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VICKIE L. KLOERIS
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is September 19th, 2012. This oral history with Vickie Kloeris is being conducted in Houston, Texas, for the Johnson Space Center Oral History Project. The interviewer is Jennifer Ross-Nazzal, assisted by Sandra Johnson. Thanks again for taking some time to meet with us today.

KLOERIS: You're welcome.

ROSS-NAZZAL: Certainly appreciate it, especially on such an exciting and historic day at JSC. I was thinking about that this morning when we were standing on top of the parking garage [waiting for *Endeavour* to fly over]. How did you come to work for JSC in the mid 1980s?

KLOERIS: Well, it's really interesting because I grew up right down the road. I was born and raised in Texas City, graduated from Texas City High School, so not far from here. Never really thought about working at the Johnson Space Center. It just didn't occur to me. I was very interested in the biological sciences so I went to [Texas] A&M [University, College Station]. My parents were retired by the time I got ready to go to college. I had a Moody [Foundation] scholarship, so I was pretty much limited to a state school because of the funding issues. So I ended up at A&M, and I actually thought I'd be premed.

Started out with that. Took a lot of premed classes, [and decided medicine was not for me. I finally declared microbiology as] my major, went all the way through. Got to my senior year. I had only one undirected elective in my whole [degree plan]. All my electives had to be within micro. They had a list. So I got to the end of my last semester at A&M, and I was short one hour of microbiology.

My adviser said, "Oh, just go find a prof [professor]; do a white paper." Well, on the list I saw this food microbiology course that was over in the college of agriculture, and I thought this looks interesting. I want to go take this. They tried to talk me out of it. They said, "It's four hours; it's a three-hour lecture and a lab. Why do you want to go do that?" I'm like, "I'm interested." So I went and took the course. I got very interested in the application of microbiology to food.

So I ended up going into food science for my master's work. My major professor actually guest-lectured in my food micro class for three days on seafood microbiology, that was his specialty. At the end of those three days he's like, "I've got three graduate assistantships that I'm trying to fill." So that's how I ended up in food science. He had industry-paid positions. I got my master's, and in the meantime met my husband who was a medical student and then a resident at UTMB [University of Texas Medical Branch, Galveston]. When I finished my program up there we got married in 1981, and for the last two years of his residency I worked in a research lab at UTMB.

Then I came to Houston. When he was done we moved to Houston. I got my first real food science job, which was with the Memorial Hospital System. They had a cook-chill food processing facility where they made food for about five or six different hospitals, and I was doing quality assurance for them. When I got into that job I joined the Institute of Food

Technologists, which is the professional organization for food scientists. They had a local chapter here in Houston, and I started attending their meetings. I met some of the food scientists who were working here at JSC. I'm like, "That has got to be the coolest food science job on Earth; I want that job!" So I kept networking with those folks. It took about a year and a half or maybe two years, and then they had an opening.

I got a call from the contractor manager of the food lab here at JSC. He goes, "We have an opening. Would you be interested in interviewing?" I'm like, "You bet." So I came down here, interviewed, and went to work for the contractor who had the food contract at the time. That happens to be what is now Wyle Labs. Now when I came to work here in August of 1985 it was called Technology Incorporated. Six months after I came to work here it morphed into Krug Life Sciences, and now it has morphed into Wyle, but it's all the same company. So I went to work for Technology Incorporated. I was primarily hired to begin planning the food system for Space Station Freedom, which was going to be the US Space Station, however, I was supporting Shuttle as well. For instance, I did a lot of the moisture analysis on the Shuttle flight foods. I supported the sensory when we would bring crew members in to try food.

In fact I came to work, whatever the first Monday was in August of 1985, walked in the door, and the guy who had hired me, Dr. Charles [T.] Bourland, he was the contractor manager for [Technology Incorporated] in the lab at that time. First thing he told me was everybody's going to be in a really bad mood here today. I'm like, "Huh?"

What had happened was the Flight Equipment Processing Contract (FEPC), which was going to consolidate all the different work related to Shuttle equipment: food, clothing, EVA [extravehicular activity] suits, all that was going to go under one contract. The Friday before I got here, Technology Incorporated found out that the team they were on was eliminated, so they

knew they were going to lose the Shuttle food contract. The part that they were going to keep was the R&D [research and development] part so that part of the contract was going to stay on site, but they were going to lose the actual preparation of the food for the Shuttle flights. So that's what he meant by everybody was going to be in a bad mood. That was how I started.

We started working on Space Station Freedom. Of course it was all on paper at that point. We were just planning, and then we get to January. I did support a couple of Shuttle flights because we were responsible for feeding the crew when they were in quarantine. The FEPC contract did not get awarded till the end of that year. So for the first six months that I was there basically we were still responsible for providing food for flights and feeding them during quarantine. So I worked quarantine on a few of the missions. Of course then in January *Challenger* [STS-51L] happened, and everything came to a grinding halt.

In fact one of the first things that I did when I came to work here was—Rita [M.] Rapp was the manager of the Shuttle food system at that time, the civil servant manager. One of the first things I did was support her in a food session for Barbara [R.] Morgan and [S.] Christa [C.] McAuliffe. That was one of the first things I did, because the rest of that [STS-51L] crew had already done all their food sessions before I got there. Christa, the educator, was added towards the end, and so she came into our lab, she and Barbara, and did a food session. That was like within a week or two of my coming to work. Part of my duties was to support Rita and get all the food ready for them to do their sensory session. They came in, did the session, Christa planned her menu. So that was one of the first things I did. When we weren't flying, naturally things got really slow.

One of the things that we did at that point, we compiled a lot of the data for all the flights that had already flown and so we basically published a book. It's an internal NASA report but it

basically had all the information about all the flights up to that time. I worked with the dietician on that who was in our lab at that time. We spent a lot of time gathering that and putting that all together and compiling that. We were doing some R&D work. Right about that time we were directed to look at changing our packaging, because the original packaging for the Shuttle flights, specifically for the beverages and the rehydratable foods that had to have water added, that package had been developed jointly between Natick Labs [Natick, Massachusetts], which is the military R&D, NASA, and Pillsbury Company; [they] had all worked together to come up with the original package design. It was a rigid package. It worked very well for the early Shuttle flights when there weren't many crew members on board and the duration wasn't very long.

But as the flights got longer and they put more crew members on board, it became apparent that those rigid packages just took up too much room, especially in the trash. Because on Shuttle they were bringing all the trash home, they weren't dumping it. About that time, during the downtime, we started looking at how we could change the packaging to make it more efficient. We ended up transitioning that in. It took us till the end of the '80s to really get a new design going, and we started transitioning it in towards the end of the '80s and into the early '90s.

So at that time, '86, I was still working for Wyle—Krug at that time, but I was still working for the same company that had hired me. Well, in early '87, that R&D contract was won by Lockheed Martin. So my badge switched from Wyle—from Krug—to Lockheed Martin. I stayed with Lockheed Martin for a very short time. So that would have been fall of '87 when that happened. Then of course in September of '88 was return to flight. The interesting thing was the FEPC contract, which Boeing ended up winning, Boeing chose not to do the food. They had a sub [subcontractor] who was doing the food for them, a company called Wornick.

