

**INTERNATIONAL SPACE STATION PROGRAM
ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT**

ROBERT D. CABANA
INTERVIEWED BY REBECCA WRIGHT
HOUSTON, TEXAS – 15 JULY 2015

WRIGHT: Today is July 15, 2015. This oral history session is being conducted with Robert Cabana in Houston, Texas, as part of the International Space Station Program Oral History Project. Interviewer is Rebecca Wright, assisted by Jennifer Ross-Nazzal and James Blair. Mr. Cabana currently serves as the director of the Kennedy Space Center [Florida], a position he has held since October 2008. In June 1985, he joined NASA as an astronaut candidate and, since that time, has flown on four successful Space Shuttle missions, as well as served in numerous management roles at the Johnson Space Center and for the agency.

Thanks for giving up your afternoon so that we can hear more about your history. Today, we would like for you to talk about your involvement with the International Space Station [ISS]. So if you would, tell us when it first began.

CABANA: Absolutely. Well, it first started, Rebecca, back when I was appointed chief of the Astronaut Office in July of 1994. As you know, the Space Station Program went through a transition and a redesign from Space Station Freedom to the International Space Station Program. At that time, we had just started the Shuttle-Mir Program. In fact in January of 1995, I made my first trip over to Star City [Russia], to check in on Norm [Norman E.] Thagard and Bonnie [J.] Dunbar, and see how training was going over there. So that was my first introduction to Russia and working with our future international partner. We would not have been successful

on the International Space Station had we not done Shuttle-Mir with the Russians. It worked out extremely well.

So from that point on, working through the Shuttle-Mir Program, I established relationships with the Russians that became very valuable later on in the Space Station Program. By that time, we had gotten through the redesign, and we had moved forward. Toward the end of my tenure as chief astronaut, it came time to assign the first crews to the International Space Station, so the first four crews assigned to the Space Station were assigned during my tenure. And believe me, it was not easy to find folks who were willing to go off and be on the International Space Station, even though [it was] very exciting, groundbreaking. At the time, we were flying eight to nine Shuttle flights a year. Shuttle flights came much more frequently. There was an extreme demand for training time in Russia, having to learn the Russian language—over two years of training prior to that first mission [and] time away from home. It was not easy for those first crews, and it has gotten much better. Their training program was more aligned with how we did Shuttle-Mir. How they trained their crews for their Mir Space Station is how they intended to continue training for the International Space Station, and it significantly evolved over time.

Also, during that period, I was involved with many of the negotiations on the international agreements that we have in place on the Space Station, for instance, the crew code of conduct. That was no easy task, getting all the international partners to agree. This was an actual document that was essentially a treaty in many ways. I remember one negotiation specifically. We're working through it all, to get everybody to agree, to get the Russians to agree and have a place on how we're going forward—and the Japanese, of course, Canadians, European Space Agency. The Japanese politely say, "Yes," but they really didn't have the

authority to say yes. They had to take it back to Japan and get their government, at the state level, to agree to what was being done. So then, if there are changes, it became extremely hard, because now, you've got to go back, and you've got to get the Russians on board and get everybody else on board. Those were some very interesting negotiations.

And then, at the end of my time as chief of the Astronaut Office, I was very fortunate to have director of Flight Crew Operations, Dave [David C.] Leetsma—my boss—assign me to be the commander of the first Space Station assembly mission. So I was able to continue working with all that I had done, from an international level, working with the partners, as the chief of the Astronaut Office—on crew assignments and working agreements and so on—to actually going over and training for the flight that put the first two pieces together. That was really special. Of course, it got delayed.

When you look at how the Space Station was done, there was a real push—after we won by only one vote in the House [of Representatives], to keep the Space Station alive—to get hardware on orbit and prove that we were moving forward. So as soon as the Functional Cargo Block [FGB] and Unity were ready, they wanted to get them up there, even though it was quite possible—and it ended up being the case—that the service module wasn't quite ready to launch, so that we could get a crew up there. They wanted to get those first two modules up there and establish [the outpost], and we even slipped a year from when we were supposed to launch. We were supposed to launch in the end of '97. We ended up launching in December of 1998.

