

**NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT**

DR. CHARLES T. BOURLAND
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is April 7th, 2006. This oral history with Dr. Charles T. Bourland is being conducted for the Johnson Space Center Oral History Project in Houston, Texas. Jennifer Ross-Nazzal is the interviewer, and she is assisted by Sandra Johnson.

Thanks again for agreeing to meet with us this morning. We certainly appreciate it.

BOURLAND: You're welcome.

ROSS-NAZZAL: I'd like to begin by asking you how closely you followed the fledgling space program in the late fifties and early 1960s.

BOURLAND: Actually, I didn't follow it very close. I would watch television when I saw a rocket blowing up, but I didn't really pay that much attention to it. I do remember when I was in graduate school—this was in the late sixties, or middle sixties, I guess—I wasn't following it too close, but I remember I was in a nutrition class, an advanced nutrition class, with mostly women. There was about three men in there, and the rest of them were twenty or thirty women. The professor would bring reprints to class every day, every time we met almost, and she brought some reprints on space food, and she said, "You boys would be interested in this."

Now, she couldn't say that today, but at that time she said it, and I wondered to myself, "Now, why would I be interested in space food?" It was really odd that it wasn't too long after that I was involved in space food.

ROSS-NAZZAL: Well, how did your studies at the University of Missouri [Columbia, Missouri] in agriculture help prepare you for your eventual career with NASA?

BOURLAND: My agriculture probably didn't help that much, although I took a lot of nutrition classes. My first degree was actually in dairy husbandry, which had little to do with space food. But then my master's was in microbiology and my Ph.D. was in food science and nutrition, and that really did help in the work that I did.

ROSS-NAZZAL: How did you find out about the opportunity to work down here, other than being introduced to some of those reprints by your professor?

BOURLAND: I got my job, I say, by serendipity. I was just about to graduate with my Ph.D. degree. I had everything completed except my thesis, which takes quite a while. I had completed the research, but I hadn't analyzed the data or written any of it up. Everybody said, "You need to send out résumés if you expect to get a job." So I sent out a bunch; I don't know how many résumés, fifty or sixty résumés, and I got a couple of responses. One was with Kraft Foods, and they interviewed every graduate from the University of Missouri, just as a compliment, so I didn't expect anything from that.

Then one day I got a call from Technology Incorporated at the Johnson Space Center. Now, I didn't send them a résumé. I sent one to the University of Nebraska [Lincoln, Nebraska], who had a postdoc fellowship, and I thought as a last resort I might take a postdoc fellowship, if I had to. Well, it turns out the University of Nebraska had a contract with NASA, and they knew that NASA was looking for somebody. They faxed my résumé to Technology Incorporated, and Technology Incorporated called me and asked me to come down for an interview.

ROSS-NAZZAL: Can you tell us about that interview? What were some of the questions they asked you?

BOURLAND: Well, it was a pretty exciting interview, but actually I was here when they landed on the Moon. There was more people at the John Space Center that day, or that week, than it ever has been since. I had to stay out at the [Houston] Intercontinental Airport [Houston, Texas]. It had just opened, and I had to stay out there and fly the Metro plane back and forth for the interviews. There wasn't a hotel to be had around here anywhere. I got to go through the quarantine facility in Building 37. I got to see that, where they were going to bring the astronauts back. It was really an exciting tour. Later on I also got an offer from a dairy, Southland Foods in Dallas [Texas], which offered more money, but I didn't have any question about which job I wanted to take, because it was really exciting to be here when they were landing on the Moon and all that.

ROSS-NAZZAL: What sort of sense did you have when you left here about what you would be working on when you first came back to MSC [Manned Space Center]?

BOURLAND: Well, they had all sorts of things going on. There was lots of programs they were involved in, and they were really short of help. They had the food system on the ships that somebody had to take care of, and they had the flight food system they had to take care of, and they had the preflight; they were responsible for feeding the astronauts at the Kennedy Space Center [Florida] before they went up. There were just a lot of things going on that they needed a lot of help, and I really didn't know what all I'd be doing when I got here.

ROSS-NAZZAL: So what were some of your first assignments when you arrived?

BOURLAND: One of the first things I did, I came to work the 1st of September, and by the middle of October I was on my way to a recovery ship. So I didn't even have a badge; I had a temporary badge. I didn't even have time to get that, and so they sent me out on a recovery ship to take care of the food for Apollo 12.

ROSS-NAZZAL: Can you talk to us about the astronaut controlled food for the recovery ship for Apollo 12? What did that involve?

BOURLAND: It was an advanced food system at that time. It was frozen food, and it was essentially TV dinners, but they were gourmet TV dinners. There was a company in California, a subsidiary of Del Monte [Corporation], and they made them. They were microwavable little food trays—and it was gourmet, really good food—and you put it in the microwave. We had a Radar Range microwave. Very few people had even seen one, and that was one of the first times

that they were in use. We thought it was a marvelous thing. It would take fifteen minutes to warm up a meal with the thing, but we thought it was really something. It must have weighed a hundred pounds. You couldn't even pick it up, it was so heavy.

ROSS-NAZZAL: How big was the microwave? You said it was pretty heavy. How big?

BOURLAND: About the same size as they are today, but it must have been made out of lead, because it was really heavy.

ROSS-NAZZAL: How did you get out to the recovery ship?

BOURLAND: We went out on an Air Force plane. That was pretty exciting for me. The Air Force said they were going to leave first thing in the morning. I don't know if you know what the first thing in the morning is; that's usually one minute after midnight. So they said to meet them out at Ellington Air Force Base [Houston, Texas], said come about eleven o'clock, and you'd get on the plane. They were taking the Mobile Quarantine Facilities [MQF], and our food and everything was going out with them, so I was going out with part of the landing and recovery crew.

Well, I drove out to Ellington Air Force Base, and there was no plane. I went up to the Operations Office, and there was an ash tray there with a cigarette burning, but nobody around. I couldn't find a soul. I looked all around. I couldn't find anybody. I went back outside, and I thought, "This was my first job, my first assignment, and I missed the darn plane. What happened?"

I was running around, and finally a guy came by. A guard came by in a pickup, and he said, "Can I help you?"

I said, "Yes, I'm looking for the Air Force plane, the C-141 that's taking the NASA stuff."

"Oh," he said, "yeah." He said, "Somebody declared that part of the stuff on there was hazardous, so it's over on the other runway way across the way. Get in the truck, and I'll take you over there." So I went over there, and everybody was over there. So then we got to go to Hawaii; left about midnight. We had a lot of exciting things happen on that. We stopped at Travis Air Force Base [California]. Well, the first thing that happened, we just got up to altitude, and this guy came back and said, "Hello, I'm the pilot."

I said, "Well, that's great. Who's flying the plane?" [Laughter]

He said, "Oh, the copilot is. Come on up," and he took us up and gave us a tour of the cockpit and showed us what was going on.

So then we landed at Travis Air Force Base, and all these people came out working on the plane, checking tire pressure and opening all kinds of panels and things. I thought, "This is really great. I've never seen anybody work on a commercial plane. I wonder how come they do all this."

So then we got ready to take off, and we got up to altitude, and the pilot came on the intercom and said, "We're going to have to go back to Travis." He said, "I lost all the hydraulic fluid. Somebody left the valve open." So we did, and we didn't have any flaps, so we had to come in for a real long landing. Finally got back, and they got the hydraulic fluid back in, and we ended up in Hawaii the next morning.

ROSS-NAZZAL: Which recovery ship were you on?

BOURLAND: This was the [USS] *Hornet*. It had picked up the Apollo 11 crew and then picked up the Apollo 12. The Apollo 12 was the last time it was at sea.

ROSS-NAZZAL: Were you the only representative from Technology Incorporated or from the food laboratory?

BOURLAND: I was the only one from the food laboratory. There were some other people from the medical side of that that were there.

ROSS-NAZZAL: Were you there when the crew arrived, or was the crew already there when you were there?

BOURLAND: Oh, no. We spent almost thirty days on board ship. We had to be south of the equator when they launched, for some reason. I didn't understand the mechanism, but somehow we had to be down by New Zealand. We were a hundred miles from New Zealand when they launched the spacecraft, and then we came back, back up, and we picked them up closer to Hawaii. Then there was a delay in the launch while we were down there. We all wanted to go to New Zealand, but the captain said, "No, we can't go to New Zealand. We're going to stay out at sea."

ROSS-NAZZAL: What did you do for those thirty days you were out at sea?

BOURLAND: On that mission, I spent most of my time working on my Ph.D. thesis. I took all the paperwork with me. My major advisor had told me that I could leave; he would help me. We could do it by mail, finish writing the thesis. Because Technology Incorporated said, “You’ve got to come within two months,” or whatever it was, “or else we can’t keep the job open. We have to have somebody there.” They said, “You can work on your degree while you’re here.” So I worked on it while I was at sea.

ROSS-NAZZAL: You brought your typewriter?

BOURLAND: No, I did it by hand. I couldn’t even type at the time. Still can’t type, but can work a computer.

ROSS-NAZZAL: So what are your memories of the crew? Were you there when they arrived? What are your memories of that?

BOURLAND: Oh yes. Yes, I was on board. We had to keep the food—it was in a freezer. We had to take our own freezer, because the Navy said we could use their freezers, but there was, I think, over 2,000 people on board ship, and 99 percent of them were looking for souvenirs. They said, “We won’t guarantee that your food will be there if you put it in our freezers.” They said, “You’d better bring your own.” So we brought our own freezers and put a lock on it. It was just an old Sears freezer, and put a lock on it and kept it locked, and then I transferred the food from the freezer to the Mobile Quarantine Facility for each meal.

ROSS-NAZZAL: Were you staying with the crew in the Mobile Quarantine Facility?

BOURLAND: No. There was [B.] Randy Stone—you know who Randy Stone is now—was inside. He was the gofer boy in there, I guess. He cooked the meals and took care of the crew, and Dr. [Clarence A.] Jernigan was the Flight Crew Surgeon, and he was in there with them. So there was two people in there with the crew inside the Mobile Quarantine Facility.

ROSS-NAZZAL: How much longer were you on the ship until you got back to Hawaii?