Wornick was a company that made MREs for the military, Meals Ready-to-Eat. So Wornick had teamed with Boeing on that FEPC contract. So Wornick was going to be the company actually producing the food and packaging it and stowing it for flight. The first flight that they were supposed to support was the one after Challenger. That flight never happened. So during that downtime they had built the FEPC facility, but they had never utilized it. They never produced a set of flight hardware. They were trying to get their act together to support return to flight.

Late that year in '87 I got approached by one of the engineers over at Boeing. They decided they wanted a food scientist on the Boeing side, because they realized they had Wornick, but they also realized they had nobody on their side of the house that knew anything about food. One of their engineers recruited me to come over and basically be the liaison between Boeing and Wornick. I was responsible for overseeing to make sure they were doing their thing like they were supposed to be. I was in charge, a lot of what I did over at Wornick was just paperwork to make sure. For instance I remember we had a big issue. They had to do the moisture testing. In order to do the moisture testing they had to have access to a facility, a vent hood where they could use concentrated sulfuric acid. Well, they had not set up their lab for that. So we had to work up a new methodology for doing moisture and to convince NASA, Rita Rapp, who was the technical manager at NASA at that time, that whatever new system we developed would meet the requirements of NASA.

I remember I spent a lot of time working on that, trying to get that figured out, how we were going to do that. Just all the necessary certification paperwork, everything that Boeing had never done before. Of course Wornick wasn't really responsible for doing that. Boeing was

responsible for that. So I worked over there, I think I went to work over there in early ’88 maybe, late ’87, gosh, I can’t remember exactly. I was over there until July of 1989.

Again Boeing now was responsible for feeding the crew during preflight here in Houston and also preflight in Florida. So at that time myself and a Wornick person were going down to every launch and staying down in Florida and making sure that the crew got fed, because they used part-time people. We used part-time people down in Florida to staff the kitchen during the time when they were cooking for the astronauts in quarantine. We had to provide food during the terminal countdown demonstration tests, TCDT, and landing. When the [Shuttle] crew landed [in Florida] they would provide a meal for the families and for the crew members.

Boeing was responsible through Wornick for coordinating all that. So I was involved in all that stuff. I was over there from early ’88 until July of 1989. During the spring of 1989 Rita Rapp was diagnosed with lung cancer. She became more and more ill over time, and she passed away that summer. [NASA] hired me from Boeing to come and be the civil servant manager of the Shuttle food system. In July of ’89 I became a civil servant, and I moved back on site and started managing the Shuttle food system. So I was now monitoring the Boeing FEPC contract that I had been working for.

I did that for quite a few years. I managed Shuttle until maybe January of 2004, so all during that time. At that time Dr. Bourland had become a civil servant, and he was managing the Space Station food system. So I was doing Shuttle, he was doing Space Station. That went on until he retired at the end of [1999], and then at that point I was doing both. It was way too much. We finally got another civil servant in [July of 2005]. She took on Shuttle. So I handed off Shuttle to her, and I stayed with Space Station. I’ve been with Space Station ever since as manager of the Space Station food system.

So now the way we have it set up, I manage the Space Station food system, I manage our actual lab, the facility, so I'm the civil servant manager of the lab. Dr. Michele [H.] Perchonok manages our advanced food technology program, which is the research arm, the R&D part of what we're doing. She and I are both about the same age. We're not ready to retire yet, but we're getting closer. In October this past year [2011] we hired a new civil servant food scientist. She's a 20 something. She's going to be the manager of the future that will take over for both of us. We brought her in in October. So the kind of thing that she's doing now is she's going to be the liaison for Orion and for the new programs that are coming on because she's the one that's going to actually live that after we're gone. So structurewise that's what I managed over time.

ROSS-NAZZAL: I did have some questions for you. I wondered if you could elaborate—where did you start when you first were looking at Space Station Freedom food? We had a station for a short time in the '70s.

KLOERIS: Yes. We looked at Skylab of course. Actually Skylab was the most sophisticated food system that NASA has ever flown, before or since, because it included frozen food. We went into Space Station Freedom assuming that we would have frozen food. We actually went into the International Space Station thinking that we would have frozen food. That's not the way it worked out. Of course Freedom went away and morphed into International Space Station. Originally on International Space Station we were supposed to have the US Habitation Module. The US Habitation Module was going to include freezers and refrigerators for food.

So Dr. Bourland, before he retired—we're talking mid '90s to late '90s—we were planning on developing frozen food, how we were going to package it, how we were going to

heat it on orbit, etc., etc., etc. Then they canceled the Habitation Module. That was a budget thing, and it was also a power thing. They really determined that they weren't going to have enough power to support all that.

They had already put a significant amount of money in the budget over a several-year period to develop this frozen food system. So Dr. Bourland, when they canceled it, he convinced them to leave that money in the budget and let us use it to develop shelf-stable foods for Space Station. If you go back to Mercury, Gemini, Apollo, those food systems were all custom food systems. Basically there was very little commercial off-the-shelf food that was used in those systems. Things were made either by Natick or [Pillsbury]—a lot of stuff was made custom, very expensive to do.

Going into the Shuttle program NASA made a conscious decision. We're talking late '70s when they were starting to plan for Shuttle. They made a conscious decision to use as much commercial off-the-shelf food as they could. When I came to work here we weren't doing any product development. We weren't developing new foods. Our product development consisted of—if a commercial product that we were using got discontinued, we would go out and identify another commercial product to take its place. That was the extent of what we were doing. So there was no real product development involved at all.

When they canceled the frozen food system and they left that money in the budget, then we were actually able to start doing true product development where we were coming up with our own formulations. During the Shuttle program we had utilized the MREs, the Meal Ready-to-Eat, the pouched entrees that they use in MRE. We were just buying them from the same vendors who made them for the military. That worked very well for the Shuttle program, but when we went into Mir we knew going into long duration spaceflight that the MREs were too

high in salt and fat for what we wanted. That was one reason we wanted to morph into this frozen food system, so we could provide foods that were lower in salt, better quality, that kind of thing.

For Shuttle also our food list was fairly short. We didn't have a huge amount of variety, because the flights were so short. You didn't really need this long list of foods and beverages to support a ten- or 12-day Shuttle flight. We knew going into Space Station they were talking about four months at that time on orbit, three and a half to four months. So we knew we would need more variety. We knew we needed to try to get away from the MREs as much as we could. In the late '90s was when we started true product development. Our food scientists started developing thermostabilized pouched products to use on the International Space Station.

Over that time we have developed about 60 some odd food items that are unique formulations that we make just for Space Station. So we have expanded our food list. On the US side we have about 200 different foods and beverages. There are still commercial off-the-shelf [COTS] items in there. All of our beverages are COTS, because we use beverage powder. So we're buying the Kool-Aids and the instant coffees and the instant teas. We're not in the beverage production business. We still utilize commercial cookies and crackers and candies.

