [Sultan Salman Abdulaziz Al-Saud], and we flew a Frenchman [Patrick Baudry], and the list goes on and on. It was all successful, it was successful for the individuals and for the program. Some people accomplished quite a bit up there, some didn't accomplish very much. But that's okay, they flew and they represented their countries or their companies in some cases, companies flew some people to accomplish specific tasks, so the program evolved in that sense.

But one of the other Spacelab missions that was a highlight was the German mission, I think they called it D-1. I believe was what they called it. Because they, Germany, bought the entire Spacelab. What I mean by that is they bought the time on board, and they had their own crew in the lab. The problem was that they used all or most of the equipment that we had built in this country for Spacelab 1 and other missions. So even though they wanted so much to be completely independent—and they were—and to completely manage the time of the crew and their training, they wanted us to have hands off, which we did except when something went wrong, particularly with experiment hardware, then we had to put hands on quickly.

I never shall forget the one that I worked some of the most on, was the one that had to do with the refrigerator-freezer. One would think that we'd put somebody on the Moon and we'd done many great things in this country, that we could build a refrigerator-freezer that would fly in space and operate for the number of days you needed and bring back frozen or refrigerated samples (tissue, urine samples, blood samples). It was hard getting one ready to go on Spacelab 1, and the German mission was a very hard mission to get that thing on board and get it checked

out and get them happy with the results and all this, and then for it to have a problem right in the middle of a flight.

I got called out at midnight from home to come to the science management area, and we had to take over, discussing with the crew how to manage the problem. It's like if you had your freezer only freezing at half-capacity. You'd take your most frozen samples and move them away from the freezing unit so the others could freeze; it's that sort of management of the samples. So it was not planned, but we did it, pulled it off, got the samples back, they were all frozen. So everybody was happy.

The other mission that was of course of significance to us was the Life Sciences Spacelab 1 and 2 missions. I had experiments on both of those as an investigator, and then I also was a NASA manager at the time, so I was wearing two hats and trying to stay out of trouble on both sides of the arena, because there were so many things that—scientists have a natural suspicion of government-managed projects in the first place, and then you add to that dealing with the astronauts. The astronauts have quite a bit to say about anything that's done to them medically and then the investigators would get upset, and it'd just go back and forth, and so it was a challenge. But it worked out, and the crew did a great job, and we got a lot of good data from that, and those results have been documented, so you could refer to those in the literature.

There were so many experiments to be done that they split it into two missions, and that's why there was Life Sciences Spacelab 1 and Spacelab 2. But those were the most medical flights; we were not able, unless it was a Spacelab flying or later a Spacehab, to give you some more room for equipment and storage samples. We weren't able to do very much as far as human research on the Shuttle. We knew that. We knew that going in, it was not to be a vehicle to do a lot of human research. So that's why having the Spacelab was so great for us, and then

Spacehabs gave us some more opportunities. Then I guess we ended up doing a Neurolab, and there's a whole series of them that I was involved in. Again working between the investigator group and the NASA management group, because everybody has a job, and sometimes those jobs don't always complement each other. But in the end it all works out, and everybody's happy. It's that thing they talk about, making sausage, you don't want to watch it being done, but at the end it looks just fine. So that part was good.

I've lost track of what they're doing in later years on the Shuttle as far as experiments. I know a little bit about what's happening on the [International] Space Station, and hopefully they've been able to accomplish—there's always an issue about doing experiments in space, and this is something that is hard for the noninvolved people to understand. The power that it takes to run any kind of an instrument is limited because we have to generate our own power on board. Anything you take up there has to be completely safe for human beings. The time that you have for the crew to do anything is limited. Again I'm talking about the Shuttle. With Station, I'm sure it's better, because they're up there longer.