BOURLAND: About three days. After we picked the crew up it took about three days to get back to Hawaii.

ROSS-NAZZAL: What kind of food was the crew offered? You mentioned that the meals were microwaved, but do you remember what kind of menus they were offered?

BOURLAND: Oh, they had steak and lobster. One I remember in particular is Pete [Charles] Conrad [Jr.], one of his favorite foods was lamb kidneys. I don't know if you've ever smelled them cooking in a microwave, but they don't smell very appetizing. But that was one of his favorite foods that he had.

ROSS-NAZZAL: How closely did you get to work with the Apollo 12 crew on the controlled food before you went out to the ship?

BOURLAND: Not very close. I just met them a couple of times when they were tasting the space food, but most of that was done by the time I came to work. They were already ready to go.

One of the stories I remember, when I was on the ship, as soon as the crew got back to the quarantine facility, Pete Conrad asked me if I would go get him a package of cigarettes. He smoked occasionally, and he wanted a cigarette then, but it had to be Winstons in a box. He said, "If you can't get that, don't get them. I've got to have Winstons in a box." So I went down to the ship's store, and of course they didn't have Winston in a box. So I went down to the ship's crew quarters where the sailors were down there, and I asked around, and finally one sailor came up and donated a box of Winston cigarettes for Pete Conrad. I can't imagine that happening today. We wouldn't be smoking in a controlled area, but it was acceptable back in those days.

ROSS-NAZZAL: So when you returned, what was your next assignment after that recovery of the Apollo 12 crew?

BOURLAND: It wasn't too long—I think in March I was back on the Apollo 13 crew, working on that. But we had to inventory the food that came back from Apollo 12. We were trying to determine nutrient intake, just by seeing what the crew ate. We were trying to determine what they ate, so we had to inventory that, and we were working on the menus for the flight food. We were working on the menus for the next—the MQF menus. We had to make sure that food got delivered to us in time, and they had the menus selected. The crew got to pick the menus for both of those. So we were really involved in a lot of different things.

ROSS-NAZZAL: Were there any foods that often came back from the crews that they just particularly didn't care for?

BOURLAND: Back in those days a good percentage of it. They were only eating about 40 percent, 30 or 40 percent of the food. They weren't eating very well at all. Some of the things that routinely came back were the bite-sized things of cubed food that were coated with a coating. We even had some cubed, freeze-dried sandwiches that didn't go over at all, but they kept sending them up for several times, because we really didn't know if they didn't eat them because they didn't want them. We found out later most of the time the reason they wasn't eating them is because they didn't want to go to the bathroom. That was the main reason, or one of the reasons they were not eating, because bathroom facilities were so bad that they'd do anything they could to keep from having to go to the bathroom.

ROSS-NAZZAL: Oh, my goodness. Did you come up with some sort of liquid diet or something to help them control that?

BOURLAND: No. In fact, when I first came to work, we were looking at ways to make the food lighter and more dense, and they were even using a term called caloric density, trying to figure out the calories per gram or calories per pound of food, trying to increase that all the time. Actually, the only way you can do that is to add fat, but I don't know how come we were doing that. But we were looking toward the goal of the meal in a pill. That was what the astronauts

wanted to do is to just be able to take a pill and not eat. But we can't do that. We found out later that doesn't work.

ROSS-NAZZAL: Why don't you tell us about working with the Apollo 13 crew. Did you work more closely with them since you were working on the earlier menus?

BOURLAND: I didn't work with them that close before the launch. Rita [M.] Rapp took care of most of that interface with the crew, and we just prepared the food for them and did all the menu work after that, so I wasn't that involved with them until they came back on board ship.

ROSS-NAZZAL: Do you recall what some of the food was that the crew for Apollo 13 preferred?

BOURLAND: No, I actually don't remember, because they didn't eat the food after they got back. They ate the ship's food, because they ate in the wardroom with the rest of us, because they didn't go to the Moon and they weren't in quarantine.

ROSS-NAZZAL: But you had the opportunity to go back on one of the recovery ships.

BOURLAND: Right.

ROSS-NAZZAL: What ship was that?

BOURLAND: That was the [USS] *Iwo Jima*.

ROSS-NAZZAL: Were you still working on your Ph.D. thesis?

BOURLAND: No. I completed that.

ROSS-NAZZAL: So what did you do this time during those thirty days while you were at sea?

BOURLAND: We didn't spend thirty days that time. It wasn't quite that long, maybe two weeks. We read a lot of books, big, thick, four- and five-hundred-page books. Everybody would grab those and read them, and played a lot of cards. There were a lot of TV personalities on, and it was always fun to play cards with some of those guys, like Charles Murphy I remember was on there. We'd play hearts with him, and we'd pass him the queen, and he'd just go into a tantrum. You knew who had the queen when somebody passed it to him.

ROSS-NAZZAL: What did you do after the Apollo 13 mission?

BOURLAND: Well, I was going to mention one thing on the Apollo 13, that Jim [James A.] Lovell [Jr.], had always been my hero, because when they came back on board ship, Fred [W.] Haise [Jr.] was sick. He was really sick. He had diarrhea, and he had a kidney infection and fevers and I don't know what all, and Jim Lovell had gave him most of his water, because he needed the water, and Jim gave him his share of the water that they had divided up. Then John [L.] Swigert [Jr.] didn't say anything. He just walked on board and didn't say anything. Then Jim Lovell walked over to a lectern and gave a speech, just like he got off a bus downtown, and

came up, and after all that, and he thanked everybody and just gave a wonderful speech. I couldn't believe that anybody that had been through all that could walk up there and give a speech.

ROSS-NAZZAL: Was there a great deal of concern while you were on the ship about the lives of these crew members?

BOURLAND: Quite a bit, but probably not as much as there was here, because we didn't have that good of communication. We only got a communication link about once a day, so we really didn't know what was going on all the time. It wasn't like today where you can just turn on a receiver and find out what was going on. They had to set up a satellite dish and get it lined up just right, and then we'd only be able to communicate an hour or two a day, and that was it. So we really didn't know everything that was going on.

ROSS-NAZZAL: So once you returned back to Houston, what were some of your other activities that you were working on?

BOURLAND: We got involved in Tektite fairly soon after that. I can't remember when. That was pretty soon; I think that was in the seventies, in 1970. We had a project called Tektite, where we were supporting divers down in the Virgin Islands. We were working on that project. We were also working on advanced Apollo missions; that was a precursor of Skylab. We were doing planning efforts on that, trying to develop a food system for that. We had a lot of contracts with

a lot of universities, and they were coming in every week or two giving reports, and we were involved in working with them.

When I first came to work, there was only seven of us in the food lab, and we were sort of the troubleshooters for the food lab. If the main contractor, Whirlpool, had a problem with the food, developing a food, then we would help them. If the astronauts had a problem with the food, we would see what the problem was and see if we could resolve it and tell Whirlpool what to do to correct the problem. So we spent a lot of time just troubleshooting.

We also prepared a few foods for the Apollo missions. We packaged pecans. I don't know; somehow we got in with the people at Texas A&M [University, College Station, Texas], and we were providing packages of pecans, and provided them for the missions. We packaged fresh bread. That was the first time we had real bread, and we had to package that here, because it didn't have that long a shelf life, and we'd package it before it went up on the mission.

ROSS-NAZZAL: Let me go back and ask you a couple of questions about all these assignments that you were working on. Can you tell us some more about Tektite? Who was sponsoring that project?

BOURLAND: That was the U.S. Navy and the University of California—I'm not sure which university was involved in that—and the University of Texas [Austin, Texas] was involved in that. It was a saturated diving experiment. They had a habitat about fifty feet below the water, and aquanauts would go down there and stay for thirty days at a time, and then we supplied the food for them.

ROSS-NAZZAL: How was the food different or similar to the food supplied to the Apollo astronauts at that time?

BOURLAND: We used frozen food for the saturated diving, for Tektite. All the time we were working toward the frozen food system.

We had an interesting experience with that, too. We rented a freezer in a local town down there in the Virgin Islands, not knowing that the electricity would go off for sometimes a week at a time, and nobody bothered [to tell us]. So we got a call from the people down there and said, “The food has got green stuff on it.” We went down there and checked it out, and come to find out the electricity had been off for I don’t know how long. It’s a wonder we didn’t kill somebody, because all that food had thawed out, and they even let mold grow on it, and then they froze it back up and sent it down there for the poor people to eat. So then we had to rent a refrigerated truck and a generator to keep our food down there, because the electricity was just not dependable enough to keep it on the local level.

ROSS-NAZZAL: Who else was working on this project with you?

BOURLAND: At that time we had—let’s see. Well, in the beginning we had Glenda Lawrence [phonetic] was the dietitian. Had Gerald Swaney was the packaging engineer. [Joan] Johnson was a technician. Mildred Bass was the secretary, and Jim Bednarchek was a technician, laboratory technician. Then Dr. Clayton [S.] Huber was our boss. That was on the Technology Incorporated side, and on the NASA side, we had Dr. Malcolm [C.] Smith, Dr. [Paul C.] Rambaut, and Rita Rapp. [Dr. Norman D. Heidelbaugh joined the NASA team around 1970.]

ROSS-NAZZAL: Do you know what eventually came of the program itself?

BOURLAND: They just demonstrated that for two or three times, and then it's come back years later in different forms, but it's still—I don't think anything has come of it. NASA is doing a similar thing down there now down in Florida with the underwater habitat.

ROSS-NAZZAL: I think it's NEEMO [NASA Extreme Environment Mission Operations].

BOURLAND: Yes.

ROSS-NAZZAL: You also mentioned that you had a lot of contracts with universities. Can you tell us about one or two of those contracts that you recall?

BOURLAND: Well, one I remember was the University of Nebraska, of course, is the one that sent me the job. They were working on radiation, and we did irradiate some of the bread that we sent out, and irradiated some flour that they made the bread from, so they were working on irradiated products for NASA. MIT [Massachusetts Institute of Technology, Cambridge, Massachusetts] had contracts working on freeze-dried foods, to try to improve those foods. I can't recall; there were several other universities. I can't remember who all was working at the time.

