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ANNETTE P. HASBROOK
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is July 21st, 2009. This interview with Annette Hasbrook is being conducted in Houston for the JSC Oral History Project. The interviewer is Jennifer Ross-Nazzal, assisted by Rebecca Wright. Ms. Hasbrook was the lead ISS [International Space Station] flight director for STS-124. She's here to talk about planning, training, and flying this mission. Thanks again for coming over this afternoon. We appreciate it.

HASBROOK: You're welcome.

ROSS-NAZZAL: [I] know you're busy with all the flights that are going up. I'd like to start by asking you what's the role of the lead ISS flight director? Can you give us a summary?

HASBROOK: Sure. The lead ISS flight director typically takes the requirements laid out by the Station Program, and they work with the Shuttle flight director to integrate an overall plan for the mission, because you've got two huge vehicles. They're both independent, and you bring them together. You have to work as a team. The lead Station flight director tends to be the overall conductor, because now the focus of activities is on the Station. We run all the EVAs [Extravehicular Activities] out of the Station airlock. Most of the tasks are Station-related, so we do a lot of the discussion and the planning, assessments, and ops [operations] trades, with our team, and then make the recommendations to the program. Or tell them, "This is how we're

going to do it," or, "You can do A or B, and this is what you gain or lose by each option." So I'd call that in a nutshell.

ROSS-NAZZAL: When did you become a flight director?

HASBROOK: I was selected in 2000. So we're the class of Y2K. Matt [Mathew R. Abbott, Shuttle flight director for STS-124] and I were both class of 2000.

ROSS-NAZZAL: Were you originally a Space Shuttle flight director, or were you a Station flight director?

HASBROOK: I've been a Station flight director for my whole career. The grand plan was to start in Station flight director, and then after STS-124 flew in 2004, I was going to cross-train. The *Columbia* [STS-107] accident changed a lot of that. I ended up working the 1J mission for eight years before it flew. So I had a very long tenure with that mission, which is atypical for a Station flight director.

ROSS-NAZZAL: Can you give us some more information about that, in terms of your preflight experience on this mission?

HASBROOK: Sure. I first started working with the Japanese back in the '80s or early '90s on what they called the Manipulator Flight Demonstration [MFD] Project. It was their Small Fine Arm. They were demonstrating it in the Shuttle before they eventually were going to launch it

on Station. I did some early work, Preliminary Design Review [PDR], for them, and then got involved in other things. Between the time of the PDR and the flight, I went and worked as the Mission Ops Rep for a second Japanese mission, the Space Flyer Unit [STS-72]. It had been launched on one of their vehicles, but then we went and retrieved it and brought it home in the shuttle because it had science collection on it. That was my second foray into the Japanese space agencies.

Then I flew the MFD mission [STS-85] as a payload officer. The payload officer is responsible for explaining Shuttle problems to a customer, what the impacts are, the payload problems to the Shuttle, and figuring out solutions. So then when the Japanese mission came along, and the Space Station assembly missions, that was a good fit for me, because I really enjoyed working with the Japanese people. As a new flight director, I went once as what we call an assembly and checkout officer [ACO]. Those are the folks that are responsible for keeping the Station and the Shuttle team, the two rooms, on the same page. We cross-communicate to each of the teams as needed. So I went as the lead ACO with the flight director and his team, and we had our first joint operations panel where we talked the mission in general and very high concepts. Then once I was selected as a flight director, I was the backup for Bryan [P.] Austin, and then he subsequently left the office and I became the lead for it.

My role was really to assimilate the Japanese and their mission requirements into the way the Space Station Program does business and the way Operations does business and make sure we had a workable plan to fly the mission. In some respects, we took it on to teach them how to be Mission Operations. They had done a lot of work on unmanned vehicles, but they had never worked really in the manned spacecraft environment—the responsibilities and the need for quick response to failures, because you have a defined limit of time that your crew members are in

orbit. It was a different concept for them. We spent a lot of time just teaching them how we do business. It's not to say ours is the only way to do it, but saying, "This is how we do business, and here's a way you can organize your team and manage your team, and you need to define rules for your element. When is it considered a failure? When do you have fault tolerance? How are you going to interact with the US team? How are you going to interact with the Russian team? How do you write your procedures so the crew members can understand it?"

It was really an evolutionary process. "How do you interplay into the emergency procedure development?" Because obviously, when the Space Station is up there and the crew members are up in space, if we have an emergency they have to be able to respond and take care of it themselves. Hopefully the ground is there and can help them, but they have to manage it themselves. The Japanese needed to understand that we had three major emergency cases, and how did their element fit into the overall emergency scenarios as an example. So I would do a flight controller 101. It was revolving around the JEM [Japanese Experiment Module] module and all their system, but in a sense it was the broader scope of teaching, "This is how we do business, and this is how we would like you to interact with us. How do you want to do business?" Then modifying and adapting from there. It was fun.

ROSS-NAZZAL: That's a lot of work. Do you speak Japanese?