For quite a few years, through the Shuttle program and even into Space Station, up until about two years ago, most all of our freeze-dried foods that we fly were commercial frozen items that we would buy. We would bring them in house to cook them like you would cook them to serve them at home and then we would freeze-dry them. So they were further processed but they were not made from scratch.

That all goes back to the philosophy that we're going to utilize as much COTS stuff as we can. That was a decision made going into the Shuttle program. Actually in the long haul that

came back to haunt us. Because now that we've got Station ten years plus under our belt, we have come to realize that there are medical issues that are occurring in some of the crew members. They now are experiencing increased intracranial pressure on orbit. I don't know if you're aware of this at all.

ROSS-NAZZAL: No. Is it because of the sodium and fat?

KLOERIS: They don't think it's because of the sodium, but they think the high salt could exacerbate it. So about two and a half years ago now we were directed to reduce the sodium in the foods. What that basically meant is we had to get rid of all those commercial off-the-shelf products, especially the freeze-dried. Everything that we had been further processing [from COTS] we're now having to make from scratch, because commercial products tend to be very high in salt. It's a very cheap way to make things taste good. So food companies utilize it quite a bit. We have been on a two-and-a-half-year campaign to come up with new formulations on about 90 of our products in order to reduce the sodium content.

We have completed that process now. We've successfully reduced the [sodium content of the] standard menu. If you ate nothing but US foods every day we've successfully reduced that sodium content by about 43 percent. Even with that we're still above the RDA, the recommended dietary allowances. There's not a whole lot [else we can do]. We can only get it down so far without refrigerators and freezers. One of the big problems that we face is the fact that these crew members get little if any fresh food of any kind. When you and I eat fresh fruits and fresh vegetables and salads, the fresh stuff virtually has no sodium in it so overall it's going to lower the total sodium content of your diet. Because they're not getting that on orbit, all

they're getting is the processed foods, that means that their sodium content is going to be higher overall.

But we have successfully reduced that. We're trying to get that [reduced sodium] food to orbit as fast as we can. It doesn't happen to all crew members but it happens to some. When [the flight surgeons] see this effect, [increased intracranial pressure], they can put them on a reduced sodium diet, and it may help. They're not 100 percent sure it will help. The way this phenomenon has manifested itself, it's vision changes in [some] crew members. So it's putting pressure on the optic nerve, and it's changing their vision. Ever since the day I came to work here I've known and been told, and known for a fact that high sodium in the diet was bad for bone loss. It exacerbated the bone loss that [the crew members] experience when they go into microgravity. But that was never really a huge showstopper for the flight surgeons because when they come back they get that bone loss back. They make up the bone. It comes back.

This whole vision thing, uh-uh. When they came back it was not improving. For the flight docs that's huge, because it's like [the] Hippocratic oath, "I will do no harm to my patient." It became a huge concern from a medical point of view to try to do anything and everything we could to alleviate that problem. So that's how we got into the whole sodium reduction business was to try to [potentially help] solve that problem.

ROSS-NAZZAL: What sort of foods have you developed? You mentioned you've got 90 new foods.

KLOERIS: Well, basically what we did was we tried as much as possible to reformulate what we already had on the food list. So for instance we would take a commercial macaroni and cheese,

frozen. We would bring it in house. We would cook it. We would freeze-dry it to make our macaroni and cheese, but it was loaded with salt. So now we are making macaroni and cheese from scratch. We're formulating it. We tried not to really just go create all new foods. We just tried to modify the ones that we had, because we already had a nice balance of different types of foods: starches, fruits, vegetables, meats. So we tried to just reformulate what we already had rather than coming up with a whole new food list. That's basically how we focused it was reformulating existing products.

So now we have macaroni and cheese that's much lower in sodium because we're making it using a reduced sodium cheese.

ROSS-NAZZAL: Are you also looking at things like fat and other issues? Or is it just primarily sodium?

KLOERIS: Well, to be honest, fat is not a huge problem for us because the menu overall is not that high in fat. The crew members really need the calories on orbit. So we don't want to reduce a lot of the fat out of there or they won't be consuming enough calories. Fat is not a huge issue. Our standard menu is within what the RDA is for fat; the recommendation is less than 30 percent of your calories from fat, and we meet that. We do have some that fly that want to get even lower than that so we will work with them and give them a printout of the food so they know which ones they can pick and choose from if they want to lower their fat even further.

ROSS-NAZZAL: You mentioned of course the flight docs are involved. It sounds like you work with nutritionists. What involvement do they have when you're formulating this new recipe? Do they weigh in? Or the nutritionists.

KLOERIS: The flight surgeons? Not so much. Of course the Nutritional Biochemistry Lab over in SK [mail code for Biomedical Research and Environmental Science] is the nutrition research facility. They're basically the ones that research the nutritional requirements and then establish what those requirements are. Then [the requirements] basically come over the fence to us and we have to implement those requirements. So yes, we do work with them quite closely. In the reformulation, they were invited to participate in taste panels when we were evaluating new products.

Right now Scott [A.] Smith is head of the Nutritional Biochemistry Lab over in Building 37. He's flying an experiment right now on Station called Pro K. It's looking at having animal protein sources versus plant protein sources and if having more plant protein will decrease bone loss. So he's got an experiment that's flying right now. We support that experiment, because when they participate as a test subject on orbit they have to eat an exact planned menu. But it's only for like four days at a time, so we pack that ahead of time. Right now for instance Suni [Sunita L.] Williams and Aki [Akihiko] Hoshide, who are on orbit right now, they're both test subjects for his Pro K experiment. The experiment involves five four-day sessions during their six-month stay.

Four out of five of those sessions they're required to eat a specific menu that's planned preflight. We pack that exactly for them so they know what to eat every day when it's during one of their sessions. We work with Scott; we work together to figure out what to pack for that.

He's done about 15 test subjects now and I think he has a couple more and then he'll be done with that experiment. So we have worked closely with him.

Scott chairs the [nutrition subgroup of the] Multilateral Medical Operations Panel—the MMOP has a nutrition subgroup and Scott chairs that nutrition subgroup. That includes representatives from all the IPs [International Partners]. We telecon about every other month and talk about the nutrition research that's going on board on Station. Then also we talk about the IPs, like Russian food, so I sit on that MMOP panel. That's how we've made agreements to incorporate the other international partners' foods into the Space Station.

When we started out on Station it was all Russian and American. It was half and half. We had three crew members on Station early on so we provided one and a half person's worth of food. Our Russian counterparts provided one and a half person's worth. They shared it on orbit. All the dining was occurring in the Service Module in the Russian segment. Then when we went to a crew of six they came up with a second food preparation area in the US Lab. When that happened the Russians were providing for three, we're providing for three, and again they determine on orbit how they want to share it. We don't dictate to them that the cosmonauts could only eat Russian food. We let the crews work out among themselves how they want to share the food on orbit. Our JAXA [Japan Aerospace Exploration Agency] colleagues have developed a few items for spaceflight. They typically only send those when there's a JAXA crew member on board. So right now because Aki Hoshide is up there there is Japanese food on board.