ROSS-NAZZAL: What was the purpose of irradiating food at that point?

BOURLAND: Well, for the bread, it was to keep it from mold and keep bacteria from growing, because it was a handy way to sterilize food without changing the form or anything. You don't have to heat it or you don't do anything to it, and it's ready to eat, whatever you do to it. We eventually ended up having irradiated food on Shuttle. We did have one on Apollo 17. We had irradiated ham that went up.

ROSS-NAZZAL: Let me ask you about troubleshooting. What do you recall that you troubleshooted most often? You mentioned, for instance, if the astronauts had some trouble with the food or complaints, you went back and would research that and try and come up with the solution.

BOURLAND: Yes. I don't know. I can't remember on Apollo. Probably on Apollo, too, but most of the complaints we get, on Shuttle, at least, was that the food was packed too tight, because they'd get it. They'd take a package out, and then they can't get it back in, because they always asked for more than would go in the container, so we put it in there, and then when they get up there they can't get it out. So that was one of the problems.

[When the Apollo 15 astronauts had heart fibrillation problems while walking on the Moon, the medical community decided that the astronauts were deficient in potassium and asked the space food folks to boost the potassium level in the food. I was assigned the task of determining which potassium supplement we should use and how much should be added to the food to reach the levels recommended by the flight surgeons. Potassium gluconate was chosen as the supplement and was added to many beverages and some soups.]

[NASA gave me an award for the work on the potassium supplement, but it gained more notoriety when the potassium laced Tang leaked into Charlie Duke's space suit while he was walking on the Moon. That was the first and last time the food folks were allowed to put anything in the in-suit drink bag in the space suit.]

One of the troubleshootings that I got involved in pretty directly was when Apollo 13 was on board ship, I went out. I was there, and they were working on the command module. It wasn't quarantined or anything, so I could go up there and look in. So I was up there, and I stuck my head inside the thing, and it just reeked with this odor from these pills that were used to put in the food to keep it from spoiling after they ate it, and put it in the empty containers. It's called 8-quinolinal sulfate [phonetic]. It's really an acrid, awful smelling. It's worse than any rotten food, in my opinion, but NASA had developed that system a long time ago, and they had been using it forever, to put those pills in there.

Apparently the astronauts were in this closed environment and got saturated with this odor and didn't even realize it was there, but it was really bad. So when I came back, I said, "We need to do something with that pill." So they assigned me to do some research to see if we really did need it, and I determined that we didn't. So eventually we took it off and never did use it after that.

You mentioned you had some of Rita's files. She kept some of those pills in those files for years, and the last time I smelled those files, they smelled like those. So if you smell something that smells like—I don't know if you know what Quinsana foot powder smells like; it's the same ingredient. It's probably not even around anymore, but it smells pretty bad. Her files smelled like that for years, because she kept those pills in there with them.

ROSS-NAZZAL: I'll have to see if I run into any while I'm searching through them. [Laughter] Goodness. Well, I was looking over your résumé, and I noticed that you also directed some microbiological and chemical research projects. Can you tell us about some of those projects?

BOURLAND: That was one of them. I determined what would grow and what the odor would be if we didn't put anything in the food, so that was one of the projects that I did. Some of the others I'd worked on trying to work on the microbiological standards. We had real strict standards, and the whole time I was there I was trying to relax those standards, because I thought they were too strict. Eventually [I] did, but it took me about fifteen years to get them relaxed a little bit. Because we were essentially feeding sterile food with the standards that they had, and people don't need sterile food. We probably need a few organisms just to keep our immune system responding.

ROSS-NAZZAL: Can you explain what some of those initial standards were when you began?

BOURLAND: Yes. The total aerobic count was 10,000, less than 10,000 per gram. I don't know if you're familiar with microbiology, but to get less than 10,000, it's essentially you get sterile because you dilute it out, and you're counting if you get one organism there. If you get two organisms, you've probably got over 10,000, so it's essentially a sterile system when you say less than 10,000.

ROSS-NAZZAL: How would you ensure that the food was sterile? Can you explain that?

BOURLAND: They'd test it. After it's produced, you test it and then determine what the count is, the microbiological count.

ROSS-NAZZAL: Other than testing the food after it was prepared, how else did you ensure that the food was safe for the astronauts to eat on board?

BOURLAND: That was essentially it. The prime contractor was responsible for testing and supplying us with the data, so we didn't actually test the food. They either tested it themselves, or they sent it off to a laboratory and got it evaluated.

ROSS-NAZZAL: Since we're sort of at that point, I did want to ask you about the hazard analysis and critical control point [HACCP], and it seems like an appropriate spot. Can you tell us who was involved in creating that concept, and then what that concept is?

BOURLAND: Yes. It happened before my time. I always tell everybody it didn't happen on my shift, so I can't take credit for it. It's my understanding that Pillsbury and the U.S. Army and NASA were working on trying to develop a method to produce food that would be almost 100 percent sure that there was no problems with it, no hazardous microorganisms or anything. Well, to do that, the way they had started out is you had to test it all. If you want to make 100 percent sure, you've got to test 100 percent of the food. But when you test it, that destroys the food, so you don't have anything left.

I'm not sure how this came about, but I think it probably was following some of NASA's processes that they had used for equipment, for flight hardware; and they probably got theirs

from the airplane industry. So NASA had a system. They still do it today. They do a process; they have mandatory inspection points, which you come to a place in a process that it's mandatory that you do this test or look at this or do something, and you have an inspector verify, "Yea, verily, this is true. They did do this."

Well, if you look back, that's a critical control point, which is the same thing that—where this came from. Pillsbury was involved in this, and they were doing some of this while they were producing the food. Then I think it sat on the shelf for maybe ten or fifteen years, and then somebody happened to look at that and said, "You know, we could use that in industry." So they started doing it themselves, and then they started promoting it, and it's worldwide now. There are books, and I get an announcement about every two weeks for another class on HACCP, so that there's all sorts of—everybody in the world is using it.

But to give you an example of how that works, I used to work in a dairy plant before I went back to graduate school. We would produce milk, and then they would send it up to the laboratory, and I would test it. Well, by the time I got my results back, the milk was already on the market, and probably consumed. Sometimes we'd get a test back, "Oh, yeah, it's got coliforms." Coliforms is an indicator that there may be something wrong. But it may not be, so if I got coliforms, then I have to test the coliforms to see if there's really *E. coli* in there or not. By that time, seven or eight days were gone, and the milk was probably all gone by the time I found out there was something wrong with the milk. And that's the way everybody in the food industry did it. They produced a product as best they could, and then they tested it to see if it met the standards.

Then they come along with the hazard analysis and critical control point, and they said, "Let's look at where we have a potential problem, and either put a person in responsible for that,

or have a recorder or something.” For example, on the milk, one of the problems would always be the temperature of the pasteurizer. So you record that, and you have somebody witness it and make sure that it’s always working, and then you know that you’ll never have a problem with the temperature, because it’s always, always there. That’s a critical control point, and you monitor that, and you do that.

One of the strange things is NASA still doesn’t use the HACCP plan. If you went out and had somebody that was good at HACCP analysis, they wouldn’t like the way NASA is doing it, because we’re not doing it the way they recommend that you do it. We’re still doing it by NASA’s way, because you can’t change the way you do—it’s a process just like flying hardware, so it’s got to go through all these loops in order to get to the end product. We’re doing the basics. We’re doing basically the same thing, but we’re not doing it like they like for us to do it. We’re doing it the way NASA wants us to do it, and it’s been done that way all the time.

ROSS-NAZZAL: You mentioned that it’s had a worldwide impact. Do you have a sense of what impact it’s had on commercial industry itself?

BOURLAND: Oh, I think it’s mandatory. The Food and Drug Administration makes it mandatory for a lot of food products. Anything that’s shipped in from overseas, it’s mandatory that they follow the process. It’s worldwide. You talk to anybody in the food industry in the world, and they all know what HACCP is.

ROSS-NAZZAL: Something that I’ve read suggests that this is one of NASA’s best spin-offs. Do you think that it is?

BOURLAND: Yes, I'm the one—one of the people that says that it's probably NASA's best spin-off, in the food area, at least.

ROSS-NAZZAL: Why do you think that is?

BOURLAND: Well, it's saved more lives and saved more food products and made things a lot safer than we could ever think about doing any other way. We'd have a lot more food illness and food spoilage and everything else if we didn't have this process in effect today.

ROSS-NAZZAL: Let me go back and ask you just a couple more questions. Where was your office located when you first moved down here?

BOURLAND: I was in Building 7 on the third floor. I moved around several buildings while I was here, but we started out in Building 7 on the third floor, and we weren't very well liked. We had a freeze dryer up there that occasionally, if you left it on overnight—and you have to run them overnight usually to run them—something would happen to the drain on the thing, and it would flood the building. So we flooded the people on the second and first floors, and they weren't happy with us. We did that a couple of times that I remember doing.

ROSS-NAZZAL: Can you talk to us about some of the facilities and tools that you would use to do your job during the Apollo Program?

BOURLAND: Yes, we had a pretty small laboratory back then. Just had some benchtops and some scales, and the most advanced piece of equipment, we had an amino acid analyzer. That was here when I came here. I'm not sure why they got that, but we were doing a lot of work in amino acids. We were analyzing all the space foods for amino acids. That was about the extent of the laboratory equipment we had. We had a little hood there that we processed food in. It was just a UV [Ultraviolet] hood; it wasn't really a clean bench or a clean hood.

ROSS-NAZZAL: Were there any other facilities that you used at that time?

BOURLAND: No. If we wanted testing done, we could send it to Building 37. They could do testing for us, like a microbiology test.

ROSS-NAZZAL: What was in Building 37 at that time?

BOURLAND: That was called the Lunar Receiving Laboratory, and they had all this equipment over there for analyzing things, Moon dust that came back from the Moon, Moon rocks. They did an unbelievable amount of testing, on growing crops and plants and raising rats and all kinds of animals and everything else, on Moon dust to see if it bothered them, to see if there were any effects from it.

ROSS-NAZZAL: You mentioned Whirlpool. How closely did you work with some of the other contractors during the Apollo Program?