But since the time is limited, you can't have them doing long tasks, because they have other jobs to do. When there's all these medical experiments flying at one time on the various missions that I mentioned, some of them would interfere with others. As an example, you'd want to take a fasting blood sample. Well, their schedule calls for them to eat, and they had to eat so many hours before they could exercise. But if you're going to take a fasting blood sample, that meant the crew had to get up early, and Operations didn't want to get the crew up early. So you finally get the blood sample, and then have to wait to do the exercise, and then something else gets in the way, so the exercise gets—it's constant. Talk about a time management challenge.

Every investigator had their requirements. Then Operations has their requirements. People taking care of the crew and all, they had their requirements, and someone has to sit and put it all together, and it really is a little bit more complex than people understand. Particularly people, as I said, that are not around the program a lot or in the program. We'd get new investigators in and they'd come in, and they'd say, "Oh this is perfectly simple, all you do is take this battery up"—can't take that battery up there. Or, "You pour this into that." You don't pour liquids in space. There's a whole series of things, and you have to be careful in trying to educate people about it, because they become offended and say, "Well obviously you don't want us to do anything." Well that's not true, but it has to be worked for the environment and for the crew. Their timelines and their health and safety and of course the spacecraft. Although crew time probably isn't as big of an issue on Space Station. But the idea of something not taking up a lot of room, not requiring a lot of power, and being safe, is still an issue I'm certain.

ROSS-NAZZAL: You bring up so many issues. What was the difference between the experiments that were conducted on Skylab and ASTP [Apollo-Soyuz Test Project] with those of the Space Shuttle, in terms of requirements and working with the PIs [Principal Investigators]?

HUNTOON: Well, with Apollo and ASTP the number of experiments were more limited. We've always been guilty of overselling our capabilities, putting a goal out there that we're going to reach. With the capsule, as in Apollo-Soyuz or the Apollo, there was very little human experiments. I know on Apollo 17 we did a little bit more extensive work, because the Russians had just lost a spacecraft crew. They told us it was because of a leak, rapid decompression. But we wanted to make sure it wasn't linked to the amount of time they were in space.

Ratchet back, this is before we knew how long people could stay up. So with that problem existing on Apollo 17 we were allowed to collect some urine samples and bring them back and do a little bit more blood work before and after flight. Because the Apollo Program—I know we're not supposed to be talking about Gemini and Apollo and all, but Mercury as you know was quick, and they examined the guys before and after the flight and that was about it for human stuff. We needed enough time to go to the Moon and come back, which was about two weeks, so we did the Gemini VII flight where they were up there long enough that we did the collection and brought back samples, and there were a lot of physiological changes, and those were the basis that we formed all the experiments for later on Skylab. Not terrible, not big medical—not diseases if you will, but just interesting physiology. The mission was long enough to go to the Moon and come back. After that we did very little medical experiments on Gemini, if any. Maybe pre and post, but talk about small vehicle, it was little.

The goal of the Apollo Program was to get to the Moon and land and get those samples and come back. We had already shown that the crew could be up there that long and it wouldn't hurt them. So the medical program was more making sure the astronauts were healthy when they flew, and they were healthy when they got back. There were some experiments put on board, particularly some of the later Apollo flights. They were trying to show that there were scientific capabilities. But because of the limitations of the vehicle size and the crew time, there was very little accomplished. Apollo-Soyuz was the same way, very little. So when you come along with Shuttle, of course the initial Shuttle flights were just to make sure the vehicle could go up and come down. There was going to be a test program for a period of time. Then they'd decide the test program was over, and now we're into operations. As far as I know that

operations thing, we never got into full operation—we are now. Now that the program's winding down, we're into full operations.

But it was never intended that we would start out doing experiments on board. Then that got worked out and we could start doing experiments, then the question comes along of crew time, and storage space on board the Shuttle is just very limited, by the time you send up the food and the clothes and tools and supplies. So it wasn't until the Spacelab missions that there was enough space to put everything needed to conduct some real experiments. We were doing some things, and I'm sure you can find records of what got done on various missions.