I remember going over to Russia and training. It was so cool. You've got the docking system for the Space Station, same one we used on Shuttle-Mir, the APAS [Androgynous Peripheral Attach System]. We're getting trained on it by the guy who designed it, [Vladimir Sergeevich] Syromyatnikov. In fact, I got a copy of his book on docking. It's in Russian, but he

autographed it to me. Here's the guy that designed the system; it's essentially the same one that was used on Apollo-Soyuz [Test Project], except the pedals, instead of going out, go in, and some other changes. To be trained on something by the designer that actually designed the system was pretty cool. So again, capitalized on those relationships that I had.

That was absolutely great, getting to work with Khrunichev [subcontractor for the FGB] on the FGB. Of course, the FGB, although it was built by Khrunichev in Russia, it was a module paid for by the United States, and Boeing was the contractor that we worked with. Ginger [Virginia A.] Barnes was the Boeing person in charge of that, and Ginger just retired from Boeing. She was working the core stage for the SLS [Space Launch System] at Marshall [Space Flight Center, Huntsville, Alabama]. To be able to see the FGB as it was being built, learn the systems—it was absolutely great.

I remember when Unity was just an empty aluminum shell at Marshall Space Flight Center in Huntsville, when Boeing was building it there. Then, of course, it got shipped to the Cape [Canaveral, Florida] for final assembly and outfitting. There are so many things. I sit here, I just run through all this, and it all starts coming back.

WRIGHT: That's good.

CABANA: The Space Station was originally designed as ship and shoot: build a module, ship it to the Cape, and launch it to space. One of the things that we pushed for was called MEIT (Mission Essential Integration Test) at the Cape. Actually checking out the systems before we launched it, using the emulators. So we had an emulator of the FGB, and we did tons of testing, spent a lot of time out at Sonny Carter [Training Facility, Houston, Texas], testing software at

the facility out there, spent a lot of time in the simulator. At that stage in the program, it was so basic. I want to say “archaic.” It wasn’t working. At that point in the program, they did not have the simulator up in Houston, where things actually worked, and you could train on it reliably. I spent a lot of time testing software out at Sonny Carter, and we said, “We really need to test the systems down at the Cape—once the vehicle is actually built, before we launch it—using emulators.” We did that, and we found all kinds of errors that were corrected in the software.

It was so neat, being down at the Cape, seeing the node go from this empty shell to becoming the spacecraft that we finally launched. I’ll never forget when we were on orbit, and we commanded to the Space Station, using IBM 760 XDs—the PGSC [Payload and General Support Computer] on the Orbiter plugged into the PCMMU [Pulse Code Modulation Master Unit] on the aft flight deck—to actually send the commands that brought the Space Station to life and got everything going.

Sergei [K.] Krikalev, I shared responsibility with him. That’s another story I’ll talk about—Sergei—but we had different places in the procedures where I sent the commands, and he watched to make sure we were doing it right. I let him send some commands, and I watched. Nobody was more surprised than me when we sent the commands and it actually worked. Everything worked perfectly. It was just phenomenal, and I attribute that to all the testing that we did on the ground. The essential integration tests were just critical. I can remember when I was chief of the Astronaut Office, getting that first flight ready to go. George [W.S.] Abbey was then Center Director at JSC, and things weren’t going well. The program was behind schedule, and George instituted what was an every-week, Saturday review. It started at eight o’clock in the morning. Everybody that was responsible for what was going on had to brief at that meeting,

every Saturday, on how we were doing, what things weren't right, what things were, why they were behind schedule, how they could get back on schedule, what issues they were having. That was, I think, critical to getting everything going.

WRIGHT: What a great a learning opportunity, for you to hear all the behind-the-scenes information.