BOURLAND: Well, Whirlpool was the main food contractor, and I didn't work with them real close. When they came down here, we had meetings and talked to them, but I never did go to Whirlpool. Some of the NASA people usually went to Whirlpool when they had meetings up there, but I never did get to go to their facility.

ROSS-NAZZAL: How closely were you working with some of the civil servants, like Malcolm Smith and Rita Rapp?

BOURLAND: Oh, we were daily working together with them.

ROSS-NAZZAL: What was your typical workday like during the Apollo Program?

BOURLAND: It's hard to tell. That's what was so exciting about it; we didn't know what we were going to be working on from one day to the next.

I worked a lot with Rita Rapp. I remember one of the first things, we came down. She was working on something. We were going to wrap some food in a special film [Kel-F]. ... It's real expensive. It's like \$5,000 for just a little roll. And she told me and said, "Go over to this bond room in the next building, and get some of this film." So I went over there, and the guys about got in a fight, because she didn't have the right paperwork. She told them she didn't care what the paperwork was; she wanted the film. We eventually got it, but I couldn't believe that they were so involved over this piece of film. But I went over there and got it for her, and we brought it back. We were packaging some bread or something.

ROSS-NAZZAL: Can you talk to us about some of the different packaging of the Apollo food system?

BOURLAND: Yes. It was probably overpackaged. They had developed a package called a spoon bowl package for the dehydrated foods, and it was really a complex package. It took a lot of labor. It had seventeen parts, I think, in it, and about thirty steps in making the package. The meals then were overwrapped in a foil; all the food was vacuum packed and then they put it in a meal form and then vacuum packed that meal. So it was just like a brick by the time it was ready to send up on the spacecraft.

ROSS-NAZZAL: What do you think were some of your biggest challenges while working on the Apollo Program?

BOURLAND: To get rid of the pill, was one of my biggest challenges. It was a big challenge to try to relax those microstandards, and I didn't do it then. I never did get that done. I always thought we should. Being a microbiologist, food microbiologist, I thought we had too strict of standards. So I didn't get that done, either.

We didn't really try to change the packaging that much, although we did introduce a few. Canned products were introduced while I was there, but commercial cans, pudding and things like that.

ROSS-NAZZAL: What was the mood like at MSC when the Apollo Program began to wind down?

BOURLAND: I think some of the people were sort of rejected, but the food people weren't. We were busier than ever, because we were working on the Skylab Program when that was winding down. We were really gearing up. [For] the Skylab Program, we had more people working in the food group than we've ever had in the past.

ROSS-NAZZAL: How many people started working in your lab? You said you had seven during the Apollo Program. How many more people were working with you then in Skylab?

BOURLAND: When we got into Skylab, we were up into thirty-some people, because Technology Incorporated was doing all of the analysis for the food. We had an analytical lab just down the street here on El Camino [Real].

ROSS-NAZZAL: Can you tell us about doing the analysis on the food?

BOURLAND: Yes, it was really a big, big project. Part of the time I was in charge of the lab; most of the time I wasn't. I was doing other things. But I was involved in getting it set up. We had to analyze for thirty-seven different nutrients, and we had to make sure that we were using the most latest and most recent technology and we had the most recent equipment to do that with. So we spent a lot of time with consultants, and we went and visited a lot of laboratories to make sure we had the right equipment and the right processes. And then even some of the processes, several of the processes, would not meet the demands that they wanted for the food system. They wanted it to be within 2 percent accuracy, and a lot of the analyses that were done at that

time weren't near 2 percent. Some of the vitamin analyses and some of those things that they did wouldn't be within 2 percent, so we had to refine a lot of those techniques to get them down to 2 percent.

ROSS-NAZZAL: You said that you were in charge of getting the lab set up. When did that start?

BOURLAND: It was right after the last Apollo, 17, I guess, we started getting geared up for that. In fact, we were doing some of the analysis on Apollo 16. For Apollo 16, we were doing some of the sample collection when the astronaut—before the flight we had to collect all the urine and all the feces, and since we were qualified to get into the crew quarters, they decided that, well, the food people can collect the feces, and they can collect the urine, and so we did all of it. I remember I was walking down the hallway down at the Kennedy Space Center one day with this ice chest, and this lab tech knew what I had in this ice chest, and he said, “Oh, Dr. Bourland.” He said, “Where did you get your degree?” [Laughs]

ROSS-NAZZAL: Kind of a messy, smelly job, I guess.

BOURLAND: Yes, but we had to work out a technique for collecting. We had to have special little things to put in the stool so you could collect the stuff, and we had to work all that out before Skylab. We did have that all worked—or part of it worked out. We tested it; did a run on it for Apollo 16 and Apollo 17.

ROSS-NAZZAL: Not to disgust our readers, but can you tell us about some of those collection methods that you came up with to gather the waste?

BOURLAND: It was sort of a little bag device that sat on the stool, and then they could collect it and then just seal it up. We had an ice chest in the bathroom so they could put it in the ice chest when they got done, with their name on it.

ROSS-NAZZAL: And this material was used for biomedical research?

BOURLAND: Right. We analyzed that. We analyzed it even [the] in-flight material. They brought it back from Skylab, and [we] analyzed it.

ROSS-NAZZAL: Tell us about the six major food-related projects that you helped direct, plan, and evaluate in the early seventies. I was looking through your résumé, and it had mentioned that you worked on evaluating six major—let's see—[reads] “six major food-related projects at NASA JSC.”

BOURLAND: I'm not sure of my own résumé, what—that must have been a summary of projects. We worked on the food for the elderly program and Tektite. Maybe I was summarizing those. I'm not sure what that was.

ROSS-NAZZAL: Okay. Did you have any involvement with SMEAT [Skylab Medical Experiments Altitude Test]?

BOURLAND: Oh yes. We supplied the food for SMEAT. Well, Whirlpool supplied it, but we ordered it and delivered it to SMEAT, and we recorded the nutrient intake and monitored everything that was going on.

ROSS-NAZZAL: What did you learn from SMEAT that you then applied to Skylab?

BOURLAND: I don't think we—we didn't apply a whole lot. One of the problems we had with SMEAT is that Bill [William E.] Thornton was in there, and he claimed that we starved him to death, that we didn't give him enough food. I don't know if he mentioned that in his interview or not, but he said we didn't provide him enough food. Well, he was riding this exercise machine, and he wore out two or three of them while he was in there. Then when he came out, he wore these pants that he normally wore that had about two inches of slack in them, and had his belt turned up, and he was walking around the Center saying, "Here's what the food people did to me." [Laughs]

He was irritated at us at first, but then later on he became a good friend of us and was over in our lab quite a bit. But at that time he thought we were starving him and didn't give him enough food and that we made him sick. He thought one of them was contaminated, and he got sick from it, but we didn't have any results that showed any of it was contaminated.

ROSS-NAZZAL: How did the Skylab food system differ from the Apollo food system?

BOURLAND: The food types were basically the same, but it was all canned. Everything was put in metal cans, and then the metal cans were placed in a metal canister, so it was really, really overpackaged. But one of the reasons it was overpackaged is that the atmosphere on Skylab was five pounds per square inch [psi], so if you package a food down here at fourteen psi and take it up to five, then it will—what—blow up, I guess.

So we had to package it down here. Whirlpool packaged it at five psi. If there was any air space in the can, they had to be packaged at five psi. Then they put it in this canister, and then you could transfer the canister back and forth. It had strong metal in it so it would withstand the pressure changes, but the cans were just little, thin aluminum cans, and they would pop if there was a pressure change. So in the case of a freeze-dried food, the freeze-dried food would be in a plastic pouch inside a can, and the can was inside a canister. All the food was in these canisters that went up there.

ROSS-NAZZAL: That is a lot of packaging.

BOURLAND: It's a lot of packaging, and a lot of weight involved in the food system. But there wasn't really a concern with weight on Skylab, so it didn't make a lot of difference.

ROSS-NAZZAL: Were these pull-tab cans?

BOURLAND: Right. It's what you call full panel pull-out lids.

ROSS-NAZZAL: The Natick Laboratories [Natick, Massachusetts] were heavily involved in some of the earlier food systems. Was the military at all involved in the Skylab food system?

BOURLAND: Yes, they were involved. Throughout my whole career we were involved with the Natick, one way or another. Most of the time they would come down once a year and show us their new products, and sometimes we would go up there, once a year at least, and see what they had and look at their new products. On Skylab they made the bread. We had baked bread but baked inside a can. I guess they baked it and then sealed the can, and that was the fresh bread that was on Skylab was made by Natick, and they were involved in a lot of development of a lot of the food, but they actually produced that one, the bread one.

ROSS-NAZZAL: What were some of the challenges, if any, that you faced while working on the Skylab food system?

BOURLAND: We had a lot of challenges. When we started out, we thought we would have a— and this sounds familiar, because it happens; every day of a mission we had the same problem. We decided that everybody would have the same menu, and then about the second or third time the crew tasted the food, they said, “No, I don’t want to eat the same thing he’s eating. I want to choose my own menu.” So then we had to work around that, so everybody got to choose their own menu.

ROSS-NAZZAL: Were there more choices on board Skylab than there were during the Apollo Program?

BOURLAND: Probably not. We only had seventy-two food items total. There weren't that many choices, but the variety was better. About 15 percent was frozen, so you could have a frozen dish once a day I think is what it amounted to, if you wanted to. They had ice cream and lobster Newburg and several good frozen foods.

ROSS-NAZZAL: One of the things that I've read, and you actually have written up, that there was the possibility of putting wine on Skylab. Can you talk to us about that?

BOURLAND: Yes. There was an interest in getting wine on board. A couple of I think they were backup astronauts were supporting the idea that we should have wine, and they wanted us to test the wine and select the wine for the project and do the packaging for it. Well, my boss was a Mormon, so he said, "Dr. Bourland, I think you should be in charge of the wine program."

I said, "Okay, that's fine with me." Then word got out that we were interested in using wine, and we got a lot of samples kept coming into the laboratory to evaluate. But I ended up talking to the University of California, one of the experts out there, and he told us that we should use a sherry, because it's been heated during the process and it's more stable. If you open it up, it won't deteriorate. So we decided to use a sherry, and the one we chose was Paul Masson's [phonetic] rare cream sherry. We even took this up on a zero-G plane. We had a package, and we'd taken it up on a zero-G plane testing the package.