HASBROOK: Just a little bit. I took about a year of Japanese in the early years as a flight director. I had a little more time, because they speak fluent English and also Japanese. For us to go into their culture and make an attempt to try and at least have some words of Japanese or a couple sentences at least, that was important to me. I grew up overseas, and it was very important to try

and respect the culture that you're entering into. So I took it for about nine months to a year and just had simple phrases. But it goes along way toward building a bridge to your colleagues, the fact that you show interest in their culture and their language. It was fun. I enjoyed it.

ROSS-NAZZAL: What impact did the *Columbia* accident have on this flight?

HASBROOK: The original timeline for the mission—we were supposed to launch somewhere in the 2003 era. Then in 2002, I believe—some of these dates are fuzzy—Japan requested a one-year delay. They basically said they wanted to swap places with the ESA [European Space Agency] module, the *Columbus* module. I think it was roughly 2004. We were preparing for that. Then when the *Columbia* accident happened, of course no one knew exactly when we were going to launch. That ended up delaying them. Instead of launching in 2004, we launched in 2008. You had the downtime, and then it was the return to flight, and then once you finally were operational, then we got back in the sequence. So they ended up being delayed about four years.

They would have been ready before 2008. I don't know if we would have been ready in 2004, because it's hard to know whether the pressure of a time deadline, [if] you'd still get there. But having the additional time gave us the capability to more fully develop a lot of their procedures and thought processes. In a sense, you got a maturation of their flight control team, because their culture, they basically move around in their professional life, and that's expected and routine. Basically every three years, they're moving somewhere else. So if you have a flight control team of 12 people, every year they would lose four and get four new ones. It took a while to come to the realization that they really needed to maintain a core set of people to be ready for their major element. I think having more time to grow helped them learn that, and then

realize that, and then implement that in their staffing. I think that became a good strength for them, because they really had a very strong core set of people when they flew the mission that understood their systems.

ROSS-NAZZAL: In between the time that this flight flew and *Columbia*, were you working other Space Station missions as well?

HASBROOK: I was. As the Space Station flight director, the way our certification was is you joined the office, and you did training, and then we did simulations, because you practiced going through a lot of failures. Then we achieved what we called an increment certification. So we were certified to sit on console for stage operations. That means when there is not a joint assembly mission, a Shuttle there. Then we did basically a delta cert [certification] to become what we called assembly certified flight director. So we went through those flows.

My first assembly mission was STS-121, which ended up being after the accident. Prior to that I had been what they called a lead increment flight director. So I basically managed a Space Station crew for six months [and] prepped them for some of the training. Then you're basically their prime interface with the ops team for the six months that they're in orbit. You become an advocate, because the flight control team moves. Your teams are constantly rotating and shifting, going on and off console. But you were there every day and knew the problems. You'd know the longer-range problems, solutions, problem solving, and what was going on to solve the issues that were coming up. It was a very fulfilling experience, because you felt like you flew the whole mission with the crew members. Assembly missions are stretched out for six months. You're not quite at the sprint pace of an assembly mission, but you've certainly done

plenty of work by the time six months is over. I did that for Expedition 10, which was Leroy Chiao and Salizhan [S.] Sharipov. Then I worked STS-121 and several other missions prior to my lead on 1J.

What that does is it helps you learn and grow in your roles, because your first mission, you'll be a planning shift flight director. Then usually you might do one or two missions with that, and then you'll be the orbit one flight director, so you would get your crew members ready for the spacewalks or do the first part of robotics activities. Typically on the Station side, our lead flight director is on the orbit two side, what we call the second half of the execute shift. All of that background prepares you and gives you your skill set, so as you're working with your flight, you know the issues that can be expected and things that you ought to be thinking about and preparing for.

Space Station has a lot of challenges with structural loads, thermal impacts based on attitudes. We have a lot of hardware. When you add on to it, you're changing what the vehicle looks like. So many specific solutions are being designed for your specific mission. When you see that going through the process of some of the other missions, that helps you prepare for your own mission. You know to go talk to certain folks to get this data and work underway.

For the Japanese, of course, you now have to bring in the international partners and say, "Okay, you need to think about this, think about this, think about this. We need the data in these deadlines in order to develop the products." So having the background with them helped, because you get asked for a lot of things very late. Someone would ask them, and they may not respond, but then if I would ask them and say, "No kidding, we really need this," "Okay, Annette-san said we need this, so we need to go work on this." That's where the years of background and trust really helped, in probably the last year, year and a half when the pressure

was really getting built to go solve the problems or go determine what your solutions were. Everybody's stretched for time. Nobody has unlimited time and resources. So you'd have to help prioritize. "We really need this piece. That's a contingency piece. You should think about that, and maybe have a skeleton thought, but here's the priority of the analysis we need." That helped a lot. Just having done the training beforehand helps you think about that for your own mission.

ROSS-NAZZAL: Tell us about planning from your perspective as flight director. We've heard from the FAO [Flight Activities Officer] and the lead timeliner. But when do you become involved with planning for the mission, and what's your role?

HASBROOK: When you're assigned as a lead flight director, you really become involved in the planning at that point. First I say strategic, really, but when they assign the flight director, usually that's when you're in more of the tactical planning. The overall requirements for the mission have been defined. For ours, it was pretty high level. Install and activate the Japanese module. Okay. So that's easy enough.

ROSS-NAZZAL: Not much detail.