CABANA: Oh yes, and then I had to be there, because I was chief of the Astronaut Office. We needed to be represented, to see what was going on, so that worked out extremely well. Initially, we didn't have a Russian on the crew. Then, it was decided that we should, and Sergei was going to be assigned to be one of the first crew actually living on the Space Station. Of course, he was on Expedition 1 with Bill [William M.] Shepherd and Yuri [P.] Gidzenko. So Sergei got added to the crew, and what a great addition. Just a phenomenal guy, still a very close friend, and a superb cosmonaut, so that worked out extremely well. I can go into the flight and talk more about that later. We want to talk about the Space Station. There are all kinds of things on that flight that were just memorable for me, but what a great mission.

WRIGHT: And if you don't mind—before we get off of it—will you just share, for just a few minutes, about opening that hatch and actually beginning the program.

CABANA: When we were on the ground before we left, the media kept asking, "Who's going to be the first one in?" I wouldn't tell anybody, and I didn't even tell the crew. I knew who it was going to be. As we opened the hatch, I said, "Sergei, come here," and I grabbed him. Every

hatch, from the PMA [Pressurized Mating Adaptor] into the node into the PMA-2, the end of the FGB—every hatch that we opened, we opened the hatch, and he and I entered side by side. Because I said, “It’s going to be an International Space Station, it needs to be an international crew entering the modules together.” So I was the first American, and he was the first Russian in the International Space Station. There was no first person in. We went in side by side, to every module.

WRIGHT: That’s a great picture of diplomacy.

CABANA: It worked out really well, and there’s all kinds of other stories I can talk about on that flight. It was amazing. It was just a dream flight, from start to finish, and the time that we were in the Space Station was just really, really special. So coming back from that flight, I had all my postflight duties, and then for a short period of time I was the deputy director of Flight Crew Operations.

I’ll back up just a little bit, because it leads into the story. Assigning the crews for those first four missions, I said, was extremely challenging. I went to some of the active duty military guys in the office, because I knew they weren’t going to say no to a Marine colonel. I gave folks a choice. Bill Shepherd ended up going from the program to be the commander of that first mission, and that was not assigned by me. That was already assigned. The second crew—Jim [James S.] Voss and Susan [J.] Helms—that was really hard for them. It was a real challenge, because all the training procedures weren’t in place. The flight kept slipping, so they spent a significant period of time training and preparing for that mission. I’ll never forget Susan Helms. She didn’t really want to do it, but she did. She just did a superb job. Afterwards, it just really

made me feel good. She got back, and she said, “Thank you, Bob. What an awesome experience, and I appreciate the opportunity.” Jim Voss is one of my dear friends, and Jim just did a great job on that flight.

Increment-3, Ken [Kenneth D.] Bowersox was supposed to be on that flight. And for a number of reasons, Ken ended up not going on that flight, and Frank [L.] Culbertson—another classmate of mine from the [US] Naval Academy—ended up commanding Expedition 3. Then, the last crew I assigned was Expedition 4: Carl [E. Walz] and Danny [Daniel W.] Bursch. They just did an outstanding job, too. For those first crews, it really was hard. Things weren’t well established in Russia. We were still working on our relationship, working on how we trained, and it has gotten much better, over time.

WRIGHT: For Expedition 3, Frank Culbertson also—it was a bridge from Shuttle-Mir for him being the program manager. That worked out well for you on that. There was so much going on through those first missions. And then, when you came back, or when you were doing that—you then spent some time in Russia, yourself. Isn’t that correct?

CABANA: I spent a lot of time—as chief of the Astronaut Office—traveling back and forth. Then, when I got back off that last flight, I was deputy director of Flight Crew Ops for a little bit, and then, George asked me to go down and replace Frank as the manager for International Operations for the Space Station Program. At that point, I was nearing the end of my 30 years in the Marine Corps; you’re not going to be a flag officer, a general officer in the Marine Corps, at NASA. I would have had to have gone back to the Marine Corps, so it’s a mandatory retirement at 30 years. So I went ahead and retired a few months before 30 years and went directly to work

for NASA. In September 2000, I was assigned to replace Frank, and I was the manager for International Operations, working for Tommy [Thomas W.] Holloway.