There's a lot of different side stories. An interesting side story up there is when you open this wine—I don't know if you've been on a zero-G plane. Whatever you open, it just immediately saturates the cabin with that odor, whatever it is. As soon as you open the wine,

you see people grabbing for their barf bags. For some reason, it just turns on the barf mechanism.

But anyway, we did have a package. We were going to put it in a pudding can. We had a plastic pouch inside the pudding can, and we were going to use that. I ordered enough rare cream sherry for the whole mission, for Skylab mission. I don't know if that's ever been done before. I ordered it on a government purchase order, and they delivered it out here to the Johnson Space Center. It was ready to go. We didn't actually package it; we just had everything ready.

Then in the end, they surveyed the crew, and it was about half and half. They didn't really care. Most of them said they didn't care if they had it or not, and then NASA was afraid of the response of us serving wine on board a Space Station, so they decided to cancel it. So we drank all of the cream sherry. We had to feed the astronauts three weeks before each mission. They were on a special diet for three weeks, and they had to eat over here at the Johnson Space Center in a trailer. So we served that wine during that three weeks before the mission. The crew and the backup crew were both eating, so they got to drink all the wine.

ROSS-NAZZAL: Is there a reason why NASA still hasn't flown alcohol on missions?

BOURLAND: I don't know; probably the same reason that was then. They're afraid of the public response, I think, is the most.

ROSS-NAZZAL: I also read that you helped with the controlled astronaut food for Skylab 2. How was that different from Apollo 12 and Apollo 13?

BOURLAND: We were feeding them the Skylab menu then. They had to eat the same food three weeks before and two weeks after they got back home so we just ended up taking the food out on the recovery ship and serving them the same food that they had been eating all along, so there wasn't anything different. They could have salads, and things that didn't have minerals in them they could eat. They were basically on a mineral-restricted diet. They had seven minerals that they had to maintain an exact level of, and they couldn't go beyond that.

One of the things that were fairly famous on Skylab was the butter cookies. I don't know if you read about butter cookies, that they were trading them and all that. They were one of the foods that they could have, because there was very few minerals in those butter cookies. We actually made the butter cookies here at the Johnson Space Center. We worked one Saturday over in the Building 3 cafeteria, borrowed their equipment, and made and packaged all the butter cookies for spaceflight.

ROSS-NAZZAL: What were those seven minerals, do you recall?

BOURLAND: I don't know if I can remember them all. Sodium, potassium, calcium, phosphorus, zinc, [protein, and magnesium]. ...

ROSS-NAZZAL: ... Is there anything else you think we should talk about, about Skylab?

BOURLAND: Well, I was going to mention on the recovery ship for Skylab, when they landed on deck, Joe [Joseph P.] Kerwin was ill from being bobbed up and down in the ocean, so he had

motion sickness. Then he decided he wanted a butter cookie, so I got him a butter cookie and handed it to him. He took a bite out of it, and then just turned it loose, and it fell down on the deck of the ship. He watched it go to the deck, and he said, “Oh, I forgot.” [Laughter] So I guess they have to learn that things will fall if they drop them when they get back to Earth.

ROSS-NAZZAL: What ship were you on for that mission? ...

BOURLAND: [USS] *Ticonderoga*.

ROSS-NAZZAL: How much time did you spend on board the ship? Was it shorter than the amount of time for the Apollo?

BOURLAND: Yes, it was shorter. We just went a few miles. That one went out of California, and we just went a couple days' sailing out of California and picked them up out there.

ROSS-NAZZAL: You weren't required to be out there the whole time the mission was up there.

BOURLAND: No. No, not—I don't know what the plan was for recovering them when they launched. There must have been a Navy ship out there, but we weren't out there. I'm sure they had a Navy ship watching, though, but the NASA crew wasn't out there.

ROSS-NAZZAL: Well, let me ask you about ASTP [Apollo-Soyuz Test Project]. On your résumé you indicate that you were the project leader for the Food Depot. What is the Food Depot? Can you describe it?

BOURLAND: In the past NASA had used Whirlpool as the contractor to provide all the food, and at the end of Skylab the contract ended. NASA decided that we would do this food processing in-house. It would be a lot more convenient, less expensive to take care of right here where we could watch what was going on. They gave us a building. We ended up in Building 36, and they started shipping all that equipment in that Whirlpool had used and that had been modified for the last fifteen years. It came in with virtually no instructions. So we had to figure out how it worked and write up processes for packaging all the food and getting it to work.

The first thing we did was put wheels on it, because we knew NASA was going to move us around. We didn't last very long in [Building] 36. They moved us over into Building 37, and that's where we ended up as our final home; we stayed in Building 37. The Food Depot concept was it would be the place where all the space food was produced. It would be done in-house by NASA and NASA contractors, and we'd have a lot more control over it, and we could maintain the inventories, and if astronauts wanted to taste something, we didn't have to wire Whirlpool and have them send samples down. We could just go over there and get it. Everything was a lot more convenient.

But it was a lot of work getting the facility approved and getting the clean benches in and clean booths, and then getting all equipment, figuring out how it worked, and making it safe. Some of it wasn't even safe, according to our Safety people, so we had to modify some of that to make sure it was safe.

ROSS-NAZZAL: Is this equipment still used today, or is the process still used today at JSC?

BOURLAND: The process is still used. The equipment, most of it's been replaced. Some of the equipment, like we had a piece of gear that made that Apollo spool bowl package, and that was used through the first few flights of Shuttle, even. It went all the way up through [early] Shuttle, because that's the only package we had at the time. It was a monster machine. The technicians called it "Puff, the Magic Dragon." It was a big, long thing, and you put a roll of film in it, and it [was] air actuated, and it would go puff, poof, and roll the thing out and seal it. Then another puff and a poof, and eventually you'd get this package come out at the end that was partially ready to be assembled. Then we had to put all the other components in that package. It was very labor-intensive to make all those packages. Now we've modified all that for Shuttle, so it's not near as complex.

ROSS-NAZZAL: Did you increase the amount of workforce then, since you had all this equipment and you were doing everything in-house?

BOURLAND: No. Actually, after Skylab, our workforce dwindled down to very few people. I think we probably got up to ten or twelve people during the Shuttle. Even when we were producing all the Shuttle food, we didn't have that many people working on it.

ROSS-NAZZAL: Your résumé also indicates that this food system was used for a food system for the elderly?

BOURLAND: Yes, that was after ASTP. Then we kind of didn't have anything to work on, because Shuttle was coming along, but it was several years away before we had any Shuttle projects. Somebody came up with the idea that we should use the space food technology to feed the elderly, like the Meals on Wheels concept, except this would be shelf-stable foods that they wouldn't have to have refrigerated. It could be delivered by the postman or by UPS [United Parcel Service] or whoever, however they wanted to get it out there. They could deliver a month's supply at a time.

This was a project with the University of Texas and NASA, I guess. There might have been somebody else involved in that. Some of the congressmen got fairly involved in that, and they were promoting the idea that we do this. We did a demonstration test, and we supplied 10,000 meals on the final demonstration. But then it didn't go any farther than that. But I remember Senator [Hubert H.] Humphrey was very responsive to this, so I got to meet him. We went to a meeting in Washington, D.C., and he was there promoting this concept. He liked the idea.

ROSS-NAZZAL: Do you recall some of the meal options that you were going to give the elderly?

BOURLAND: They were similar to the space food. Most of it was freeze-dried, and there were a few canned items in there. It was a little packaged meal that came in a little cardboard package, kind of like a McDonald's thing, which you could open it up and had instructions in there for adding water. You didn't add the water in the package; you could put in your own cooking utensils and heat it up.

ROSS-NAZZAL: Did any of the congressmen come out for a taste test?

BOURLAND: I don't recall anybody tasting that. They could have, though I don't remember anybody.

ROSS-NAZZAL: Did you get a chance to go over to the Soviet Union while you were working on ASTP?

BOURLAND: No. I got to meet the cosmonauts. They were here. I do remember, they'd come by and they toured our laboratory in Building 37, and we gave them a sampling of the food. We gave one of them a sample of peanut butter, and I'll never forget that. They don't normally eat peanut butter, and I guess this guy had never eaten peanut butter. He almost gagged when he got it in his mouth and he couldn't get it out, and he was spitting and hacking. [Laughs] Didn't know what it was, so he didn't like that at all. It wasn't a normal food for them.

ROSS-NAZZAL: Did you get a chance to see what some of the Soviet food was like and do sort of a comparison between the U.S. and Soviet food systems?

BOURLAND: Yes, we had samples of food. Somebody brought samples back. I'm not sure how it got back over here, but we had some samples here.

ROSS-NAZZAL: Do you recall how cosmonaut food differed from astronaut food at that point?

BOURLAND: The technology they were using was basically the same. Their packaging was a little more crude than ours, but I have a photograph that we took in 1972, and it's not any different than Russian food in 2006; it's the same packaging. They don't change anything. There's metal cans that you have to open with a can opener, a drink package that's essentially open on both ends. Once you get it rehydrated, you have to hold it, and you're always spilling liquid if you're not careful. But they apparently have a concept if it works, don't fix it, so they haven't changed their—changed some of the ingredients, some of the components, but the packaging hadn't changed hardly at all.

ROSS-NAZZAL: And the astronauts and cosmonauts, were they swapping food up there on ASTP?

BOURLAND: They had a meal together. I think our crew went over to their side. I don't know if they came over to our side or not. I think our crew went over to their side, and they had a meal together.

ROSS-NAZZAL: Is there anything that you learned from ASTP that you later applied to the Shuttle-Mir Program?

BOURLAND: Probably not. We didn't learn that much from working with the Russians in the food area at that time.

ROSS-NAZZAL: Let's talk about the Shuttle food system. When did you begin working on that?