It's one of those round-robin things. The crew is busy so they can't do extra experiments, so you fly some more crew members. But when you do, it requires more food and more clothes and more hygiene supplies. So you have people now that have time to do some extra work, but you can't send many experiments up because the crew doesn't have space to put anything. So it's I guess maybe a self-fulfilling prophecy that we couldn't do too much except on the Spacelab missions. I'm not speaking in absolutes here. I know there were experiments on many missions, and there were some nonmedical experiments that took place that were self-contained little units that you'd flip a switch and turn it over and take a reading. But they did fly early on the Shuttle, and I can't tell you which one, the first bioreactor unit. That was flown I believe by McDonnell Douglas and a guy named Charlie [Charles D. Walker]. Flew as a payload specialist to operate that. So that was the idea of a commercial venture, to fly that bioreactor and make measurements. I think that's flown a lot since then.

So those things did occur, but they were onesies and twosies, wasn't a massive program. I think the other thing was some of the student experiments that flew that were good. I think most of that stopped after the *Challenger* [STS 51-L] disaster, and didn't start up again for quite

a while after that. But there was a big student experiment program where a lot of kids got to propose experiments. In that case it was very helpful for them to learn how to write procedures and design equipment. They would get the astronauts involved in helping them. It was a good program. I don't know how much of that's going on today.

ROSS-NAZZAL: We've interviewed a number of women from the '78 class. So many of them have spoken so fondly of you, because you were one of their true mentors when they arrived here. Can you share with us your mentorship program for these six women and then the next two that came on board in 1980?

HUNTOON: Well, we really didn't have a program, a mentorship program. One of my goals was to make sure that they were treated equally, and that sounds so funny now looking back on it, but the issue is when we were getting ready to select women everyone would want to make a special consideration. We want some women; we're going to fly some women. We'll talk about size. I'll just use that as an example. Now that we're flying those women, we're going to have to deal with size. Yes, there were some smaller women, but there were some bigger men too, and we had to deal with that. Some of the guys were small, or at the same size I'll say, as some of the larger women. It wasn't like it was all—let's don't put this all off on the women to be the different sizes.

As an example, trying to deal with their training facilities. I wasn't asking or did not require that NASA build a bunch of special facilities for women. All we asked for was that they at least had restrooms where they were going, for training, wherever it was, and a place to change clothes when necessary. It sounds funny now talking about it that way, but when I first

came to work at the Johnson Space Center there were so few women's restrooms in any of the main buildings we worked in, I'd have to go upstairs to go to the one women's restroom in one building I worked in. It wasn't that anyone purposely didn't want women to have restroom facilities, it just wasn't an issue, there weren't that many women working, they didn't need to. The same thing with the women astronauts, no one purposely thought of not having things for them. I got called over to the gym and asked to check out the gym, did they have what they needed in the gym and all this. I said well, it would be nice to have some hair dryers, as an example, because they're going to have to shower and dress. So it was that sort of thing, getting ready for them.

Once they were here, again it was mainly making sure that someone was around to listen when they had a problem and could help with management. I didn't have the official title as their chaperone, although that's what they called me half the time, when they were first on board and we'd go off on trips to all the NASA Centers and all. I would go along, and they all started referring to me as their chaperone. But I've looked after a lot of the guys as much as I did the women, because they were young people straight out of graduate school, universities, coming into this environment—and a lot of them were scientists with not the engineering background, and they'd come into this environment with a lot of military type background and engineering and it was like, "Whoa, what have we gotten ourselves into?"

So I tried to help them out when needed on occasion, too. But really that was the program. It wasn't anything specific or written down or anything else, but I think having someone available that would understand what they were talking about when they had issues. At the Center, people started realizing that I was working with the women astronauts. So any time anyone had a complaint about the women, they would want to make sure they told me,

whereupon they wished they hadn't have when they did. Because I would say things like, “Well, that sounds just like a man, doesn't it?”

“You know what she told me? She told me that that wasn't right, and at a meeting she told me.“

I said, “Now, which male astronaut hasn't spoken up in a meeting and told you something?” It was like, what were other people expecting of women astronauts?