ROSS-NAZZAL: What kind of food is it? Is it sushi?

KLOERIS: No, they have thermostabilized curries. They have some freeze-dried stuff. They have a seaweed soup freeze-dried. Culturally it's typical Japanese food and then they also send some commercial items. They send bonus containers that have some commercial Japanese items in them as well. Now the thing that's different about Japan and about ESA [European Space Agency] is they do not have a dedicated company that's making the foods. Basically they're going out to commercial companies, and they're soliciting them to make specific items. Same way ESA is doing it.

Russia has a dedicated company that does nothing but make space food. So any time you negotiate with the Russians they're going to say okay, no matter what I'm providing 50 percent of the food on Space Station, because they're protecting that company. You can't blame them because that's all that company does. The Russians are going to do their thing and send up their food. They ship all their stuff to orbit on Progress, because they have their own cargo vehicle for sending it to orbit.

Chris [A.] Hadfield is about to go up and be the first Canadian commander of Space Station. CSA, the Canadian Space Agency, is sending quite a few commercial items to us to pack in his bonus containers to send to orbit. That's the way it is with ESA too. When ESA provides food, they will ship it to us. We pack it in the bonus containers, and then we send it to Russia if it's going to launch on the Progress. We'll send it to Japan if it's going to launch on HTV [H-II Transfer Vehicle]. We'll send it to South America if it's going to launch on ATV [Automated Transfer Vehicle]. We have to ship everywhere. Of course we were shipping to Florida [Kennedy Space Center] whenever it launched on the Shuttle. Now we're shipping to Florida to launch on SpaceX because that's where they launch from as well. So we have to ship all kinds of places. You get into the whole import/export thing. Life got very complex when we

started sending food to Russia, and ESA started sending food to us. JAXA started sending food to us.

I work with NASA Headquarters [Washington, DC], Office of External Affairs. They work with USDA [United States Department of Agriculture]. We get special import permits to allow us to import the space food from Japan and from Europe and from Canada, because we can't meet the normal commercial import requirements. It would just be too expensive to do that. We basically have waivers, special permits, that allow us to import the stuff, with the understanding that it will never go anywhere other than into space. We can't sell it; we can't let it out to the general public or anything like that.

We're in the process right now of renewing, because these permits are only good for a year. So we're in the process of renewing the one right now for ESA foods, for European foods. We have an Italian crew member who's going to fly next year. A couple of companies in Italy have made some special stuff for him to take with him. In order for it to get there they have to import it into the US, and we have to stow it in our containers to ship it out. So we're working on that permit right now so that they can ship. We just got a shipment of food for Chris Hadfield from Canada. A couple of the products that they're sending are meat products and because they're meat, they require an import permit. We just got through getting that permit in place so that Canada could ship to us.

Now the nice thing about Japan is they're not going to ship [food] over here anymore because now that they've got HTV going they can just launch it on HTV. So they're handling that internally now on HTV. So that's good. That helps us. Of course ATV doesn't really help the Europeans because ATV launches from South America. I joke to my boss that my job

description needs to include import/export. Our biggest challenge for Space Station from the start always was getting stuff into Russia, very difficult.

ROSS-NAZZAL: Dr. Bourland mentions in his book [*The Astronaut's Cookbook: Tales, Recipes, and More*] that one of the first shipments to go over there was rejected. You guys were going to have to pay huge import fees, so he talks about a bootleg operation. Were you part of that?

KLOERIS: Yes.

ROSS-NAZZAL: Can you talk about that? It just sounded interesting.

KLOERIS: It's interesting because when the Phase 1 program came along and we were going to send our crew members to Mir I was managing the Shuttle program. He was managing Station at that point. When the original agreements were signed—and this was at the State Department level—when they were signing agreements with the Russians saying yes we're going to send our crew members over there, the original agreement was that there was not going to be any US food on board Mir. Our crew members were going to eat all Russian food. Well, when that word got back to the Astronaut Office it was like, "No!"

This would have been '93, '94. It was Dr. Helen [W.] Lane, who was head of the Nutritional Biochemistry Lab at that time, and Dr. Bourland. They both started negotiating with their Russian counterparts that they identified to try to get US food on board Mir, because we knew we wanted to at least get some up there. Well, it was interesting the way that worked out because basically what happened was Russia was being paid to provide 100 percent of the food.

So what we basically said is, "We'll give you some food, and we're not going to charge you anything for it." What that meant was, "Oh we're going to get paid to provide 100 percent of the food, but we only have to produce 80 percent of the food." So we had to make it profitable for them.

So we did that, and that's how we originally got the Russian Space Agency to agree to accept our food and send it to orbit on the Progress. That's how we were going to do that. Well, then we started having to deal with Russian customs. That's what he was talking about, about the shipment getting rejected. The whole Russian customs thing was a nightmare. The bad thing was they would seem to change the rules every time you would go to ship. The next time you'd see the shipment, they wanted some other document. This went on and on and on for a long long time, even into International Space Station. It took quite a while.

Now it's basically a smooth operation. Of course now we're not going to be flying food on Progress anymore. Now we're going to be flying it strictly ATV, HTV and the commercial vehicles. As far as food is concerned, Progress is only going to be a last resort if we can't get it on something else. Up until this past year we've been flying significant amounts of food on the Progress and of course on the Shuttle any time we had a cargo flight.

The last Shuttle flight was a cargo flight. It had the logistics module. It was loaded with food. That launched over a year ago. This whole time they've been eating food that launched on that flight. Mr. [Michael T.] Suffredini [ISS Program Manager] made sure we loaded up that vehicle with food and clothing to be sure that we could transition beyond the end of Shuttle and get to the commercial flights.

It was a huge concern that we have enough stuff in place, because nobody was certain how soon SpaceX was going to be able to fly. Your ATV and your HTV only fly once a year.

So it limits you when you don't have Shuttle. We really did load up Station with stuff in preparation for transitioning to the commercial vehicles. Now we're a lot more comfortable. When we went to Mir the first time, Norm [Norman E.] Thagard was the first US astronaut to fly on Mir. Of course he had flown on Shuttle previously. We actually went and retrieved Norm and the two cosmonauts who were with him. No way I'm going to remember which two it was, but the three of them came home on the Shuttle. They were participating in medical experiments. During those medical experiments they would have to record everything they ate, because they needed that for the data.