That was a great time. There was so much going on, just working all the agreements, working crew assignments. Tommy, he didn't know what to expect at first. He had a feeling that, "Oh, you astronauts, you think you can come into these senior management positions and just move up without having requisite experience." So I explained to Tommy all the jobs that I had had in the past that I felt qualified me, and I just said, "Well, I'll show him." I worked really hard, and Tommy is one of the finest gentlemen I've ever worked for. Tommy is the reason we have an International Space Station, I think. He brought a programmatic structure and fiscal responsibility to the Space Station Program, and actually kept it going and really made it successful. He had some huge challenges, but a great person, cared for people, technically proficient, the utmost in integrity, and I just really enjoyed working for him. And boy, he let me go and just do pretty much anything I wanted. I kept him informed and worked hard to make our relationship with our new international partners—all our agreements and our operations—move smoothly.

One of the things that he used to do—Tommy, he loved being involved technically. He didn't like going to the Cape and just sitting around and not doing anything. All the flight readiness reviews, Tommy would go to the Cape, because that was a finite period of time. He had to ensure that things were technically right, but then, when it came launch time, a lot of times, Tommy wouldn't go to the launch, because they'd slip. He had more important work to do, so he'd send me to the launch. If it slipped, I'd be there, and he'd be back in Houston working. So that was always interesting. I did that for almost a year, and George wanted me to go over to Russia and run our operations in Russia and replace Mike [Michael A.] Baker.

I said, "I'll do that, but I really think I shouldn't just report to the Center Director." That's the way it had been set up. "It really ought to be the Center and the ISS Program, and I think Tommy should have a role in this, also." He said, "I agree." I talked to Tommy, and I guess George had already talked to him, but Tommy said, "Yes, this is good." We set out what was expected and how we were going to do everything. Then, I said, "Tommy, if I'm going to do this—I've picked up a little Russian, traveling back and forth—I really need full-time Russian language training if I'm going to pack up and move to Russia." He said, "Absolutely, but there's a few things I'd like you to get done first, before you go off and do that." "Okay."

So I was coming to work by six o'clock every morning, working in the Space Station Program to eight, taking Russian language from eight to noon, and then working in the Space Station Program from noon to six, and then studying my Russian for the next day, getting my homework done. He never did let me go. I did that the entire time until it was time to pack up and move to Russia. Tony [Anthony J.] Vanchu, my Russian language instructor, was so proud of me, because I was the first student that got through the whole book on Russian. Then, when I got to Russia, I continued to take Russian language from **Vladimir Sergeivich Baldushkin [phonetic]**. Dr. Baldushkin taught at Moscow [State] University; he was my tutor, and he was doing this in his spare time, to make extra money. He had his books, and he had his way of teaching foreigners how to speak Russian. Once a week, I was taking classes from him, so that was still interesting. So I got pretty good at Russian while I was [in Russia]—unfortunately, if you don't use it, you lose it, and I've lost a lot of what I had.

That was absolutely just a great year and a half that I spent over in Russia. Again, having those established relationships with those folks really helped, working all the technical issues, the crew issues. We had a team over there, working in Moscow, in the Russian Mission Control

at TsUP, and they were over there on TDY [Tour of Duty]. And then, I had a small team that was PCS [Permanent Change of State], and we were the direct interface.

Over in Russia, the Russians work from 9:00 a.m. to 6:00 p.m., every day. It worked out well. I'd get to my office at 9:00 a.m. It was right in the building where Roscosmos has their headquarters. We had a separate little office suite on the first floor, off in a corner, where it was not accessible to the rest of the building. I'd work there from 9:00 a.m. to 6:00 p.m., and then I'd go home. And I had an office in—we were in a hotel apartment—the Volga Hotel. It was a furnished three-bedroom apartment, so one of the bedrooms was my office. Because of the nine-hour time difference, I'd get home at 6:00 p.m., and then it was Houston work time, so I'd work to midnight, one o'clock in the morning or whatever. I'd take time out to do dinner and stuff like that, but then, there was all the interface with the folks back in Houston.