BOURLAND: Some people were actually working on the Shuttle food system while we were working on Skylab. We had a guy that was assigned to NASA; he was an Air Force colonel, [Dr.] Norman Heidelbaugh, and he was working on the Shuttle food system while we were working on Skylab. He was always way ahead, doing things far in advance, and he was working on the Shuttle concept then. He had the concept of having open containers and a meal tray to eat from.

ROSS-NAZZAL: Can you tell us how the Space Shuttle food design evolved over time, give us a sense of that?

BOURLAND: Yes. The packaging is the thing that changed mostly. We started out with a square package that was an injection-molded little square package. You put the dehydrated food in, and it had a place to insert the water. We spent a lot of time—a lot of research on getting that right device to put the water in so you could put water in, and it wouldn't come back out the hole that you put it in. We developed a little septum that goes in there, so you could put the needle in, add water, and then it won't come back out.

Then we used that same package for the beverage. All we had to do was put a top on it that would billow up when you fill it up, put the water in, so it would rise with the water, and it was our beverage package. We thought that was really a neat concept. We didn't get that on board until about STS-5 or so. We started out with just the plain old Apollo packages, because our package wasn't ready yet. General Electric [GE] was working on the package design for

this. We used that package for several missions until they started putting a lot of crew members on board, and then they decided that it was generating too much trash, because even though you could nest them, it still accumulated a lot of trash, and you couldn't compress it, because they were pretty strong packages. So eventually we had to change those out to a flexible package that they use now.

ROSS-NAZZAL: And those can be laid flat?

BOURLAND: Yes, they're just a flexible film, so they can be compressed or whatever.

ROSS-NAZZAL: Why don't you tell us some more about the hardware, because I understand that you supervised the development of things like the medical kits, the food warmer, and some other miscellaneous hardware.

BOURLAND: Yes. It's hard to believe that this little group—we had about ten or twelve people—we were producing all the food for Shuttle. We were going down for all the launches. We had to go down for the—what they call it, the countdown demonstration test. We had to go down there and feed the astronauts when they did that. Then we had to go back for the mission and cook the food while we were down there, preflight, for the mission. Then we had to prepare the flight food.

They had a medical kit. I had one guy who was in charge of the medical kit, and we did most of the packaging in the food lab, packaged all the medical kit stuff.

We were working on the galley. GE had a contract for the galley, but they had all kinds of problems, and we tried to resolve a lot of those problems, getting the galley to work. But first we had to put a water dispenser on. We made that water dispenser ourself in the lab when we didn't have a galley. We took up a hand-operated water dispenser so they could add water to the Shuttle packages, because they didn't even have a way of getting water in the package.

So we did all that with just a few people, and then if you look at people now that's doing the same job—and we, I don't know many missions we had at one time. The max [maximum] was eight or ten missions a year; [there were nine flights in 1985]. ... We were supporting that many missions. Now they've got three times that many people working and don't have near that many missions. There are more people working on one of those items than we had working on all of those things, so we were doing it all ourself. Of course, we didn't know if we were coming or going most of the time.

ROSS-NAZZAL: Sounds like it. With only ten to twelve people, that's a lot of work. How much time did you spend working with the flight crews themselves on the Shuttle Program?

BOURLAND: We spent quite a bit of time working on the menu, because they would always come over and taste the food and choose their menu. When we started out with the Shuttle, they told us there was going to be fifty-six missions per year. It's hard to believe. You go back and look at the paperwork, it says there's fifty-six missions a year, and there's a crew of seven, so plan on that. We said, "Well, if we're going to do that, we're all going to eat the same thing. We can't be providing a choice of menu items." The first two or three crews that went up, we started getting complaints about "I don't like this, I don't like that."

Then finally before Sally [K.] Ride went up, she decided to take on the cause that they were going to have individual menus, and she went to a whole bunch of work, came over with a bunch of diagrams and paperwork to show that we could have individual menus. She said, "I've got asparagus on my menu. I don't like asparagus. I don't want to see asparagus. Why do I have to have it on my menu?" [Laughs]

So eventually we saw the light, and we changed it so everybody gets to choose their own menu. It wasn't that hard a deal, once we started doing it, but at the beginning we thought it was going to be fifty-six missions a year. We were going to be doing this every two weeks, or every week I guess we'd be having a mission.

ROSS-NAZZAL: Did you start developing new food? Because you have more choice now on the Space Shuttle, correct, of food choices, than you did on Skylab and Apollo?

BOURLAND: Oh yes. One of the concepts for Shuttle was that they wanted us to use commercial foods. Wherever possible, they said to use commercial food. We thought that was a great idea until we started using them, and then you do run into problems with using commercial food, because you buy it one time, and then the next time you go back to buy it, it's new and improved; they did something to it. So it doesn't match what you bought the first time, so you've got to go test and find out what it was, see if it affects what you're doing with it. Will it rehydrate? Will it do this? And what the properties are. So we spent a lot of time testing, evaluating. And sometimes they just do away with it, so it just disappeared.

A good example is puddings came out in a metal can, steel can, so we got that approved, and that was flight-worthy; we could take that. Then they came out in an aluminum can with a

pull top, so everybody said, “Well, no, that’s too flimsy. That won’t work.” So we had to test that, do the shake test and all that stuff, and it passed. So then we used the aluminum can.

Then they came out with a plastic can. That was when we were working with Mir, and the Russians said, “Oh, no. Definitely we can’t use that plastic can.” So we had to go through all the tests again, and sure enough, the plastic can works just as well as any other thing. Then a little bit later they reduced the calories in the thing, and you know how they reduced the calories? It was a six-ounce serving, and they made it a five-ounce serving or whatever. Anyway, they reduced the serving size, so we had to go back and change all our paperwork for that.

So it’s just a constant battle, changing all the things. If you just make it yourself, then you know what it is and you don’t have to change it anymore. But using commercial products, you have to go with what they do. Even Tang every once in a while would come out “new, improved Tang.” They’d do something to it, so we’d have to go test that.

ROSS-NAZZAL: How long would it typically take you to test something before you could put it back on the Space Shuttle, if it was new and improved?

BOURLAND: If we had to take it over and do the shake test and all that, it might take several weeks, because you’ve got to get in line and get on the schedule and get set up to do it; write the paperwork and go through all the processes to get it done. It takes a long time to do it.

ROSS-NAZZAL: Let’s take a break here for a second. We need to change our tape.

[Tape change]

ROSS-NAZZAL: What are your memories of STS-1?

BOURLAND: Well, one of the memories is going to the Cape [Canaveral, Florida] a bunch of times and not seeing anything launch. We went down there I don't know how many times. We went down for the countdown demonstration test; I think we probably went down more than once for that. Then I don't know how many times we went down for a flight, and it didn't go for one reason or the other. Eventually it did go, and I got to see it from—in the early Shuttle missions, they let you go up on the roof of the O and C [Operations and Checkout] building, and stand up there and watch it go. It was really a good view from up there. They stopped that now; they won't let people up there.

ROSS-NAZZAL: Was that the first time that you had seen a launch of a manned space vehicle?

BOURLAND: No, I got to see Apollo 16 when it went up.

ROSS-NAZZAL: Can you tell us about your memories of that Apollo 16 liftoff?

BOURLAND: Yes, I have quite a few memories on Apollo 16 that I was going to mention. One of them is that I was down there collecting feces, as I mentioned before, and urine, and we were also feeding the crew. I was down there with Rita Rapp and we were serving the food. One thing I might mention, too, that a lot of people aren't aware of—I don't know, Rita must have started this way back when—but the first thing we did when we went down there, for the first

half-day was bake cookies, hundreds of cookies. Everybody knew we were baking cookies, and everybody was up there eating cookies. [Laughs] So some of the astronauts even said, “You shouldn’t be baking those cookies, because I just keep eating them.” But anyway, we baked cookies.

But another job I had while I was down there, Baylor [College of Medicine, Houston, Texas] had an experiment called biostereometrics. They were measuring volume. They were mostly interested in the leg volume, to see if there would be any changes in the volume after they come back. They measure them before, and they measure them when they come back. They did that with a mapping technique, and they had four Hasselblad cameras set up, and they were synchronized. You put the astronaut in between, in the middle—they had a spot [marked] out there for him—and take his picture.

So they figured out, “Well, you’re down there, and you’re cleared to go in there. You can do that.” So I had to go to Baylor and get the training on how to set that equipment up, and I carried it down there and set it up.

I was in there when they were doing their flight physical just before flight, and I had to take a picture of them in their skivvies, in their underwear, standing out in the middle of this thing. I remember it was John [W.] Young and Charlie [Charles M.] Duke [Jr.] and [Thomas K.] Mattingly [II]. Just a few months before that, Burt Reynolds had come out in *Cosmopolitan* in a nude exposure, and John Young said—I won’t say it the way he said it, but he said, “If this comes out in *Cosmopolitan*, I’m going to have your rear.” [Laughter] So I got to do that while I was down there.

Another funny thing that I recall when I was down there then, too, was Charlie Duke had been out on the beach sunbathing or something, and running; I don’t know. Anyway, he had a

nice tan on his legs. Chuck [Charles K.] LaPinta was the flight surgeon, and he was examining him. Charlie Duke said, "Look at those legs, Doc." He said, "Aren't they good-looking?"

Chuck LaPinta said, "They'd look good on a chicken." [Laughter] He did have some pretty small legs, so I thought that was kind of funny.

But we got to watch the launch from out there on the causeway. I remember most of us got sunburned from being out there all day long; didn't realize we was going to be out there that long. But it was quite an experience to see that thing go. That's the only Apollo mission that I got to see launch. Being on the recovery ships, I missed the launches, and I also missed the splashdown parties, because they all happened here in Houston before I got back. [Laughter]

ROSS-NAZZAL: Were there any sort of parties, though, on the ship, once the crew was on board?

BOURLAND: No.

ROSS-NAZZAL: Even though the crew was in the MQF?

BOURLAND: Yes, the crew was in the MQF, and nothing going on in the ship.

ROSS-NAZZAL: So after STS-1, did you get a chance to see any of the other flights lift off?

BOURLAND: Yes, I saw several launches for the Shuttle. In the early Shuttle I went down there quite a bit. Then eventually we even hired a dietitian down there at the Cape to work, so we all didn't have to travel down there every time to provide the food for them.