So one day I was on an elevator with some guys, and they were talking about one of the women astronauts, and they go, “She just acts like she knows everything and she acts like she knows what to do.”

I go, “My goodness, gracious, now what would you expect?” I said, “She probably thinks she's as smart as any of the guys are.” So that was also going on around here for a few years. But everybody soon realized they were smart and quick. You've met a lot of them you said, so you know this. What they had to do was just come and go do their jobs, and after the newness wore off, if you will, of having women in those roles, they became quite respected for their smarts and what they were doing and their work ethics. The same things the men were known for. So it worked out, that worked out fine.

We did a program making sure that those mission specialist astronauts that wanted to (men and women by the way) pursue technical training from their past, or wanted to continue doing some experiments in the areas they were familiar with, I would help secure the time and money for them to do that. We're not talking about big bucks here. We're talking about money to help collect samples out in Utah or time to use one of the major telescopes once every three months or so.

So we had a little bit of money that we would be able to fund some of those kinds of things. Again, it was not something that was required of anyone. Why do you go and solicit people to come to apply to be astronauts who are scientists and have backgrounds in research, if you want them to cut it all off and not be that anymore, because then it won't take long till they're not of great value to you, because their science is old or their experience is old. So we wanted to make sure they had the opportunity if they wanted it or thought they needed it. Through the years, quite a few took advantage of the program. Not all at the same time, not all doing the same thing, and that's the program I was running. They said what they wanted to do and I worked with them to find out how we could best do it, and not interfere with their training, because they all wanted to be the first up, if not the second, if not the third. So they didn't want to be penalized in the order or ability to go fly when they got chosen. So that was the other issue.

After the *Challenger* disaster occurred, we had quite a few that I helped go do some things, because there was going to be a period of time, and everyone knew it, until we flew again. Some of them looked upon this as an opportunity to return to school. Some went and joined one of their colleagues at some university and did some research.

ROSS-NAZZAL: Was that an idea that you came up with, or was that something that you had learned from the '65 and '67 selection of scientist-astronauts?

HUNTOON: I can't take full credit for coming up with it, but it was something we initiated with them. The other guys, the '65 and '67 group, I think a few of them maintained some of their relationships they had before they came in the program and dealt with that on their own, and a lot

of them didn't. Of course as happened with the Shuttle astronauts, after they're here a while and get caught up in their training and things, they didn't want to go do these things as much. But then, as I said, after the *Challenger* disaster, we went through another cycle of people doing some things, because they had the time. But the program that we ended up pursuing wasn't necessarily the one that we had anticipated it would be.

We had trouble getting the science program in Washington to fund this, because it wasn't the same kind of peer-reviewed proposals they were used to funding. All I required from the astronauts was one or two pages about what they wanted to do and why they wanted to do it kind of thing, and who they were going to be doing it with, to make sure that it was legitimate. But we didn't require a lot of paperwork and budgets. So it was hard to get the Headquarters science to help us, with the exception of the life sciences people. Maybe it's because I was more familiar with them, and they understood what I was trying to do. So we got some operations money to help us to help do that.

As I said, it wasn't a lot, and the whole thing wasn't very big. To me it was the idea that if someone wanted to, and they're sitting there one day saying, "I gave up all this to come here to be an astronaut, now they got me sitting here doing nothing," at least they had the opportunity if they wanted to to do something to maintain their technical skills. That's what the program was for. It wasn't to push back any great frontiers or anything.

ROSS-NAZZAL: I wanted to go back and ask just an additional question about the women. One of the women astronauts we talked to mentioned that when she came on board, and the other women did as well, in '78, that they doubled the amount of professional women working at the Center. Is that accurate?

HUNTOON: I don't know about doubling, because you'd have to go to personnel or something, because as you've probably realized by now I can't remember numbers.

ROSS-NAZZAL: That's okay, it's 30 years ago.