HASBROOK: Yes, right, well, there's a lot to installing and activating. You had to do spacewalks to configure hardware. You had to do robotics to actually get the element out of the bay and put onto the Station. You had to do IVA, Intravehicular Activities, to install jumpers so that the

lifeblood of Station: power, data, water, command, telemetry, you could now hook into the new element. Then you had to actually turn the element on, and then go into it, and then outfit it.

Those are the flow down. We worked with the Japanese to say, "Okay, well, how do you get it out of the bay?" So there's a piece of planning. "Well, I need to remove this connector and this jumper, and I need to pull this cover off." The robotics were pretty much left up to the United States, because the Space Station robotic arm was putting it on the US segment. But of course, my robotics officer needs to understand all the constraints on it and build the robotic timeline. Then once we mate it, well, what do we need to attach first, or what do we need to connect first?

Most of the elements have what you call a prime and a redundant string. They (the Japanese) were like, "Well, to be considered activated, we have to have both strings." This is where you pull back on your knowledge. "I know that's what you want, but what is our minimum mission success criteria?" You're defining what your minimums are to achieve mission success. In a sense, that's a planning activity. They said, "Okay, one string has to be activated." So we worked out the details for that, and there are thermal delays, and obviously you're going to end up with crew day constraints. You negotiate back and forth. "Okay, well, is this really a strong thermal requirement? Do you have to have a wait time of this many hours? Because this is what it's going to cost you. We can't activate till the next day, for example, if the wait time is too long."

Okay, well, then you go back and negotiate. So in a sense, the planning starts very early. That continues on, because the *Kibo* module, once it was installed and activated—it only launched with four racks installed. It was so heavy. It's the largest module overall, not the heaviest, but the largest. Based on the CG [Center of Gravity] in the Shuttle, it could not launch

with all the system racks in. It has eight total system racks. So they ended up launching what they call the Japanese Logistics Module, which is the little guy on top of the *Kibo*, the flight before, with four systems racks installed plus four other racks to transfer into the *Kibo* once it arrived. Once we finally got *Kibo* installed and activated, then you had to work the process to get all those racks out and into the module. There's another planning aspect. What's the priority? What are the constraints?

We developed that timeline. When we first started, we were on an Orbiter that we called a non-SSPTS [Station-Shuttle Power Transfer System] Orbiter, [*Atlantis*], so it did not have the capability to transfer power from the Station to the Shuttle to extend its docked duration. Our mission was so heavy, we were very low on ascent performance margin. We had a three-day docked mission. It was like a seven-day mission total. So it was a very short, condensed mission. We said, "Okay, what is the minimum that we have to get done in order to be able to undock safely?" So we defined that. Then gosh, I don't recall, maybe two or three years before the flight, they switched vehicles on us because of where we had moved in the sequence. Now we had one of the extended duration capability Orbiters, [*Discovery*]. So we could add so much more into the timeline.

Then it was back to planning. "Okay, well, how do we want to prioritize our mission? What is really important to get put into the timeline to set up the module in the best situation possible?" Planning from that perspective goes on all the time. As a flight director, I don't sit there and lay out the crew's timeline and manage it down to the five minutes. That's what the FAOs and the ops planners do. That's their specialty. They're very good at it. But it's more of working with the Japanese flight director and saying, "Okay, how do we generally want this plan to work, and what are our constraints, and where are the tight spots?" Then you review what the

planners lay out, and you think, "Okay, does that make sense, or is there some other way that we could orchestrate it to make it more efficient or line things up so maybe from a spatial perspective where we can deconflict people or bodies from an area?"

We continue to do that through the whole evolutionary process as the timeline develops. "Okay, well, if we get new requirements for the program, how do we add that in? Where does that fit based on the list of priorities that the program gives us?" They give us a whole raft, 1 through 57 for example. We tend to timeline and plan it in priority order, but not always, because there's efficiencies that you get. So that's how I would describe planning from the flight director level. Does that make sense?

ROSS-NAZZAL: Yes. Tell us about crew training for this mission. How does that work with the ISS and the Shuttle FCR [Flight Control Room], and then you've got all these international partners? It sounds very complicated.

HASBROOK: There's two parts to training. There's crew training and there's flight controller training, because not only does the crew have to be trained, but the flight control team has to be trained and ready to execute the mission. The crew training perspective, there's an organization that is dedicated to crew training. When a crew gets assigned, there's a certain basic catalog of courses that they need to take for the mission, because they need to know how to fly the Shuttle. If they're assigned to do a spacewalk, they'll have a sequence of lessons that they have to complete to be qualified to work in the spacesuit. If they're a robotics person, there's a series of lessons they would have to take to be certified to operate either the Shuttle arm or the Station arm and finally the JEM arm, because the arm came up on our module. So there's a catalog.

Then one of the very early things that we do is sit down and have a crew task panel. That involves the training team, the crew, the flight directors. We invite some management types, robotics folks, EVA folks, and the planners. Basically, the commander will provide a broad brush of, "Here's how I'd like to utilize my crew, and this is what I'm thinking." Then we review that in this board, with all these participants, to say, "Okay, does this make sense?" Because we know, based on the tasks, the training loads required for different things. Like CBM, the Common Berthing Mechanism, that takes quite a large chunk of training. Robotics takes a large chunk of training. EVA. So does that line up? Are we really going to be spiking somebody in their training? Or based on how the timeline lays out, we want this person to do A, B, and C, but all three of those are happening at the same time, so that doesn't make sense, so we need to rearrange how we train, or who's responsible for what. So you lay out the straw men and say, "Okay, we think this works."