I truly, truly enjoyed my time over there, working for Tommy. Toward the end of that time, Tommy decided it was time to retire, and Bill [William H.] Gerstenmaier was his deputy. Bill became the ISS Program Manager, and he asked me to come back and be his deputy, so I left Russia and moved back to the States. And for all of about three months, I was the deputy program manager in the Space Station Program. Then, Beak, Jeff [Jefferson Davis] Howell, who was the Center Director at the time, asked me to be the director of Flight Crew Operations. So that was my time in the Space Station Program, working as the manager for International Operations, Space Station operations in Moscow, and then, for a very brief time, as the deputy program manager. I continued to work closely with the program while I was the director of Flight Crew Operations, because of our crew involvement. And of course, that was in the end of 2002, and my very first flight as the director of Flight Crew Operations was STS-107 *Columbia*,

and we lost the crew. It was heartbreaking, but it had a real impact on the Space Station program.

At that time, Ken Bowersox and Don [Donald R.] Pettit were onboard the International Space Station, and we didn't have a Shuttle to bring them home or swap out the crew, so we had to rely on our Russian partners and the Soyuz vehicle to get the crew home and to get crews to the International Space Station. We had to work a lot of agreements that I'll never forget. So I flew over to Russia for the crew return. They're coming home on a Soyuz, and I go from Moscow down to Baikonur, and we went to Astana. We staged out of Astana, in Kazakhstan, to retrieve the crew. We're on this Russian helicopter, going to the landing site, and the weather is not that great, and we keep flying and flying. Then, it turns out the crew's not there. The crew didn't come back. And I'm thinking, "Oh my gosh." What happened is they ended up having a malfunction. They did a ballistic reentry, and they landed 350 kilometers short of where they were supposed to be. Well, the helicopters had to land and get fuel at this outlying site. Then, they decided that was too many helicopters to take all the way there. I was on one that wasn't as critical, so I had to wait. So they sent a fewer number of helicopters on to get the crew, and I joined up with them on the way back. It was a little tense there for a while.

You talk to Ken Bowersox, they landed, and there was nobody there. They got out on their own. He said one thing that he'll never forget is—when they opened the hatch—the smell of the Earth and the dirt. He said, "It smelled so good." They got themselves out, and they were waiting when the retrieval force arrives.

WRIGHT: All the protocols were broken that day, weren't they?

CABANA: Pretty much. So then, we had other crews after that, while I was director of Flight Crew Ops. And even as deputy director of JSC, I got to travel to Russia, Kazakhstan, see the crews arrive on the Soyuz vehicles, and then got us flying again—Returned to Flight—and we were able to complete the Space Station Program. So I've seen it [all]. I can even say I think I had a significant role in the end of the assembly of the Space Station Program, having been the director of KSC and flying out the last six Shuttle missions safely, and seeing that the final hardware got up there. I have been blessed. The positions that I've had, I have been intimately involved with the Space Station from its very start, to its present-day configuration, and now, working to get commercial crew going, to get crews going up there on a US rocket, with both Boeing on the Atlas V with the CST-100, and SpaceX with the Dragon on the Falcon 9. That's going to be awesome, when we start launching crews to the Space Station again from US soil.

WRIGHT: Yes, it will be. Well, you certainly have had a front row seat, as you mentioned. Looking back through those years with ISS, could you share with us what you think are some of the most significant challenges that you had to overcome, to accomplish what you needed to?

CABANA: Sure. The technical challenges were significant. The International Space Station is one of the modern wonders of the world. When you consider all that hardware, built around the world, coming together for the first time in space and working—that is a huge technical challenge that we have succeeded with, unbelievably. When we started, they used to have this thing they called the Wall of EVA [Extravehicular Activity]. We're never going to be able to surpass this Wall of EVA. How are we going to do this? Look at how well every one of those EVAs went. Even when there were problems, we were able to work around the technical

challenges. That's the advantages of having humans in space. They're so adaptable. It's great. The preparation that we did going into it, to get through all those EVAs, we never had one issue until recently. Luca Parmitano had that water issue in his helmet. Up until then, there were technical problems we had to work around, but we completed all those EVAs with great success. So technically, it's amazing how the whole team pulled together to meet and excel at this technical challenge.