HUNTOON: Yes, there was an increase in professional women. But I'm not for sure it was because the astronauts came. That probably was a part of it. But that's the same time the federal government decided that they could no longer discriminate against women, and they really needed to have a workforce that looked more like our country as opposed to a workforce that was all male, throughout the government particularly. But NASA made that decision also. So they started recruiting women. I know that when I first came here in 1968, on a postdoc, there were very, very few women that were not either secretaries or administrative assistants. Maybe like four or five. I'm talking about throughout the program.

That changed after a while. But as I said, I'm not sure. It's probably the same thing why we selected women astronauts, because you could no longer discriminate against someone based on gender or race. Many of the jobs were off limits for women. They couldn't do it. Then that all changed when women wanted to, and they challenged the system, and the laws were changed. That made a big difference. So I would say yes, that might be true, but there's more to it than just the astronauts coming in. It's also our whole country was changing at that time.

ROSS-NAZZAL: One of the things that this office is interested in is pursuing a monograph about the women at JSC. I was wondering if you could talk just briefly about what you think some of the accomplishments of the women at the Center have been over time.

HUNTOON: No.

ROSS-NAZZAL: Okay.

HUNTOON: I could think about that and talk to you about it some other time, but I think it would be an interesting thing. I'll just say this. When I first came here, there was a woman who was the nurse that had come with the astronauts from when they were in Florida, and came back here to Houston when they opened the Johnson Space Center, and stayed here for many years before she left to move to California. Here name was Dee O'Hara, and she was a registered nurse. She was very instrumental in a lot of what we all did, as far as during the Apollo Program working with the astronauts, because she had the rapport and she had their trust and all. So she was the interface for all of us that were trying to collect samples or understand what schedules were or training or what have you. Dee had to balance the two of those, and she did a terrific job.

There was another woman who was in charge of the food program, Rita [M.] Rapp, and she also, because she had been working with the astronauts so long and all, she was able to get some of the requirements that the scientists thought they ought to be eating a certain amount of this or that or the other, and get it into a food system that the astronauts would eat and would enjoy and not complain about. They still complained, but anyway. So there were women along

those lines that did quite a bit. There were some engineering women that did quite a bit. I would have to think through to remember names and accomplishments.

The women astronauts, quite a few of them, have done some pretty outstanding things. So it's good. I think it'd be good if you did a monograph on the women.

ROSS-NAZZAL: Certainly you being the first female Center director.

HUNTOON: Well, yes, I would expect to be on the front page, right? But there was a time where we had the Federal Women's Program. I guess they don't have it anymore; I don't know. But they would highlight women and women's accomplishments. Once a year we'd have a banquet and honor somebody for helping women. I got in trouble one time because I was interviewed for the *Roundup*. Is there still a *Roundup*?

ROSS-NAZZAL: Yes.

HUNTOON: I was interviewed for the *Roundup*, and I said that my hope was that we would one day not need the Federal Women's Program. We don't have a Federal Men's Program. It should all be the same. You would have thought that I had taken the Lord's name in vain. I was really chastised for saying that. I thought it was fine for the program to highlight and get things going and make sure that women were taken care of, as they were climbing into this morass of engineering and operations. But my hope was that we'd get to a point we didn't need it, that it would all be the same. But I got in trouble for saying that. So one of my early lessons in

politics. Not to say something should go away. Because then they say, "Well, she said we need to get rid of that." That wasn't the point at all.

But if you look back at—if you have the history stuff—you have access to all that. There's quite a bit in there, and quite a bit about what women have accomplished.

ROSS-NAZZAL: We have a list of folks we'd like to include in that book.

HUNTOON: I bet. Because there were some—in fact I've lost track of a lot of them.

ROSS-NAZZAL: What do you think was the most significant scientific accomplishments of the Shuttle?

HUNTOON: Well, the biggest science accomplishment is when you talk about the vehicle itself. We talked for so many years before and had these animated drawings that we used to use in speeches for years before we flew the first Shuttle. It was going to take off like a rocket and land like an airplane and be in orbit, be a vehicle to take things to orbit and return to Earth. We all believed that, and as it turned out, it worked.