Then the training team goes off and lays out the lessons. If it's an experienced crew, they get some credit for previous training that they've taken, so they may not have to take all of the same courses over. They take some core courses, and then they start doing standalone training. They will go over into the SSTF, the Space Station Training Facility, or the SMS, the Shuttle Mission Simulator, and they'll run through their paces with the training team. That's all autonomous. They're developing their skill set.

For the Space Station training, and obviously with the Japanese in this case, they now had to go to Japan to do some training for the *Kibo* module, because the big module simulator is in Japan. The Space Station Training Facility here has a model, but there's training courses that the Japanese teach that we do not teach. So there's negotiations there to determine who would go over for the training. Just because it's time away from the family, and it's also time that you're

not here to be able to do some of the other activities. That gets negotiated. They actually flew over there and took training. We sent some of our folks over there with them, both as monitors and also from the learning perspective. They're building up their repertoire, and then eventually they get to a point where they're ready to do what we'd call integrated simulations. That gets them ready to work with the ground teams.

The ground teams conversely. You have your generic flows. I described the flight director one. Every flight controller has their generic flow to get certified either to be in the back room or in the front room. Then for flight-specific, it depends whether or not there's additional training requirements from a specific system perspective. For the Japanese, it was a little unique since it was a new module. They're responsible for it, but we wanted to have a good understanding of how their module worked. So they offered us a weeklong series of training classes. We were able to send anywhere from eight to 16 folks to these classes and attend them. They conducted them three times, so we ended up being able to send quite a few of our folks through the class and really learn their systems. Once we got that, then they came back to the United States and were able to teach the rest of their group the ins and outs of the Japanese systems. They at least had the knowledge.

They also ended up being the lead team for the activation. They had a lot of knowledge. It helped because they could then converse in great detail with their Japanese colleagues, and we were all working from a good understanding of the Japanese module. So that went on. That was probably in 2005 timeframe, 2004, 2005, 2006, right in there, when we conducted those lessons.

Then once we got our mission timeline built, you'd build the timeline, you'd build procedures. We'd have a big review to say, "Okay, are we ready to do simulations, integrated sims?" We reviewed the procedures, the timeline, and the flight rules. Then out of that we

started doing what we called the integrated simulations. The crew members are in the simulator. The flight controllers are in mission control in our training room. We had our Japanese colleagues in Japan in their flight control room. They ran the simulator. The training team puts in malfunctions, and then we have to respond to them, communicate to the crew and communicate with each other, communicate to the Japanese, and figure out what's the problem, what are the impacts, what are the workarounds, and what are the downstream impacts.

We conducted a series of simulations with the crew. It really teaches the team how to work together as a whole team. The crew has been off training on their own. They've become a very tight, close-knit group of people, because they have to depend on each other for their safety and their lives potentially. They do a lot of autonomous training. We've done our training and development with the Japanese. Then we bring it all together to make sure we can mesh and function as a single unit, because once we get in flight, we have X number of days to accomplish the mission. So the better our background and our interactions are, the more likely we're going to be able to succeed as a team with whatever failures come our way.

ROSS-NAZZAL: What were some of the periods that you did integrated sims [simulations]?

HASBROOK: You usually do your highest priority mission objectives. Then the areas that you think might be the most difficult coordination-wise, where a whole lot of different things are occurring. So we typically sim the rendezvous docking twice, because it's a very dynamic phase, and you pretty much get one shot to bring the vehicles together correctly. We will do the undocking once just to make sure we know how to get away and separate. We did EVA 1. That was the major EVA to get the module ready for installation. One time as a standalone, and then

we did one what we called a long sim. It was say 36 hours, and that was in order to execute the Category 1 objective, which was get the module installed. That included EVA 1. Then to activate it the next day.

Then I think we did another activation sim, a shorter one, just because we wanted to make sure that we could actually activate it. Then from a complexity standpoint, activating our second channel was the hardest, because even though it was what we call a Category 2 objective, it was on top of also conducting EVA 2. So you had a huge amount of comm [communication] going on with the spacewalk, and you had a huge amount of comm going on with this activation. So we simulated that. I think we ended up simulating that twice, as well, just to try and make sure that we had that down pat. Because we did it once, and it was pretty messy, so we did it again. It was good, because we changed the way we did things.

Part of these integrated sims is to practice cockpit resource management and make sure that you're aware of your inputs, and you're keeping your eye on the objective. The feedback I got at the end of that sim was my flight controllers felt they could not talk to me because I was so busy with the spacewalk, dealing with EVA and my CapCom [Capsule Communicator] and the crew, and as you're probably very familiar with, the spacewalks are extremely busy, because the crew is talking all the time. The flight control team felt they couldn't talk to me to get the activation going for Channel [A], because they were never sure when they could step in. So based on that I said, "All right, we need to have a second flight director here for that phase, just so you have someone to talk to." So I kept the offgoing flight director. He just stayed a few more hours, and we practiced it once. He managed to work with that team. That worked very well in simulation.