Well, we did baseline data collections prior to flight. We did those in Russia. Scott Smith, myself, a couple of the people from his lab made trips to Russia in late '94 and early '95 to do baseline data collections for Norm and the two cosmonauts. Basically during those baseline data collections they were running a lot of medical tests on them, getting blood work, all kinds of stuff to get data on them. During those days that they were being tested medically, we had to weigh and record everything they ate, so we prepared the food. His dietician and I were the two chief cooks and bottle washers. We went to Russia and the first BDC, the first baseline data collection, was in November of '94. We were there for Thanksgiving. The Russians don't observe Thanksgiving. When they worked out the dates for the BDC, it ended up that one of the weeks—it was a two-week BDC, I think—and it ended up that one of the weeks was Thanksgiving week. So we were there for Thanksgiving. We missed Thanksgiving at home.

When we went over we flew obviously. Because of all the issues with customs and trying to get food [imported], we hand-carried all the [US] food that went [to orbit] with Norm. So when we checked our baggage for that flight --

ROSS-NAZZAL: Is that all you brought?

KLOERIS: I had a suitcase, and I had four cardboard boxes of food with me. Same way with everybody. We took all this food as checked baggage, because we had no other way to get it over there because of all the issues with customs. We had to get it there if it was going to make it for the flight, so we hand-carried it with us.

It was just freaky. Because we get over there, and we were just so unbelievably afraid that we were never going to make it through customs to get into Russia. It was bad enough getting out of here but trying to get into there. Actually I remember the science liaison from the US embassy met us at the airport to help us get the stuff in. It was just nerve-racking because you thought you were going to end up in jail or something.

ROSS-NAZZAL: Yes, it wasn't that far in the past--

KLOERIS: Yes. Here am I, a person who went through grade school doing the duck and cover thing under the desk, and here I am standing in Moscow. It's like who would have ever thought that I would ever do that. But we went out there. On these trips we would spend one night in Moscow at the hotel and then we would go out to Star City, which is their equivalent of JSC. Well, back then let me tell you Star City was pretty remote. You could not get a phone line to call back to the US. It was very difficult. When the Moon was full and the stars aligned you could get through to get back to the States, but the communication was horrible. The places where we stayed--

ROSS-NAZZAL: Where were you staying?

KLOERIS: Well, Barbara and I, [Scott's] dietitian and I, since we were cooking for the crew members, they let us stay in the Profilaktorium, which was their crew quarters. So were staying where the cosmonauts were staying, because we had to be there at like 5:30 in the morning to start cooking breakfast for them and weighing and recording what they ate. Well, this is November. There's snow on the ground. So they allowed us to stay there in that building; the other folks we were traveling with were staying across the center in a hotel that they had within Star City. Star City is interesting. I don't know. Have you been there?

ROSS-NAZZAL: No, I haven't.

KLOERIS: Okay, well, Star City is interesting because it's a gated community, basically. You're inside a military base more or less. It'd be just like JSC, if JSC had houses and apartment buildings and grocery stores inside the gate. That's the way Star City was. The people lived there. The people who worked there lived there. So they actually had a hotel where the folks that we were traveling with stayed.

What a dump that place was. It was in horrible condition. As Phase 1 progressed and International Space Station was coming, NASA money started pouring into Star City, and they started renovating all these places. They built communication back to Houston. Now they have the cottages there where the astronauts stay when they go over to Star City. They basically built condos there. That's where the NASA astronauts stay when they go over there for training, but during the time that we were there they were staying in the high-rise buildings. They had high-

rise apartments. So when Norm Thagard was there that's where he was staying. Then Shannon [W.] Lucid flew to Mir. We were over there when Shannon was there doing baseline data collection for her as well.

So Star City was very interesting at that time. It was a little bit—I don't know—a little bit more rustic than it is now, that's for sure.

ROSS-NAZZAL: Only a few years from the fall of communism, I can imagine.

KLOERIS: Yes. So I've been back a few times since then just for various things. It's definitely quite a bit different than it was when we went there in '94 and '95.

ROSS-NAZZAL: How did the Russians treat you, being that you were a woman? Women of course are in the sciences there, but they weren't accustomed to women being very powerful.

KLOERIS: Well, it's interesting because what I was doing, I didn't really have that issue. The task that I was doing, I wasn't really interfacing with people; I didn't have much authority in what I was doing other than just doing my job. But I know when I was there Peggy [A.] Whitson was head of the sciences. So I know from observation and from stories that she had quite the issue with some of those male Russians, because she was representing US science. She was the lead, and I know she had lots of issues with some of those gentlemen over there who weren't used to dealing with women in authority. It was interesting. It was a good experience. I'm glad I did it. I will never forget, because it was very very interesting to do that.

ROSS-NAZZAL: Sounds like it. In the meantime you're still working on the Shuttle system. You'd come back and work on the Shuttle food system.

KLOERIS: Oh yes. We still were involved flight to flight. FEPC continued to have that contract. They picked it up at the return to flight. They had it all the way until September of 2010 when that contract was retired. Now early on it was the Flight Equipment Processing Contract and Boeing had it. Then Boeing [came together] with Lockheed [to create United Space Alliance], USA. But it was all the same facility, the same people that ran that the whole time, same technicians. Pretty much all the same people were involved in the Shuttle food processing through that whole era, so from '88 to 2010. It was all done in the same offsite facility. So we continued. I was the technical monitor like I said until 2005, and then Michele Perchonok took over as the monitor to finish out the end of the Shuttle flights.

The offsite [USA food] facility was shut down in September of 2010 in anticipation of the end of the Shuttle program. As it turned out those last three flights got delayed a little further than they thought. So we ended up in the onsite facility having to package some food and support those last [missions].

Because USA, before they shut down, they packed the last two missions—well, at that time we thought we were going to have two. It ended up being three because they added another flight.

ROSS-NAZZAL: Right, yes, they added the last one.

KLOERIS: So for [STS]-133, [STS]-134, which we thought were going to be the last two missions, they had already packed that food before they shut down in September of 2010. We ended up having to repack some of that food because those flights ended up getting a little delayed. Some of the food got too old, and we had to go in and replace it. We produced some replacement items in the onsite facility and put it in, replaced some of the stuff that was in there. Then of course when they added that last flight we had to do the full provisioning.

When Space Station first started, on site we weren't doing 100 percent of the Space Station food. We were utilizing the Shuttle facility for certain items because there was an economy of scale having them produce beverages say. We were buying beverages out of the Shuttle inventory because it made sense, since they were already doing it for Shuttle to just do more. So it was an economy of scale.

So we were producing I would say probably 70 percent of the food for Space Station, and we were buying maybe 25 percent of it or 30 percent of it out of the Shuttle inventory, because it's the same products. Many of them were the same. When we started looking at ending the Shuttle program, options were presented to the Space Station program. We don't need two food facilities anymore. How do we want to do this?

So one of the tasks that I had was to present Mr. Suffredini with different options. "Okay, do we keep the USA facility, shut down the one on site, consolidate into the offsite facility? Or do we consolidate into the onsite facility?" There was even discussion about sending the whole works down to Florida. With Kennedy running out of Shuttle [work] it was like, "Well we need to find work to send down there."