I was talking to someone yesterday about the fact that it's getting old now. Because someone said, "Is it really safe?" Well, there's things about it that are difficult now. But there's always been things about it that were difficult. When I was first working as a technical assistant to the Center Director at the time, Chris [Christopher C.] Kraft, we would go into his office every morning of the week, five days a week, and meet with the head of the Orbiter Program and the head of the Space Shuttle Program, and they would go over what they were working on and what

the issues were and what the problems were with Dr. Kraft, and so I was privy to hearing that, as they were building the vehicle and the challenges. But just the complex design of that vehicle and making the timing and the computer systems that that made it all work at the right time at the same time is one of the wonders of the world.

When the Russians built their Buran it looked an awful lot like the Shuttle. They claimed at first it was not. They had done that themselves. Later, the designer of their space vehicles was here for a speech, and someone asked him about it. He said, "Well, if someone has something good, there's no reason you shouldn't copy the best parts of it." So he admitted that they had done that, which they had done. So as I said, the design and the aspects that it flew—and we've had some terrible tragedies, and I know that. We also had quite a few successes with it and have learned a great deal from that. So I would put that as the biggest accomplishment, was putting that vehicle together and flying it. That to me was outstanding.

Skipping along to some of the medical accomplishments, we were able—because of what we had learned on Skylab—at that time, we did more medical work on people in space than has ever been done to date, and this is something that's little known or little understood. But between the metabolic work that I was involved in and the cardiovascular, vestibular and the exercise, there was a complete set of human physiological experiments conducted on nine crew members, the 28-, 56- and 84-day flights. The very same experiments. They ate a controlled diet, and we collected all their urine and all their feces and brought it all back and did analysis. There is not another set of experiments like this. The Russians never did it, and we've never been able to do it again. So that is, if you will, the foundation of what has followed in human physiology, and one refers back to those data as being the biomedical baseline of spaceflight.

I was very—used to be—upset with the Russians. You get over that after a while, but I was perturbed at them for when they started flying longer missions that they did not do other medical work that would extend the database we had established with Skylab. They could have confirmed our data and then extended it to six months. They just did data points along the way. They never did the complete cadre of experiments and the complete analyses. But again I will say these were mostly observational. And true scientists will tell you, when you do a scientific experiment you perturbate a system, you hold something constant, you perturbate things to see what happens with change, not—the perturbation for our data was spaceflight. We didn't interfere with anything. We just collected samples. So that's why I say it's the baseline for weightlessness.

So when we got to the Spacelab missions, we were able then to do what I would call experiments. In the cardiovascular area they were injecting and making measurements with guys on bicycles or treadmills. Vestibular, they put them in chairs to stimulate their vestibular apparatus, to see what the changes were compared to those on Earth and all. So they were perturbating the system to get data, which is really true science. So there's a whole cadre of those kinds of experiments that did occur in the Shuttle Spacelab missions, because again they were able to do it based on the fact that we had a lot of baseline data coming out of the Skylab missions.

Another area that doesn't get a lot of attention, but I'm familiar with and to me is very important, and that is putting humans in this closed environment for this period of time and keeping the environment safe and clean. A lot of people do not understand or know that we had a very large toxicology for any material that goes on board the Shuttle, we have a signature of what it's made of, and if it's got certain things in it they have to do what they call outgassing

studies to analyze if this were to heat up, what compounds would get into the atmosphere. Why is that important? Well, because the atmosphere is just recirculated and cleaned through filters, and if the filters don't take care of these substances, then they'd collect in the atmosphere and could be dangerous.

So a whole program had to be put in place for this. Not only making measurements on all the things that went on board the Shuttle, but also taking air samples and bringing them back to make sure we had cleaned up the air on the Shuttle. Eventually we got an apparatus that did that on orbit. So we had to develop tools to do what you need to do, and that in itself was a scientific accomplishment. This would also feed into the Space Station program. Because many findings gave us the foundation for this indefinite duration on Space Station. Not only for the humans to live there, but how to take care of the atmosphere for the humans. So that was another area that was I think very important.