I think one of the real challenges, though—and I don't know how often it gets talked about—is the cultural differences that we were able to overcome. Having the United States, Canada, Japan, the European Space Agency, Russia, and all its partners, and we're all working together as one on the International Space Station. I think that is going to be one of the highlights of the International Space Station. It's a model for how we work together. It's going to be the model for how, when it comes time to leave planet Earth, we leave as explorers of planet Earth, not from any one nation. I just think what we accomplished and all the agreements that we put in place, overcoming all of that, to make that happen, where we can work together so well, as one team, I think that is just absolutely phenomenal.

WRIGHT: That is amazing. Along those same lines, you mentioned, of course, when *Columbia* was lost, you had to move into a different type of agreement with the Russians to transport the American astronauts. Are there other decisions that you believe greatly impacted the Station, through your involvement, through the last years? Some of those other ones that are significant, that changed policy or changed operations or maybe even were impacted by cost?

CABANA: I think we had a great plan, and we executed the plan. I don't have anything that really sticks out as, "If it wasn't for this, then X would have happened." I think, again, it goes back to getting everybody to work together. That was just huge. That was probably the biggest challenge. I think, when I look back on how we're doing things better, what you really have to do is build trust. You have to build relationships, and you have to build trust between your partners. And once you do that, then that can enable change. I think one of the biggest challenges was for our crews living and working in Russia, and the training that they had to accomplish in order to get to the point where they were certified to go fly. I look at how we do it now, compared to how it started out, and we don't do things better or worse than the Russians, or vice versa. We just do things differently. I think, once we showed how we can get to our goal using a joint way, rather than specifically one way or the other, it was through that trust that we were able to come up with better training plans, less time for the crews. It just took time, and I think, now, we have excellent working relationships, but it has been built up over time. It is establishing that trust.

WRIGHT: One of the policy changes that was made recently was the decision to use commercial cargo and also built toward commercial crew. Can you tell us, from your experiences, how that impacts the Station or is going to impact the Station?

CABANA: If we look back, obviously, the Shuttle was just phenomenal. We could not have built the International Space Station had it not been for the Space Shuttle. What a great vehicle for getting crew and cargo to and from low-Earth orbit. With the retirement of the Shuttle, we had to meet our commitment to get supplies to the International Space Station. The commercial

cargo contract—it was a totally different way of going about doing a contract, a new way of doing business.

Change comes hard for folks, okay? I tell the KSC team, if you don't like change, you'd better die, because the only folks not changing are those that are six feet under, and even those folks that are dead are changing, they are rotting away. So change, it's a way of life, and you need to embrace it. If we're going to be successful in the future, we've got to be more innovative and more open to change. We can't do things the way we've always done them, and I think commercial cargo was a great way to come up with a services contract, to get cargo to the International Space Station. But, I think, even more importantly, it set the stage for the Commercial Crew Program, on how we go about acquiring a new crew vehicle through a series of Space Act agreements, necking down to a firm, fixed-price contract, FAR [Federal Acquisition Contract] based contract, where we develop a capability with options for services, leading to a pure services contract to fly a crew. What we learn through cargo helps set the stage for commercial crew, so I think that it was really good.

I think we have two good suppliers, and it's important to have redundancy. We showed this when we lost *Columbia*. We were able to rely on our Russian partners with the Soyuz, to be able to get crews and supplies, with Progress, to the International Space Station. During the Shuttle-Mir Program, it was the Space Shuttle that helped keep the Mir Space Station going, in many ways. So having more than one provider to get cargo to ISS is important. We've got Progress, the European ATV [Automated Transfer Vehicle], the Japanese HTV [Transfer Vehicle], and now, two US capabilities with Orbital ATK's Cygnus and SpaceX's Dragon. For example, recently, who would have thought that right in a row, we would have lost an Antares

Cygnus vehicle, a Russian Progress vehicle, and followed right after that by a Dragon—three supply ships to Space Station, in a row.