In real time, we would have been able to do it with one flight director, just because the spacewalks were calmer. You don't get all the failures. But it showed me that if we had a bad day, we really were going to need two people to be able to do those activities in parallel. That's where I felt it was very beneficial to do the training, because it gave you a chance to evolve and change.

ROSS-NAZZAL: Did you keep that same configuration for the flight?

HASBROOK: We did, yes, he stayed about three hours I think.

ROSS-NAZZAL: Who was that?

HASBROOK: [Robert C.] Bob Dempsey. He was my orbit one flight director.

ROSS-NAZZAL: How many hours of sims do you end up doing before a crew ends up launching?

HASBROOK: In terms of integrated sims, it will vary anywhere from about 80 hours to maybe 115. The hours have come down over the years, trying to streamline the time and make sure that the hours that we do spend doing that are the most effective possible, and trying to keep the crews' workloads down, because one of the drivers is their weekly workload and hourly load. So it'll vary depending on the mission. But somewhere between 80 and 115.

ROSS-NAZZAL: How many hours does a crew train, compared to how many hours they're on orbit? Or how many hours do they spend training on the ground versus how many hours they're spending in orbit? Do you know what that works out to?

HASBROOK: Well, from a gross perspective, we basically assign the crews one year before flight. They're not training 40 hours a week. But if you think about it that way, they train for a year and they fly for ten days. So if you want to do spacewalks, typically the folks will train in the Neutral Buoyancy Lab five to seven hours for every hour of spacewalk that they conduct.

ROSS-NAZZAL: That's the one I could find. I couldn't find the other question that I had, so thought I would ask. Do you want to talk about the flight itself? Actually we should probably talk about some of the delays. I understand there were delays because of the External Tanks, and then there was a delay, you were supposed to launch in April, but there was a delay because of some power issues with the Shuttle and Station. Or not.

HASBROOK: You're right, this is where the memory lapses are.

ROSS-NAZZAL: You could just talk in general about delays, and what impact that had on the flight, or if it really didn't have much impact.

HASBROOK: Delays have an impact. The other thing with Space Station that's unique is the flights before you have an impact on your flight. Shuttle flights before Space Station, they were very self-contained. You had "Here's my mission, it's wrapped up in a book, you launch it, you

do everything you can, you come home." With Space Station, you're building the book chapter by chapter. So you put a chapter up there. Well, you almost got to the end, but the last paragraph is missing. So the next flight has to somehow incorporate that paragraph before they write their own chapter. Often you find out that that paragraph is missing a month or two before your flight. If it's a really important paragraph, then you've got to do something about it. One of the largest challenges for these missions is you spend a long time developing it, say one to two years. Eight being a very crazy extreme. But most of our flight directors are assigned a year or two before flight.

You spend a long time developing this mission. It becomes your lifeblood. You've got it all laid out, optimized. Then you find out that "Oh, the mission before you didn't get this task done on the EVA, or this broke." Now you're bringing up this new piece of hardware. You've got to stick that in your mission, and you have to add that to your EVA. You have to be ready to reprioritize and replan and figure out what, no kidding, do we need to train or discuss in detail to get ready for this now, my new mission. That goes on with every single one.

For our flight, one of the things that were looming over its head for a long time was the tile repair DTOs [Detailed Test Objective]. Was it on, was it not on? So you had that going along, until finally, okay, decision is made, and that's put behind you. Then inevitably something else will come up. That's probably one of the biggest challenges. Then from delays in general, just like coaching for a game, as a flight director you're a team leader, you're a decision maker, but you're a coach in many senses of the word and the pep committee. You're getting everybody ready, and you're getting them in there. Okay, this is flight time. Then, all of a sudden, a delay comes. It's very hard for people. Because once you're ready to go, you want to leave, and then you have to wait, hurry up and wait. It can have an emotional toll on your

team, and you have to be there to say, "It's all right, there's no rush, we're going to get there, take some time for yourself, relax, take a few days off, come back." Meter and manage your energies is really key. That can be hard. It's hard for the flight directors, too, because you're getting ready, and I always say it's like being at bat. You're next up, and then all of a sudden they come in with TV time-out and you're like, "Oh." So that's probably a frustration for folks.

One month isn't bad. I think about this last Hubble [Space Telescope] mission, [STS-125]. We were two weeks from launch, and the component failed, and they ended up flying nine months later roughly. That was a big deal. It takes an emotional toll, and then you have to build yourself up again and modify your whole mission based on the new priorities. But that's what we're trained to do. MOD [Mission Operations Directorate] has always been very good at that. They continue to do that very very well.

ROSS-NAZZAL: Tell us about the flight itself. What are your recollections of that flight?