I should also mention the Shuttle-Mir flight. It is something that I personally worked very hard on from the inception to the completion. The NASA Administrator asked what we could accomplish scientifically by putting an American astronaut on the Mir space station. Because the Mir was limited in space power and equipment, we had the idea to send a fully-equipped Spacelab to meet the astronaut at the end of his stay and do measurements on orbit so the physiological changes would not be affected by the landing/recovery process. This would include sending our prime and backup crew members to Star City [Russia] to train with the cosmonauts and launching an American on the Soyuz to Mir. Norm [Norman E.] Thagard did a terrific job and used Russian countermeasures on board. He returned in great shape. The program was a tremendous success and continued for several flights. In all, seven astronauts

spent time on Mir. The program helped the US get ready for the ISS [International Space Station] and certainly taught us how to get along with the Russians in orbit.

ROSS-NAZZAL: Any lessons learned in particular that you think NASA can pass along to future programs that it learned from the Space Shuttle Program in particular?

HUNTOON: Oh yes. It's hard to say what was learned from the Space Shuttle that Shuttle didn't learn from Apollo and Apollo didn't learn from earlier flight programs. The program has evolved that way. Because I think the issue that we got into, of stepping into missions as opposed to we're going to go fly for 30 days—our first Shuttle flights were just what, a couple of days, and then we extended them and extended them to as far as we thought we could for maintaining the number of people we wanted to fly. As I was saying earlier, it was balance; you want a large crew so they can do a lot of work but you have to have supplies to take care of a large crew, so you have to balance all that. We knew that from the Apollo flights, and we got experience with it in the Shuttle. That would certainly pass on to any other vehicle that you use for launch and reentry.

I think we learned a lot in the Operations area of what people can do, in even as small a space as the middeck of the Shuttle. So when you're talking about how much room do people need, well, of course it's what do you intend to do. Then as we found out with the Shuttle, we ended up doing a lot more than we ever thought we would do, as far as science experiments and demonstrations. So I think that's another thing that should be remembered as we build another vehicle or go into another program.

Another thing is when you build a vehicle for a program that's going to stretch out for 20 or 30 years in the future, it's very difficult to predict exactly how it will be used and for what purpose. I didn't mention when we were talking about scientific things, I didn't mention satellite work. I should have, because the idea that the Shuttle could take up a satellite and put it out and test it and do something to it if it didn't work right or something before it left it, as opposed to our previous way of just launching them and having to leave them where they were, it was a big step forward. Then add to that the idea of going up and retrieving satellites that were going to fall back to Earth or were no longer working, and fixing some of them or bringing them back. Then of course the Hubble Space Telescope, the investigators that use that information won't let us quit working on the Hubble. Because it's great. They've been able to repair and fix things and keep going with it.

To start from scratch and build another thing and get it up there and test it and all, the amount of money and time it would take, would be a big hiatus. So I think the Shuttle has certainly proven itself technically. I meant to say that earlier, but what I was going to say about the intention of a vehicle. Right now, let's just say we're going to start this year building something, and it's the year 2008, and we think we know what we're going to do, but we do not have a program paid for yet or national support for a program to explore the universe. We've got plans that we'd like, but there's nothing there. So whatever vehicle gets built and tested has to have enough flexibility built in to accomplish the programs that evolve.

I think of when I was first at the Johnson Space Center in the late '60s, and we were called into a conference room, and I was fresh out of graduate school, so that's when you have a set mind of what things you can do with information. You're very knowledgeable right out of graduate school. We were asked to design the requirements to send humans on an unknown

mission of unknown duration in an unknown vehicle. Well, I was saying, "We can't do that." I wasn't the only one in the room obviously, I was probably one of the younger or less experienced people in the room.