ROSS-NAZZAL: Were there any significant changes made to the Shuttle food system or the equipment after the first couple of flights of the Orbiter?

BOURLAND: Oh yes. It kept changing for several missions. We started out with the Apollo packages, and then we went with the square packages, and then we ended up with the flexible packages. We started out with a beverage package, the old Skylab beverage package, and then we changed that to the flexible foil pouch that we have now.

We have a lot of interesting comments. For example, the astronauts really liked this flexible Skylab package. It had a bite valve; you could bite it and then squeeze it and drink out of it. And you could see through it. It was not clear, but a opaque plastic. Soon as we came up with the idea of using this foil package, the astronauts said, "Oh, I don't like that. I can't see what I'm drinking."

But my response was, "You can't see what's in a Coors can, either."

So they [said], "Oh, I guess that's right." So we eventually convinced them that we could use that. Now that we got it going, they like it a lot better than the other old package we had.

ROSS-NAZZAL: How has technology changed the manner in which you conducted research and development since the late 1960s?

BOURLAND: Well, the sixties, we were working on everything ourself. It was to be produced either by a contractor or in-house. The biggest change we made was going with commercial food, trying to use more commercial food. Then I guess the other concept that changed is we

were trying to make it more homelike all the time and have more variety and being able to eat out of an open container. I guess Skylab was the first time we demonstrated that you can eat out of an open container. Skylab was the first time we used regular utensils to eat with an open container.

It was very interesting, in I don't know what year this was, but in the middle of Shuttle, one of the cosmonauts, [Valentin Lebedev], came over from Russia. He was promoting a book, [*Diary of a Cosmonaut*], that he wrote, and we showed him a Shuttle meal, and he said, "Oh, that's well and fine, but," he said, "you can't eat that in microgravity out of open containers."

So, one of the astronauts explained to him, "[We]'re doing that every day now." They told him, "Yeah, we do that." He didn't believe that it could be done, so it was a concept that everybody believed, that you couldn't eat from open containers in zero gravity, but you can.

ROSS-NAZZAL: Were there any specific lessons that you learned from the previous programs that you applied to Space Shuttle, from Apollo, Apollo-Soyuz, and Skylab?

BOURLAND: Yes, there was a lot of changes we made. Probably the biggest one of them, it took us a long time to learn that you have to have personal preference. Everybody has to be able to choose what foods they want. In several cases, we started out with a uniform diet, but it didn't go very far, and decided that that wasn't the case. We changed a lot of packaging. On Apollo, we wrapped all the food in one meal in one big package, so if you want something that's in another meal, you can't get to it.

One of the things we're doing now on the International Space Station that was unheard of is that they have a pantry-style packaging now. They plan a menu, but they don't necessarily

have to follow that menu. We send the food up—all the beefsteaks are in this tray, and some other entrées in this tray, and they just go get what they want. We never did think that would work, but it's working, apparently.

ROSS-NAZZAL: Where were you when the *Challenger* accident happened?

BOURLAND: I was in the conference room in Building 37. I didn't realize anything was happening. I saw the plume of smoke. Rita was in there, too, Rita Rapp, and she had been to every mission [launch] since the first Mercury, probably. She only missed one or two; up until several Shuttle missions, she'd been down there for every one. As soon as that plume of smoke went up, she walked out of the room, so I knew something was terribly wrong, because she knew what was wrong.

ROSS-NAZZAL: Yes, I think that was a difficult moment for so many people. Were you close with members of that crew?

BOURLAND: Yes. Probably closer to them than the *Columbia* crew. I knew a few of the *Columbia* crew, but I didn't know all of them. But I knew all of these folks. [An example of the kind of people on the *Challenger* crew: Ellison S. Onizuka flew on STS 51-C. The day after the crew returned to JSC, I was coming to work, and this car started following me and tailed me all the way into the parking lot. I was thinking, "What is wrong with this guy? Turns out it was Ellison, and he followed me to tell me what a great job we did on the food for their mission, how he appreciated it, and he thanked everyone for doing a fine job.]

ROSS-NAZZAL: Did the accident have any impact on the food laboratory? I know a lot of the flight hardware was reexamined. Did you take that opportunity to go back and look at the food system and make any changes?

BOURLAND: Yes, we had to do a safety analysis of it, whatever they were going through; just a paperwork analysis, but we really didn't change anything.

ROSS-NAZZAL: I have just a couple more questions for you. Your résumé indicates that you were on the Space Food Development Group [and the Space Station Service System Team. Could you identify these groups and their purposes?]

BOURLAND: ... [The Space Food Development Group was the name of the Space Food Lab. Every time NASA reorganized we got a new name. In regards to Space Station], I was working for—I forget what they—Krug is probably what it was called, Krug International. Because the contract moved over to Lockheed, and I moved over to Lockheed. We were working on the Space Station food system. I worked there about three months, and then NASA hired me, so I switched over. But we were working on a concept for a food system for Space Station.

ROSS-NAZZAL: Can you talk about that concept and how it evolved over time?

BOURLAND: Yes, that concept, we did several studies, and we determined that the ideal food system was to have a frozen food system, or a good part of it, some part of it at least, frozen. We

pursued that from when was that, 1986 or something, until just a few years ago. It was in the plans until they took out the habitation module. It was to go in the habitation module, so when the habitation module didn't go, our food system went down the tube with it.

We still believe the best food system we've ever had in terms of meeting the nutritional requirements was from Skylab, and that had some frozen food on it. That might not be the total reason, but at least they met about 99 percent of the nutritional requirements, and most of the people on today are meeting 70 and 80 percent, some of them even less than that. So we can't go on a two-year mission somewhere if we're only meeting 70 percent of our nutritional requirements; we're not going to be alive when we come back. So that was one of our goals was to have an improved food system that people would eat.

One of our incentives for this is that anytime the Shuttle goes up, there's a little freezer they send up sometimes to bring back samples. Anytime that Shuttle is going up there with a freezer, it's going to be on and it's going to be full of ice cream, most of the time legal, sometimes illegal, but one way or another, they get ice cream on that freezer, and they get it turned on and set it up for launch. So we were sure that frozen food would be a big incentive, to have it on there.

But the only success we've had so far is that the logistics module that goes up there now that the Italians built has the utilities for a freezer and refrigerator. That's the only hardware we have built that goes, but our plan at one time was to send frozen food up on the logistics module and transfer it over to Space Station.

ROSS-NAZZAL: And now it's combination of Shuttle food and then Russian food?

BOURLAND: And Russian food, half and half. It's basically the same as Shuttle food, except there's less dehydrated food on the Space Station, because the astronauts don't like dehydrated food that well over a long period of time. It doesn't wear well.

ROSS-NAZZAL: Did you have any involvement with the Shuttle-Mir Program?

BOURLAND: Oh yes, we were involved with that quite a bit.

ROSS-NAZZAL: Can you talk to us a little bit about that and your involvement?

BOURLAND: Yes. I did get to go to Russia for that. I went over with Dr. Helen Lane, and we negotiated the food system for that. When the Shuttle-Mir Program first came out, the plan was for the Russians to supply all the food. There was to be no U.S. food on board, and we had a hard time overcoming that, trying to negotiate that, because the Russians, they're good negotiators, and they already had one up on us already before we started. So we ended up getting them to agree that we would supply half the food. Then we had all kinds of horror stories about getting the food over to Russia, but we eventually got it over there.

ROSS-NAZZAL: Can you tell us one or two of those horror stories?

BOURLAND: Well, one of them, we went over, we hand-carried it; sneaked it over in our luggage. Carried it over, and it went through our luggage over there. That's the first food we

sent over, carried it. We gave everybody that was going over to Russia a box of food to carry with them, so they carried it over there, and it was flight food. [Laughs]

The next time we sent a batch over, the Russian customs opened it all up. Well, it's got a seal on it, so when the Russians inspectors see it, "We can't accept that. Somebody's already been in there and opened it up." Then on top of that, they wanted a \$10,000—well, it wouldn't be called a fine, but they wanted us to pay \$10,000, and we said, "No, send it back. We don't want it." So we sent it back.

Eventually Vice President [Albert A.] Gore [Jr.] went over there and worked out the details so we could ship it over there. We could ship it to the embassy and not go through all this hassle with their customs; it got to bypass their customs. But that was a constant problem. I think they've had more problems with that recently, because that ruling or whatever it was expired, so they just started over the same thing again. [Laughter]

ROSS-NAZZAL: What a challenge. When did you decide to retire from NASA?

BOURLAND: I probably decided to retire in 1998. I had a heart attack and had looked at a lot of people [that] had retired from NASA, people who even worked years past their retirement and then they retired; several of them, within a year they died. So I said, "Well, I'm going to get out of here early while I can and see what it's like on the other side." So when I had that heart attack, I basically decided then, "When I reach retirement age, I'm going to do it," so I went ahead and did.

ROSS-NAZZAL: When did you officially retire?

BOURLAND: In December of 1999.

ROSS-NAZZAL: Since then you've actually been a consultant for the NASA Food Technology Commercial Space Center. How did you get involved with that?

BOURLAND: Well, they were working on that a little bit when I was working at NASA, and they were struggling. They had a Director, and then the Director quit. They got a new Director. I knew what they wanted to do and what their concept was, so I called them up and asked them if they needed some help, and they [said], "Yeah, we could use some help." So I went up. I got involved with them, and we helped to get it started and got the ball rolling.

ROSS-NAZZAL: What's the purpose of that center? It's now closed, am I correct in that statement?

BOURLAND: Yes. NASA discontinued the funding in December of this year. The purpose was to get industry and universities involved in developing food for space, but the food that they developed had to be able to be used on Earth as well as in space. We had a lot of interest and a lot of participation. If you look on the web page, we had a bunch of major companies that were involved in this and really excited about working in it. We did develop several products some of them are being used on the Shuttle and on the International Space Station today.

ROSS-NAZZAL: What were some of those products?