HASBROOK: It's a blur. The flight itself was very very smooth. We really had no major problems. The challenges we were given right before our mission we were able to incorporate. It was when the Solar Alpha Rotary Joints were having the contamination problem, and we were having to go do inspections. A month or two before our flight, we were told we needed to go start inspecting these joints. So we had to modify our plans and put that in, which my EVA guys did very well. My EVA crew members had no issue with that. But we launched, and I remember when they open the hatch, as you recall the Russian toilet was nonoperational. Mark [E.] Kelly opened the hatch, and he goes, "Do you need a plumber?" It was such a great line, and it was in high def [definition]. So I died laughing. But you could see the focus, because

they always show the greeting ceremony, hugs all around. Man, right into the safety briefing, and off they went. Then it was straight to work. They got the crew members into the airlock, got them ready to go.

The next day they did the first spacewalk and pulled the LTA [Launch-to-Activation] cables off of the JEM [and] the protective cover off of the Passive CBM. Then watching them pull the JEM out of the payload bay. It was just amazing. This big structure comes out of the bay. I always call it the pirouette or the baton move, because they had to pull it out and then basically flip it 360 to install it. When you see it sped up in a digital recreation, it's very impressive. They did it extremely slowly, but it was just really neat to see it attached. The activation went really well. We had one hiccup. The crew was attaching the Internal Thermal Control System [ITCS] lines, Moderate Temperature Loop, and we saw a funny signature, and the Japanese were worried that they had a big air bubble in the system, and that if we started it we may cavitate the pump if we pushed the air bubble through the pump. So we spent quite a bit of time talking with them about the trades of if we swap the line, then use the Low Temperature Loop, because it would change the activation sequence.

This is where the years of interaction really helped immensely. Because my THOR, your Thermal Operations and Resource Officer, Victor [C.] Herod, had spent years working with his counterparts in Japan and trading this is how things work and suggestions and helping them develop procedures and flight rules. So the respect and the trust were there. He was talking to them. He goes, "The way the lines are built and the ITCS lines, there's so many bends and turns in it that there's no way you're going to have this one big bubble." He convinced them to go ahead and stay with the nominal plan. I think that really set the mission on the right course, because then we ended up proceeding with activation nominally.

There were no problems. The whole mission proceeded really smoothly. Probably the most striking moment was when they entered the *Kibo* module. It was really neat. Aki [Akihiko] Hoshide was one of our crew members, astronauts on the Shuttle, but he was also a JAXA [Japanese Aerospace Exploration Agency] crew member. It was just really neat. He hung a banner at the entrance to the module. You see these banners in Japan hanging at the entrance to restaurants and shops. It's usually either advertising the name of the restaurant or their specialty. I think of it as restaurants, because that's where we would go a lot. But it said *Kibo* in Japanese.

Then they opened the module and went in. It's gigantic, because it's empty. There's only four racks and it has capacity for 24 racks. So as opposed to seeing the labs that are maybe seven or eight feet by eight feet, you saw the circumferential diameter. So it was 15 feet. Huge. They go flying in. Garrett [E.] Reisman was on orbit. If you see in the video, you thought you were in a Romper Room watching them. It was just pure joy. They're floating around and doing flips and having lots of fun. Again, it's like you get your five minutes of ecstasy and fun, and then bam it was back to work, because then they started moving the racks from the Japanese Logistics Module into the big module. By the time they left, it looked like a laboratory. It was really neat.

The real-time operations really did go very very smoothly. The goal is to try and execute your mission as you have designed. You always have to be ready for whatever happens. But having done all the preflight planning and thinking and training, it sets you up to be able to take anything that might come and incorporate that into your plan pretty smoothly. So putting the lead team on orbit two, the purpose of that is you do your EVAs, your major robotics, and then depending on what, if anything, goes wrong, that team and that flight director establishes

direction for the planning team, "This is what you need to have done overnight, and this is what needs to be ready to go the next morning," because you have the background and the knowledge. So you can lay the framework for the planning team. Then they'll go off and develop the timeline for the next morning. You come in and execute. Fortunately, we didn't have anything major on our mission. It actually executed quite smoothly.

ROSS-NAZZAL: Any other anecdotes from the flight that you can recall? Doesn't sound like there were any challenges.

WRIGHT: Not at all.

ROSS-NAZZAL: We heard that from Terry [L. Clancy] and Gail [A. Hansen]. They both said that this was a pretty nominal flight.

HASBROOK: It was a very smooth flight. One of the things that makes it smooth is we had one large module that we had to put on board Space Station. One major player that you had to deal with, and one significant set of requirements and constraints. For example, this current mission, [STS] 127/2JA, where we're putting on the last element for the Japanese, they're just one part of that mission. You have their Exposed Facility, which some people call the front porch. Then you have your logistics pallet, which has more Japanese payloads that they have to attach on and transfer the payloads and return this pallet back into the bay. It has a carrier that has a whole bunch of US spares on it. So you have to put that on board Station. EVA, move everything off and bring the pallet back.

So it's much more a composite hodgepodge of things. They all have different drivers, in a sense. You're trying to take the multiheaded Medusa and flow them into one nice smooth swim lane, whereas for the *Kibo* we were fortunate. It was one big thing. It had lots of parts that had to get activated, but you were all still focused on the same objective. It was one system basically, one big system. But it was more streamlined, I think, really to get it activated.