So one of the tasks that Michele and I had to work together on was to present the program with options. Eventually costwise and for a lot of reasons they decided to consolidate into the

onsite facility, not try to go to Florida, which never made economic sense because they would have had to rebuild all kinds of facilities down there. That was more of a political we need to provide jobs in Florida type of thing. We ended up consolidating into the onsite facility, and so the offsite facility got shut down [in September 2010].

But we picked up quite a few of the people, because we had to expand our workforce obviously on site, and so quite a few of the people who had supported the USA contract now support our bioastronautics contract [food lab] on site and help do some of the same type of tasks that they were doing over at USA. We brought equipment from that Shuttle food facility on site. A lot of it is serving as backup to our equipment, but we have consolidated it all into the facility. We picked up freeze-driers that they had and stuff like that.

ROSS-NAZZAL: Sounds like things are still hopping quite a bit.

KLOERIS: Oh yes. They still eat. We're still producing a lot of food. We have to. I talked about us formulating our own thermostabilized pouched products. When we started doing that, the food that we produce, those thermostabilized pouched products, those are considered experimental foods by USDA, by [the] Food and Drug [Administration, FDA]. We're not allowed to commercially sell those, because we don't go through the whole thing where we do the nutritional labeling. The stuff that would be required if you wanted to sell it. We're just making it for spaceflight. It's considered experimental food, so we have to supervise the production of that. We have to have somebody from NASA or from our contractor supervise that production.

Those particular products have to be done in a retort, which is just a piece of equipment similar to a big autoclave. So we were using retort facilities from the vendors who make it for the military. We would basically go into an MRE facility, and we would rent that facility for a week or two. We would use their equipment and their employees. We would send our food scientists in there, send our ingredients there, and we would make our products. So about once a year we'd go sublet a facility and make what we needed to make for the whole next year.

Well, that worked well until the war in Iraq came along and persisted for so long, because then we got to the point where these facilities were making MREs two shifts a day 364 days a year. We could not get into these facilities. We had to come up with our own retort facility.

So we started [with] the bioastronautics contract. Wyle started talking to a commercial company here in Houston who was interested in developing pouched meat products for the commercial market. They were going to partner with us and establish a retort facility here in Houston. Those talks went on for quite a while, over a year. Then somewhere up the chain on their side they nixed it. Their management said, "No, not going to do it, that's out."

We started looking around. We got to have other alternatives, because we need ways to be able to reliably produce this stuff on a predictable basis. So we actually put out a bid. What we really wanted was a facility close enough that we could drive back and forth, because we have to get personnel there, pick up food when it's made, bring it back, all that kind of stuff. So we had bids submitted. What we ended up with was a retort facility at Texas A&M University. It's in the research park up there at A&M. A&M actually has an electron beam food processing facility. They have a facility where they irradiate food. That facility was built quite a few years ago now by a commercial company who was in the business of irradiating frozen hamburger meat for the commercial market and also for the fast food market.

This all dates back to the ’90s when they had E. coli, and people died from H57:O157 from undercooked hamburger meat. This wasn’t the only company, but it was one of the bigger companies that was irradiating frozen hamburger meat especially for fast food market. You irradiate it so that you kill off E. coli and salmonella. You still have to refrigerated it afterwards. It’s not like you’re making it shelf-stable or anything, but you’re killing the pathogens so that you don’t have to worry that you’re going to have E. coli survive and make somebody sick. So they built this facility—it wasn’t their only one, they have a couple around the country—where they were irradiating hamburger meat.

Eventually, not really for financial reasons but for legal reasons, that company went out of business. A&M bought that facility, and they continued to do that. So through their extension service they operated that facility. They irradiated hamburger meat still for the commercial market. They do a lot of irradiation of medical equipment, medical packs, because there’s an awful lot of medical equipment that cannot go through an autoclave because it can’t get that hot, because a lot of it is plastic and it’ll melt. So they cold-sterilize it using radiation. They do a lot of medical stuff at that facility.

After 9/11 they irradiated mail to get rid of anthrax. They ran a lot of mail through there just to make sure there wasn’t going to be an anthrax issue when that was a big deal after 9/11. So it’s still an operational facility, but they had some space in it that was not being utilized. The nice thing about this facility is it’s already built out to food production standards, USDA, FDA. It has the floor drains, it has the cleanable walls, everything you need for a food production facility.

So they bid on our desire to establish this retort facility, and we partnered with them. It has worked out very very well, because we utilize their student labor. So their [food science]

students get hands-on experience in doing thermostabilized food products, and they can use that retort for teaching when we're not using it for production. They can use it on a noninterference basis. It's been a great partnership. It's worked out really really well. We've had that open since I guess early 2007. That allows us to produce food basically every week if we want to. We can go up and produce a product. We do that pretty much.

Any time the schools shut down for holidays or whatever, we don't produce. Other than that we're up there pretty much every week producing thermostabilized products for spaceflight. So that's worked out really really well.

ROSS-NAZZAL: You had another partnership for a while. It's closed down, at Iowa State University [Ames].

KLOERIS: Yes. NASA Headquarters funded what was called a Food Technology Commercial Space Center. It existed for about five years. The purpose of that was to try to get food companies to have an interest in partnering with NASA to develop products to go into space. Not highly successful.

We had Kraft actually join the Commercial Space Center. We had a European company, a big dairy company, Arla, joined. Actually they developed two thermostabilized yogurt products that we still fly that they developed during that Commercial Space Center time. But it's just very very hard to get the commercial companies to be interested because we have very different requirements than the commercial market. We want foods to last a really really long time. Commercial companies really don't want that. They want for you to have to keep buying it over and over again, so they're not looking to have it last that long. The quantities that we

need are so low that most of these companies, they don't even want to fool with us. It's like, "What do you mean you only need 400 a year?" They don't even turn on their equipment to make 400, because they're used to producing things on very large scale.

I've been a civil servant how many years now? I've been here 26 years plus. I've seen many efforts during that time to try to persuade commercial companies to come either do the whole food system [or] produce the galleys for the Space Station, produce the ovens for the Space Station. None of those efforts have really been successful, because there's just not enough in it for the commercial companies. So it's very very difficult.

We still have some companies who do special things for us over the years. An example would be Tang.

ROSS-NAZZAL: That's not very popular any more.

KLOERIS: No it's not. People have the myth that [NASA] created Tang. No, that's not true. Tang was already out there on the market at the time NASA was looking for beverages that all they had to do was add water to them. Well, if you think about that era, there weren't that many beverages on the market that you could just add water to. Typically you had to add a cup of sugar. Tang was close to orange juice and it was perfect for NASA, because all you had to do was add water. Basically Tang was on its way out when NASA started using it. Because NASA started using it, oh my goodness, they were able to advertise and really take off with that. But they've been very good to us over the years.

At various times different companies have owned Tang. It's been General Foods. It's been Kraft. It's been you name it, because these companies are always merging and buying each

other out. Over the years they have provided us with flavors that they do not market here in the United States, that they market elsewhere in the world like mango. So we've had a lot of stuff. For a lot of that time they would provide it free of charge. So they're an example of a company that really kept with it, got into the idea of supporting the space program and continued to do so. They're not the only ones, but that's just probably the biggest example I can think of.