BOURLAND: There was a yogurt that Arla Foods developed. They got a chocolate milk powder that they developed that's being used. There was a chili made by a company called [Triple "F"] Foods in Des Moines [Iowa], made out of soybeans, that's used on Space Station and Shuttle. There's several other products that had a lot of potential and probably will be coming down the road. There was one sanitizing agent called PRO-SAN that this company developed that it's made out of edible materials. You could just drink the sanitizer if you wanted to; it wouldn't hurt you. But it's just as effective as chlorine. I mean, it's made out of all food-grade material. So that thing had a lot of potential.

Then we had about thirty professors at different universities working on—a lot of them was just projects that they were working on that had application to space, and we'd let them sign on as being an affiliate faculty, and then they could attend their meetings and exchange ideas. So there was a lot of interest. We had a lot of people involved, a lot of companies, Kraft, Monsanto, and a lot of big names, Pioneer, was involved in doing all this.

ROSS-NAZZAL: Sounds like some great products. I'd like to try that PRO-SAN.

BOURLAND: They've got another one coming out. I think Arla probably is going to produce this one. It's called Milk Balls. It's kind of like a malted ball-type thing made out of milk. You take two of them, and it meets all your calcium requirements for a day, and they're delicious.

ROSS-NAZZAL: Sounds good.

BOURLAND: I don't know if they'll make it over here or not, but they're going to market them in Europe for sure.

ROSS-NAZZAL: If you look back over your quite lengthy career, what do you think was your most significant accomplishment?

BOURLAND: Oh, for me? I don't know. Probably just being there. I see a lot of people from NASA and other places, "Oh, I did this," or, "I was responsible for that." I don't claim anything. I was on a team most of the time, and the team did something. I might have directed the team; I might have been involved. But if I hadn't had the team, I wouldn't have got it done. Like the packaging, I had a packaging engineer. I helped guide him along, and I had several packaging engineers over my career. So I didn't accomplish anything by myself. I was just always part of a team, and I don't think I did anything myself that was really that outstanding. I just tried to follow the directions and guide the team.

ROSS-NAZZAL: What do you think was your most challenging milestone, or your team's most challenging milestone, while you were working for NASA?

BOURLAND: Probably the Shuttle food system was probably the most, because we didn't— Shuttle, and ASTP was pretty challenging, too, because we didn't know how all that equipment worked. We were on a deadline to get that stuff out. People were saying, "They're going to launch, and you're not going to have the food ready," and all that kind of stuff. But then on

Shuttle we also had a lot of challenges, trying to get the food system to work, and the galley wouldn't work.

For example, one time they made a meal tray, and the food packages were supposed to fit in there by friction fit. Well, we had packages; we tried to get a sample of this meal tray before it went up to see what it was like. They said, "Oh, no. That's in bonded storage, and there's flight hardware, and you can't have it."

Well, when the crew came back, the Pilot [Robert F. Overmyer] was right in our office the very next day, just chewing on us like you wouldn't believe, because those packages didn't fit in that meal tray. They were about an eighth of an inch too short. They [were just] flopping in there. They wouldn't fit. [Laughs] We took the blame, although we didn't make the tray, we just made the food. But it was our fault. So we ended up with a lot of challenges like that. We had to get those things straightened out. That was STS-[5]. ... [Overmyer] called us over. I know he called us over to the photo lab to show us the photos the very next day after he was here, to show that those things didn't fit. [Laughs]

ROSS-NAZZAL: I'm going to ask Sandra if she has some questions for you, and then we'll let you go. I know you have a lunch date.

JOHNSON: Yes, I just have a couple of quick ones. One thing, I think you mentioned a couple of times a "shake test." What exactly was that?

BOURLAND: It's a vibration test. You put a food tray together, and then they have a shaker that simulates launch to see if it passes the launch test.

JOHNSON: You mentioned the KC-135 in testing the food, and then you mentioned the open containers. Did you yourself ever fly on the KC-135, or how were those tests conducted? And were all foods, or different—every time you came up with a different container or packaging, was that always tested on the KC-135 first?

BOURLAND: Most of the time we tested all the containers. Then sometimes we'd test the food. Now, on Skylab, somebody above me decided that all the foods needed to be tested on KC-135, and my boss, Dr. Clayton Huber, said he was going to do it. So he went over and went through the school. Went up on a flight one day, and he came back just white as a sheet. He said, "Dr. Bourland, come to my office." I went in there, and he said, "This is going to be a bigger project than I anticipated. I'm going to put you in charge." [Laughs] He said, "You need to go over there and go to school and get on the zero-G plane."

So I ended up testing all the Skylab food. I don't know how many missions we went up there. We were on a lot of flights.

JOHNSON: Did you ever have any kind of sickness from being up there? Were there any problems?

BOURLAND: You should ask me did I ever not have any sickness. [Laughter] The first time I went, I didn't take any medication, and then I really had a problem with that. The first time, I didn't know too much about it. We went to Florida. We flew out of Florida. We flew the plane down there, and then the crew down there, we met in a Holiday Inn, and they had orange juice

and pancakes and sausage, and everybody was eating all this stuff, so I ate all that stuff. As soon as they got up there and did the first parabola, I was sacking all that stuff up the hard way.

So then later on, the next mission, I started taking the medication, and I could last about thirty parabolas. Then after that I'd usually get nauseated. But I finally worked out a system so that I'd just eat a real light dinner and don't even take a drink of water for breakfast. No coffee, no nothing. I could handle it then. And take the drug, and then I could handle it for thirty or forty missions. Then if I did get sick, all I had was dry heaves, so it wasn't that bad. [Laughs] But it was pretty miserable.

JOHNSON: Yes, I could imagine actually testing food while you were up there doesn't help. [Laughs]

BOURLAND: No, I ate a few samples of food, and then eventually I would give it up, and all I could do is just see if you could work the utensils.

JOHNSON: You mentioned that on Skylab they used the canned food, and that was a change. Why did they go to cans after Apollo?

BOURLAND: Because the food, we knew it was going to be at least two years old before the last crew ate the food, and it had to have an extra long shelf life, and we didn't think Apollo would last that long in the plastic packages that it was in. They decided it had to be in a metal package.

It turned out that was a good decision, because then when the first Skylab went up, the solar panel failed to deploy, and the cabin got hot. It got up to 130 degrees, maybe warmer,

because our scrambled eggs turned a little bit brown, and we had to replace the ketchup and a couple of things. But if it hadn't have been packaged like it was, it would have probably ruined the whole food system, and we'd have had to cancel the mission, because we didn't have any way of getting any food up there. The Apollo would take just a few packages, but that was all you could get on board. We did take those bars, nutrient bars, up there to extend the mission, but that still didn't have that big of an affect, so we couldn't have replaced the whole food system.

JOHNSON: And you mentioned, I think, Skylab had some frozen food. That was the first time that frozen food had flown?

BOURLAND: Yes.

JOHNSON: How did they heat it once that it was up there?

BOURLAND: They had a serving tray that had three heating wells in it. You could put the food in there and turn the switch on, and then it would heat it. Come back later, and it was ready to eat. I've had lots of interesting comments of particularly newer astronauts come in, and we'll mention something on the Space Station, "We'd like to have frozen food."

And they said, "Oh, that's too high-tech. We can't do that."

"Well, we did it twenty years ago. I don't know why we can't do it now." [Laughs]

JOHNSON: I'm looking at my notes. I think the only—well, a couple more. I think I read that some of the astronauts said that when they were in space, the food was more bland. Was there

any kind of testing to see how much spice or what you could do to make the food not taste quite so bland for them?

BOURLAND: We've had three experiments that I'm aware of, and none of them came out with any good results. The best one we did was on Skylab, but we only had three people, and if you look at the data, one's here, and one's here, and one over here, so it's just kind of a mixed result. So we don't have good data, and that's all anecdotal. We really don't know if it does or not. You'll ask some astronauts; probably half of them will say, "Yeah, it changes."

The other half will say, "That half is crazy. It doesn't change at all." So you never know. But there are some people are really adamant that it doesn't change.

But then others say, "Yeah, it does."

I ran across one retired astronaut, and he said, "I used to drink coffee all day long every day, and I went up there and tasted coffee, and I haven't drank one since. I can't stand coffee." So it really affected him, if he can't drink coffee from the time he flew on the missions. So it has all kinds of different effects, but we have no data to back it up one way or the other. We really don't know.

JOHNSON: You were talking about doing the urine and feces collection during Skylab, and of course, in Apollo 16 and 17 before that. During SMEAT, I believe, was where they had the problem with the urine collection system. Did you have anything to do with that or was that out of your—?

BOURLAND: No, I wasn't involved in that on SMEAT.

JOHNSON: I think that's all the questions I had. I thank you.

ROSS-NAZZAL: I just thought of one more question for you. Do you have a favorite food item? You know, testing all that food, is there one food that you really liked, or did you think it was so-so? You know, it's space food; it's not that good.

BOURLAND: I sort of agree with the astronauts. Their favorite food was shrimp cocktail. I think that's probably one of the better foods. One of my favorites, too, because I had a lot to do with the development, is irradiated steaks. We did get that approved officially through the Food and Drug Administration. NASA has approval to fly high-dose-irradiated meat. So I was involved in getting that approval.

ROSS-NAZZAL: When was that approved?

BOURLAND: That was late Shuttle, in the—can't remember—probably nineties. It took several years to get it approved. And I didn't realize—we started out, I was drafting a letter and sending it to [the] NASA Administrator to sign to send over to the Food and Drug Director, who would funnel it back down to his employee. We did that about three times, and finally the employee at Food and Drug called and said, "You know, we can do this ourselves."

I said, "Really?"

She said, “Yes.” Said, “You send me a letter, and I’ll send you a letter.” [Laughs] So eventually we did it that way, so my name is on the official document that it’s approved. I didn’t realize we didn’t have to go through all the protocol to get it done.

ROSS-NAZZAL: Is there anything you think we might have overlooked that you wanted to talk about today? I know sometimes individuals want to come in and talk about certain stories or events.

BOURLAND: I think we’ve about covered everything that I can think of, right now, anyway.

ROSS-NAZZAL: Okay. Well, we sure appreciate you coming out and seeing us.

BOURLAND: Okay. You’re welcome. It’s been fun recalling the old stories.

[End of interview]