So blessing or curse, depending on what you enjoy, but it was a lot of fun. It was neat to see. That was really the premiere for the Japanese, for their real-time flight control operations. First time they'd had flight directors. Watching their team execute and perform under pressure was very very impressive. That gave me a lot of self-satisfaction, to see how well they did after all the years of discussion and preparation. You never know how it's going to work, and it worked very very well.

ROSS-NAZZAL: Knowing that that module was up there, what are your thoughts about that? Knowing that the mission succeeded, met all the objectives?

HASBROOK: Oh, it gave me immense personal satisfaction. Because it's something you've invested years and years in. Also, from NASA's perspective, it really rings home and brings home the truth that it is an International Space Station to see all the partners up there. It's just fabulous. All working together for a common cause. You have good times and bad times, but you have multiple nations all working to a common objective, where on the ground they may have a lot of differences of opinions. But in space, they're all continuing to achieve the goal of Space Station and do the research. So I just found that very personally fulfilling. Then just seeing a job well done. It's always nice to see the success from all the hard work that's been put

into it. Watching my team operate. I'd seen them develop over the years. I had some folks who were very young and inexperienced in 2000 when we first went over to Japan. Then see them as the senior flight controllers. Granted, they'd had a lot of time to evolve. Eight years is a long time. But to see that evolution in them is really neat, too, and knowing you had some part in making them who they were as flight controllers.

ROSS-NAZZAL: How many people are on a Station flight control team?

HASBROOK: A lead team will be, I'll say, 15. It's 12 to 15 flight controllers, including the flight director. That's just your front room. The flight controllers is just one aspect. You have the MER, the Mission Evaluation Room, so they have a whole bunch of people evaluating the systems. Then your program folks dealing with all the requirements. They have a cadre of folks there every day as well. So it's a big group of people.

ROSS-NAZZAL: Yes it is. It is. Were there any lessons that you learned from this flight that you'll take forward?

HASBROOK: Lessons that I learned. It taught me patience, and it continued to help me learn my prioritization skills. I figured, you can't do it all, so you need to understand what has to be done and what can be put off. It continued to teach me that there's nothing more exciting, fulfilling than working with a team of folks that are motivated by a common objective and wanting to see the job done. Continue to want to do that for as long as I can.

ROSS-NAZZAL: If you don't mind, I'm going to ask Rebecca if she has any questions for you.

HASBROOK: No, not at all.

WRIGHT: When did your responsibilities stop? When they undocked, were you somewhat relieved of your first and foremost duties?

HASBROOK: Yes. When they undock, basically about three hours after undocking, we hand Space Station back to what we call the increment team. Then you stop sprinting, and then you go back to the marathon of Space Station, because we're always up there. My team went off console about three days before the Shuttle actually landed.

WRIGHT: Right when you first started, you used a phrase called ops trades. Could you share a little bit more about the trading off of the operations of when? You also mentioned your prioritization skills. How do you know that when you get down to those negotiations, that this is what's got to be done over this, when both of them are so important? Can you give us a clue?

HASBROOK: Ops trades are usually—a simple thing would be I could tie my lace left over right or right over left, what's the difference? Well, left over right I could do it with one less step, but right over left ends up being a better knot. So which should I do? Should I take more time and tie a stronger knot, or is tying the looser knot good enough for what I need to do because I'm short on time? Depending on where your constraint is: time, people, power, you may have to make a trade between solutions. If you had no constraints, you might do your activity one way,

but based on the other constraints that are out there, you can either put something at risk and do it this way because okay, this is the right way to do it, but because of the thermal environment I'm in, I run a higher risk of freezing or burning something up because it takes me longer to do X action. Or I don't do everything, and I can basically get it activated, but the capability may not be there as early, and then later on I come back and finish it potentially. So does that explain it?

WRIGHT: Yes.

HASBROOK: Then the prioritization. The program will always give you a list of priorities, 1 to 50. But if you do it in that priority order, I may only get 30 of those priorities accomplished in the mission. But if you let me optimize again within my constraints, people, time, power, what we're doing, I may be able to get 37 of them. So they always give us a shopping list longer than we can hope to achieve. Because that way, if you get ahead somewhere, then you have a shopping list that you can go through and say, "Oh, well, we can pick that up for you, or we can pick that up for you."

The priorities are always geared usually: Category 1, those are required for the continuation of Space Station, i.e., install the *Kibo* module. You could say, "Okay, Space Station doesn't need that to continue," which is true, but the partnership needs that to continue, and the Japanese have spent a huge amount of time and effort. So that's Category 1—and activating it. Single string. Then my Category 2, one of the highest priorities was to activate the redundant string, because now we've put this multimillion-dollar facility up there, but one power failure and it's blacked out again. Obviously you'd want to have redundancy as soon as you can. But depending on what else is going on in the mission, I can get you that redundancy right after I

activate Channel A, or maybe we do something else, and then I activate that second string. That's how you play the priority games.

EVA does that a lot, because on the spacewalks you basically have six and a half hours outside every single time. You tend to do it in priority order, but you get your major goal accomplished, and then there's say an hour left at the end of the EVA. Well, that's not enough time to accomplish your second objective, but I could go do objectives 7 and 8 right there. Person one can go do 7, and I can go do 8. Or because it's right on the translation path back to the airlock, it makes sense to do it there. That's where you'll often see your priorities mismatched, but they're doing it from a crew efficiency and time fit.