But that's almost what you're talking about when designing for future space missions, since we don't know exactly what is going to be—it's going to take us a number of years to get something built. The good news is the Space Station, because we know that we have it, and we know that it's operating and it's quite effective. We know there's a lot of accomplishments going on there. We have the other nations involved. It will endure for a period of time, and then we will need transportation back and forth to that Space Station. So that locks you in on a primary use of a new vehicle or new program. But then there's of course many other things people have in mind. So you have to keep in mind that the vehicle you design and build may be used for other things too.

For a period of time we were very oriented toward taking up military satellites, and there was a lot of top secret work going on in that arena. Then after the hiatus caused by the *Challenger* disaster, the military had to go on and do their own thing. But there again, that's what I'm talking about, with planning one thing and then circumstances cause you to evolve into something else. I think that's one issue.

ROSS-NAZZAL: I think that's important. One of the other questions Helen wanted us to ask about were any unique accomplishments or significant accomplishments related to national security. I don't know if you can address that topic or not.

HUNTOON: I really can't. A little bit of stuff that I know, I probably shouldn't talk about. But I would say that—I won't call it national security. I'll call it our national priorities or whatever else. The space program has always been a very positive thing for our country, not just internally, but the rest of the world, we're known for our space program. The Russians are too, by the way, to quite an extent. I think that we have accomplished a great deal. A lot of people are still very excited about that and look up to us for having done it. I think that's very important. The national security issues, I won't comment on.

ROSS-NAZZAL: We have just a few minutes left, and I was curious if you could comment on this. I was doing some research about a year ago on Skylab and the wine controversy.

HUNTOON: I got a letter from you on that.

ROSS-NAZZAL: Yes. I was just curious if you had any involvement in that, since you were probably working with [G. Donald] Whedon and [Leo] Lutwak and their concerns. If you recall what the big debate was over, and your involvement in that.

HUNTOON: There was a lot of issues. You got a letter, I think, from Dr. [Paul C.] Rambaut.

ROSS-NAZZAL: I got a little bit of information from him, yes.

HUNTOON: He would have been the one to probably say it best. He was Harvard-educated and always had a way with words, writing and speaking and all. It was an interesting controversy. It

was technical as well as emotional, and it got into being religious. It was fun, looking back on it. At the time it wasn't, but looking back on it, it was fun. On a technical side, part of the experiment that I was involved in was the fluid and electrolyte control in the body with the antidiuretic hormone and the salt-retaining hormone, aldosterone. Alcohol is known to inhibit the antidiuretic hormone. So technically I could not say it was okay, with my experiment, for people to drink wine.

Now my other hat as a NASA person involved in operations and all this, they weren't talking about gallons of wine, it wasn't like they were going to take a vineyard up there or something, kind of thing. They were talking about a little wine, or whatever. I understood that, and I understood that I would probably be overruled. But technically I could not hold my head up in the scientific community and say that I'm doing this very involved experiment on fluid and electrolyte control, oh yes they can drink wine. As I say looking back on it it was fun, but Dr. Whedon of course didn't want them to do it, because again the involvement of alcohol with the hormones, as well as the calcium metabolism, and it was just one more perturbation in the system that we probably could have taken care of with the proper controls, because one of the things with Skylab, as you may or may not remember, is that three weeks before the mission and three weeks after the mission, we did the exact same protocol that we did during the flights.

So we had that ground baseline before they flew, in-flight levels and then after flight, we would watch the measurements (biochemical and physiological) come back to normal. So we had the baseline, and we had the exposure to weightlessness, and then we had the recovery. If we had, during the baseline, given everyone a glass of wine at night or whatever, then when they did it in flight, you'd say well that's apples to apples kind of thing. But if you didn't drink it then and you did it in flight, then you couldn't compare it. So it had to do with experiment controls.

So it was a little bit more than just people being ornery about it. But I can't remember who even made the final decision. But I know I got an email from Paul, who said he had been contacted and had answered. I said that sounds good.

ROSS-NAZZAL: Yes, he was kind enough to go through some of his materials. He had saved some stuff. So I thought that was particularly nice. I was trying to encourage him to donate the rest to the JSC History Collection.

[End of interview]