Those are few and far between is what I'm trying to say, because there's just not a real economic incentive for these companies to get involved. I wish there were. It would make our life easier, but there's really not.

ROSS-NAZZAL: I can imagine. At the end of the day do you actually go home and cook? Or are you just tired from cooking all day?

KLOERIS: No, to be honest, I'm to the point where I don't do that much hands-on stuff anymore. Hands-on stuff is done by the technicians in the lab. I'm doing more paper pushing. These days the biggest thing is manifests. We've been playing for the last month the SpaceX-1 game. What food is going to be on there? Because we shipped food for SpaceX-1, we had a plan.

What they'll tell us is okay, "This is how many kilos of upmass you have on this flight for food." We have to look at our plan and see what needs to go up when and figure out what we're going to put on each vehicle. So we sent what we thought was going to be the food for SpaceX-1. Then they asked for more. Then they came back and said, "No, we're going to take everything off, because we need to put something else on." Then they're like, "No, we're not going to take anything off." Then two weeks ago they took half of it off. Now last week they

put all but about a third of it back on. So it's just been this one thing after another. That's so typical of all these flights.

The planning is just horrendous trying to figure out. When we're trying to support the science experiments and we know food for those science experiments has to be there at a certain time, you've got to be sure it's on a vehicle to be there when they need it on orbit. Same way with their bonus food. The core menu that they eat is standard, but they do get to augment that with what we call bonus containers. The bonus containers, it's their preference. They choose what goes in it, so it augments our standard menu. The bonus containers obviously have to get there at the same time the crew member is there, or it doesn't do any good. So I spend a lot of my time now tracking the food that's on orbit, tracking the usage rates, how quickly they're going through the food, planning the manifest. This week they've been after me. "What are you going to put on SpaceX-2?" Well, SpaceX-2 is launching in January. It's like, "Until you tell me what I'm getting on SpaceX-1 I can't tell you what I'm putting on SpaceX-2. Every time you change what's on SpaceX-1 it changes what I'm going to put on SpaceX-2."

So I spend a lot of time working manifests. It's a big deal trying to figure out what upmass I need to get stuff there the right time and looking at the shelf life of the foods on orbit. How old they are. How long it's going to take the crew to get through them.

Today we had the operational readiness review for Expedition 33. The launch of 32-S later this year is going to begin Expedition 33. So we have to go through this process where we say yes we're green or we're yellow or we're red, depending on what issues we had. Today Space Life Sciences, we had our review. One of the things that I had to discuss with them was the food that we have on orbit now is expiring. So they're going to be eating expired food

basically. Our expiration dates, they're really best if used by dates. They're not true expiration dates, so the food can be consumed beyond those dates.

But the quality starts to degrade—it's not a safety issue, but it's a quality issue. So one of the things that I talked about today with my management at this review was the fact that by the time we get to the end of the year when Chris Hadfield and [Thomas H.] Marshburn get there they're going to be eating all food that's past its best if used by date. It's a psychological issue for the crew members. Here they're opening up a container of food that plainly says the best if used by date is November of 2012 and you're sitting there and it's December.

So that's a big fight that we have to fight. We maintain control sets on the ground of that food. We have a category of food up there called soups and cereals. They're packed together in a container. We pack pantry style, so all the veggies are together. All the meats are together. Soups and cereals happen to be together. They have one of each category open at a time. By having all eight categories open, that gives them access to all the different US foods, and they pick and choose what they want to eat for that particular meal. We know that we have 20 containers of soups and cereals, and they reached their best if used by date on August 30th. Well, at that usage rate, it's going to be another almost six months before they get through with all those containers and move on to the next [best if used by date].

They're going to be eating that stuff potentially for six months past its best if used by date, which is not good. So we have a control set on the ground that has those same products made at the same time, packaged at the same time. What we're going to be doing is monitoring on the ground. When we see that the quality of certain products has degraded, then my job is to go to Mr. Suffredini, to the program, and say here's the stuff we want to throw away because it's not good anymore. He doesn't like that.

ROSS-NAZZAL: It costs money.

KLOERIS: It costs money, because you've paid to get it to orbit. At the same time it's a Catch-22 because we know ATV-4 is coming. HTV-4 is coming. They are loading those vehicles up with food, because they [don't have enough other stuff] to put on them. We are the ballast of choice. That's what happened on ULF7 [STS-135]. They didn't really have stuff that they needed on orbit. Same way ATV-3. They didn't have enough to fill the vehicle. But Mr. Suffredini is like, "We will not launch an MPLM [Multi-Purpose Logistics Module] to orbit that isn't full. So fill it up with food. Fill it up with clothing." ATV-3 was the same way. We added a bunch of food to ATV-3, because they weren't even full. You end up just constantly kicking the can down the road where they're always eating old food, which is not good.

Probably at the end of June [2012] they finished all of the food that came up on ULF7. That food had a best if used by date of 7/31/11.

ROSS-NAZZAL: Ooh. Almost a year [past its date].

KLOERIS: Yes. Now some of the categories they had finished off earlier, but some categories they were continuing to eat that food all the way till early this summer. So starting early this summer until now—so for a two-and-a-half-month window here they've actually been eating food that was within the expiration date. Now we're starting down the path again. So at the end of August we had some expire. Another category will expire at the end of September, another

two at the end of October. By the time they get to December they're going to be eating all food that's past its best if used by date.

So today I had to brief Chris Hadfield and Tom Marshburn and [Roman Y.] Romanenko. The three of them will be launching in December to go up there. So I had to sit there at their consumables briefing and say, "You guys are going to be eating old food the whole time you're up there."

ROSS-NAZZAL: Probably didn't go over very well.

KLOERIS: Well, no, actually, they understand the situation. They know why it is what it is. It still pains me, and it pains the folks in my lab because we know if they were eating it when it was fresher that they would enjoy it more. We always get debriefs with the crew members whether it's a Shuttle flight or a Station flight. When they come back we will have a food debrief with them. Now we've had so many debriefs on Station, and on Station they've been eating old food for so long that they'll come back and they'll say—one of the questions we ask them, "Were there products that you particularly disliked? What were they?" We can almost predict what they're going to say. It's like, "Oh yes." They'll name a product like our teriyaki beefsteak. "Oh, that stuff was horrible." It's like, "Yes. If it hadn't been five months past its best if used by date it would have been fine. You would have liked it had you eaten it five months earlier." So it pains us because we know that there's just certain products where the quality degrades when it's that old.

That's the argument that we had. With the Shuttle ending, until they're more confident about the commercial vehicles, we call it the hoard mode. They're hoarding food. They're

hoarding everything, because they're worried they won't have enough. It's like but gosh, you're just condemning them to eating old food the whole time.

ROSS-NAZZAL: What's the shelf life for most of the food that you have for Space Station?