WRIGHT: Do you get to make those calls? Is it your sole responsibility, when there's a possible conflict of priorities, or people are giving you input that everyone thinks their issue is the priority; do you get to make that call?

HASBROOK: In a sense, I do. But you never make that in a vacuum. These joint ops panels that I had mentioned, these are meetings where you have all your specialists, and your MER reps, your safety reps, the crew, and your partners, and that's where you're discussing the various different issues that are arising. Often times those discussions will come to that panel. This person is advocating for why you have to do it this way, and person Y is advocating for why no, this is more important. You have a discussion and try and assess the trades and make the recommendations.

If these people don't agree with your recommendation, they can go to a higher board. The joint ops panel is considered a program level panel, but the program basically, not

empowers, but they delegate the authority to the Flight Director Office to chair the ops panel, because we have the operations expertise. But if these people, by God, they disagree with the decision we make, they can go up to a program board and re-review it. Often if it's wildly divisive, we'll make a decision, and then we'll take it to the program board. We'll say, "Okay, here was the issue. Here were the trades. We made this decision, and here's why. If you choose to go this way, this is what it's going to cost you." Because ultimately all the hardware belongs to the program or belongs to the international partners. They get the final say in what you do with the hardware, but they usually allow us to execute according to our knowledge and background.

But for some of the big things they'll weigh in as well. They may redirect you. They tend not to, because usually we have pretty solid rationale. But sometimes there's reasons why, even though we say, "Operationally it makes the most sense to do it this way, and here's why," we end up doing it that way, because there's a programmatic reason why. Which is fine. They just need to understand the trades and what it's costing them. We do that every day.

WRIGHT: Makes me tired just listening.

HASBROOK: It's fun. In a sense you're a problem solver. You just figure it out. Or a puzzle solver, if you want to think about it that way. You got all the pieces out there, and you have to figure out how to put it together. The interesting thing is the picture is not on the front of the box. You end up designing the picture based on all the pieces that come together. Then in the end, it's a beautiful thing called Space Station. So it's pretty amazing.

WRIGHT: What's your background?

HASBROOK: My background. I got a degree in mechanical engineering. Then when I graduated from college [at the University of Notre Dame, Notre Dame, Indiana], I actually worked for Arthur Andersen for two years in consulting. Our social life was down here. A gal who worked in the Payload Operations Group was moving on to Space Station back in the Reston [Virginia] days, the early early days, [Space Station] *Freedom*. She's like, "Oh, I think you'd really like working in payloads. Send in your resume, and I'll have my boss interview you." Literally, he picked my resume and interviewed me. I was on site a week later, two weeks later. It was crazy.

When I first started in Payload Operations Branch, we were in the same building as the flight directors. I just remember going, "Wow, what a cool job." You think of them as just these amazing people that just have so much knowledge. You don't realize that you gain knowledge over time. I don't really recall what year it was, but it was like, "I want to do that job." So I worked at it till I was selected. It was fun.

WRIGHT: Glad you did. So it was fun.

HASBROOK: Still is.

ROSS-NAZZAL: Will you keep working in this [position] until Space Station is finished?

HASBROOK: I don't know. There's a life cycle to every flight director. I don't really work console anymore, because I'm the deputy of the office. So more I do management of the flight

directors. During the missions, I sit at the MOD console, the Mission Ops Directorate console. So the purpose of that console is to facilitate between the real-time team and the programs and the MER. The flight director runs everything and deals with a lot of things on the loop, but if people have questions and issues come up, MOD can do a lot to answer those questions and keep it out of the hair of the flight director. Or conversely, package it so it's in a smaller neater box that then the flight director can go figure out how to attack it. We try and understand really what's going on and what are the drivers, boil it down, and then give it to the flight director, because they're in charge of the mission.

It's a fascinating job. It's a whole different facet of mission operations. So it's really interesting, because when you're in the real-time environment, so much is going on, and you're all tied into it. Then you realize there's a whole lot of people who aren't as plugged in. So really, most of the time people just want information to understand what's going on. But then there's negotiations that go on as well.

ROSS-NAZZAL: It's interesting. Is there anything else you think we should know about planning or training or flying that we haven't touched on that you think, "You should really know this if you're going to write about this aspect"?

HASBROOK: Mission ops, their foundation was built back in the early Mercury, Gemini, Apollo. The whole concept of mission ops was plan, train, fly. They have a very organized structured approach. That's what makes, I think, good flight controllers. You plan for what you're going to do. You train really hard. Then you can go execute, and you can deal with whatever challenges occur in that mission, because of all the planning and the training that you've put into

it. In a sense, there's a methodology that they go through in this whole development process. So it makes them very flexible and smart and quick on their feet in real time. So those foundations were laid back with Chris [Christopher C.] Kraft and Gene [Eugene F.] Kranz, and it's evolved today. But it really has maintained. That is the core for MOD. Everybody in that organization believes in it. That's what I think makes them so strong.

ROSS-NAZZAL: All right. Well, we thank you for coming in today and sharing your thoughts with us.

HASBROOK: You're welcome.

[End of interview]