KLOERIS: About two years. If you look at ATV and HTV, we produce that food. We have 200 different products, so to completely produce everything we need it takes about three months or so, if you're having to replenish everything. Takes three or four months for us to produce all the different stuff. Then for ATV and HTV we have to ship it out the door six months before the flight launches. So you're looking at food that's about nine to twelve months old before it ever even leaves the ground and then it's got to sit on Station for 18 months, 24 months before they eat it. I don't know why it is what it is. When we ship to ATV and we ship to South America, ship to Japan, we have to ship that stuff six months before the vehicle is going to launch. If you look at ATV-3 which docked in spring, that flight slipped like two months. So we had already produced it, shipped it last year. Then after it was already over there the flight slipped. That added another two months to the age of the food before the vehicle ever launched. ATV and HTV, they can carry a lot of stuff and they can carry a lot of food, but it's not really a good vehicle for [the food team] because we have to do it so far in advance.

Progress was better because we only had to ship that about two months roughly in advance of the launch. So that was a lot better. Shuttle of course was the best because we didn't have to send that near as far in advance. SpaceX is not too bad. It's about two months in advance of the flight. We can handle that. That works much better for us than six months.

ROSS-NAZZAL: Do you have to accompany food when you ship to all these different places or when you used to ship to the Cape [Canaveral, Florida]?

KLOERIS: No.

ROSS-NAZZAL: Does it just go on a Gulfstream or is it commercial cargo?

KLOERIS: Well, when it goes overseas it has to go by commercial shipper. I don't know, whether DHL, there's a contract here, the Cargo Mission Contract, CMC for short. CMC handles the shipping of all the hardware to the international destinations. So we send our food to CMC. CMC ships it to Russia or to Japan or to wherever it's going to go. So they're responsible for boxing it up, but we have to do all the paperwork that goes with it. With food there is a ton of paperwork. Every time we do an international shipment you're looking at a stack of paperwork like that [demonstrates] for each of those shipments. We also have to get a permit. Our Russian customs and also French—Japan doesn't require it. When we ship to ATV in South America, believe it or not, it has to go through Paris [France].

ROSS-NAZZAL: A roundabout way.

KLOERIS: Yes. Apparently you cannot ship directly from here to French Guiana, so it goes through Paris. Because it goes through Paris we're dealing with the European Union and their import requirements. European Union and Russia both require a USDA permit. Basically what the USDA permit states is that the food is safe. That's basically what you're saying.

We had to set up an arrangement with USDA to provide us with the permit, because we are not a USDA-inspected facility. Because we are a federal facility and not a commercial facility, USDA has no jurisdiction over us. Nor do they want to. They don't have anything to do with us. They don't want the responsibility, but they did agree that they would provide these permits if we paid them. I have to write a letter that says, "You're not responsible if Russia or Europe rejects this shipment." In other words if Russia were to come up and say no, I don't accept this certification, USDA doesn't want to be held accountable for that. I basically have to write a letter whenever we apply.

Every time we ship to Russia or we ship to Europe I have to apply for this USDA permit. We do that through their office in Austin [Texas]. I have to write a letter basically saying, "We will not hold you accountable if this stuff doesn't get through." They issue us a permit. The permit covers—it really only has to cover meat and dairy products. So everything that's like all vegetable, nobody cares about that. It's mainly your meat and your dairy that these customs people care about. So we have to provide that cert. That was another challenge because we had to figure out how to set this up with USDA to be able to get them to certify. That went all the way back to when we were first shipping on Progress. That was a big challenge to figure out how to make that happen as well. So there's been a lot of issues with import/export, certification, all that kind of stuff.

ROSS-NAZZAL: Do you do any work with the FDA?

KLOERIS: Not really, no. They're involved in the sense that it's like a USDA FDA—at Headquarters when we get that import permit, it's basically coming from both. I don't get

directly involved. NASA Headquarters has been handling that permit. They work with USDA with the offices there in Washington, DC and get the import part of it worked out. But we've worked with USDA on the export part of it.

ROSS-NAZZAL: Do you have much contact with the Natick Labs as they're developing new things for MREs?

KLOERIS: Yes, we do. We trade information on what we're working on. We actually have nine irradiated meat products that we fly. We have special permission through the Code of Federal Regulations to irradiate meat to shelf stability, which is not approved for commercial sale here in the United States. It is in other parts of the world, but not here. Here when you irradiate food, you can irradiate—like we discussed earlier irradiating hamburger meat to kill pathogens. But that's considered a pasteurization dose, because you're just killing the pathogens. You're not making it shelf-stable. It still has to be refrigerated after you're done. What we're irradiating to is a level of commercial sterility where it is shelf-stable, so that's not approved for commercial sale. You can go look in the Code of Federal Regulations. It says NASA is allowed to produce these foods for spaceflight.

Natick actually makes those for us, so we contract with Natick. They have an arrangement with an irradiation facility in Florida. Those products are made by Natick, they're irradiated in Florida, they ship them to us, and we fly those. We have beefsteak. We have sliced turkey. We have beef enchiladas. What else? A breakfast sausage. We have teriyaki beefsteak. We have chicken teriyaki. Beef tips with mushrooms. I think that's about it. We have these products that they irradiate for us.

Any time they come up with new stuff for MREs, they'll send us samples so we can try it and see if we're interested in it. Historically the stuff that they make for the troops, too high in salt, too high in fat. They're feeding a much younger crowd. Their typical customer is an 18-to-20-something-year-old soldier. They need the calories in there, the fat to boost the calories, because they're trying to get a lot of calories. Obviously an 18-year-old can consume a lot of calories. So they're trying to get a lot of calories in a small amount of food. So they use fat to do that. Fat makes it taste good too. The salt, they tend to put a lot in because it makes it taste good. Also the soldiers, if they're in the desert and they're sweating out, they need those electrolytes to replace what they're losing. We don't want that high salt for our astronauts. A lot of the stuff that they develop, we're not going to add it to our menu just because it is so high in salt.

In the reverse order we started some of the thermostabilized products that we've formulated. We've shared samples with them at various times. I know one of our dessert products that we did, we have a chocolate pudding cake. They liked it so much that they took it and made it into an MRE item. This was quite a few years ago. I don't know if they're still using that formulation or not, but they were using one of our formulations for MRE at one point.

ROSS-NAZZAL: Oh that's neat. Now we have about 15 more minutes. Do you want to keep going or would you like to come back?

KLOERIS: I don't know that we've covered everything.

ROSS-NAZZAL: I don't think we've covered everything, but I hate to keep you, especially if you want to get a chance to go see *Endeavour*.

KLOERIS: Can we reschedule another session later?

ROSS-NAZZAL: Absolutely, yes.

KLOERIS: I'm willing to come back.

ROSS-NAZZAL: Yes because I find all of this fascinating. I'm sure other people will too.

KLOERIS: Okay, yes, I wouldn't mind coming back, and I can take your questions and highlight the ones that I think we hit. Yes so I wouldn't mind coming back for another session.

ROSS-NAZZAL: Okay, that'd be great.

[End of interview]