Having that redundancy, we've got an HTV that's going to be launching in August. We launched an older model Progress recently to get supplies up. Orbital ATK, in order to meet their commitments on their contract, have contracted with ULA [United Launch Alliance] for an Atlas V vehicle, to get their Cygnus vehicle, in December, up to the Space Station with supplies, so that they can meet their contractual requirements. So having that redundancy between vehicles is very important and having the same for crew it also important.

WRIGHT: Mr. Cabana, in your experiences during the years, you certainly have learned a lot. We there times during your different roles that you realized or learned that there are other ways to do things—that you were able to make recommendations to the Agency to go forth in a certain path? If so, could you share some of those with us, that you recognized that maybe if you did it this way, or maybe if we attempted to do it that way, that it might go along that way, and it made its way through fruition?

CABANA: I can't think of anything that jumps out at me that says that. I think having seen how other people work broadens your perspective on how you can accomplish a task. Again, it's not that the Russians do things better or worse than us. They just do it differently, and I think having all of us working together on the Space Station, we can get a little bit of what's good from everybody, to make it successful. That opened up a thought here, and you use it or not, but if I think of one thing that the Space Shuttle brought to America's space program, it brought diversity. If you look at the Astronaut Corps prior to the Space Shuttle, it was a bunch of white,

military test pilots with a couple of white scientists thrown in at the end, all male. And you look at the Space Shuttle—that first group, 1978—men, women, scientists, military, black, white, Hispanic, Oriental. From the 5th percentile female to the 95th percentile male, they all fit. And what you get through diversity—it's not so much diversity of race or gender or color—it's diversity of thought. We all bring a different answer based on our environment, and by getting all that diversity together, you have a team that can bring you to the best solution. I think a lot of what we're doing on the Space Station—we have that diversity from our different cultures, and we're bringing different solutions together to get the best solution.

WRIGHT: As we close up this interview, I wanted to ask you what you believe will be the legacy of the International Space Station.

CABANA: The legacy is going to be the international cooperation. That's going to be huge. The book is not closed yet. We've got a long ways to go in developing what we need. I talk about pioneering and exploring. Bill Gerstenmaier got me started on this. When I give talks now, I've got slides, and I show a picture of [Ernest H.] Shackleton's voyage to Antarctica and Captain [Frank] Worsley's ship, the *Endurance*, locked in the ice on Antarctica. That's exploring. Explorers go from a safe environment off to an extreme environment. They explore, gain knowledge, and go back to the safe environment. I've got another picture that shows a family standing in front of a sod hut on the plains. That's pioneering. They have established a presence, and boy, that was an extreme environment back then, when they were doing it too.

We were, and still are, explorers in space, but on the International Space Station, we're pioneers. We have established a presence up there. For the last 14 years, we have had humans

living in space continuously. I've got a picture of six people of diverse cultural backgrounds having a meal together on the International Space Station, working as one. We have established that presence in space. So the Space Station—it's going to be a superb engineering tool, to develop those systems that we need to expand beyond low Earth orbit, to go out and establish that presence in the solar system. We've got a ways to go before we can develop an environmental control system that I'd feel comfortable taking away from Earth for two years, knowing that it was going to work and be successful. The Space Station allows us to have an engineering test bed, to prove those systems and develop them.

Then, finally, I think we're just beginning to see the results of the science that is going to be coming from the International Space Station. It takes time to gain the knowledge, and then actually prove what you've gained, back here, on Earth, in order to develop something that is a breakthrough. And I think you're going to see more and more, as time goes on—there's going to be more science. We're going to learn more. So it is a superb cultural melting pot, if you will, helping us work together, as one, in space. It is an engineering test bed, and I think it's going to prove to be a great science laboratory, with many breakthrough in the future. So there are many, many more good things yet to come from the Space station.

WRIGHT: Thanks. Jennifer, do you have anything you want to ask?

ROSS-NAZZAL: I did have one thought. You've been talking a lot about teamwork and building trust. Would you talk about how you, as chief of the Astronaut Office—or in another position—helped to build those relationships and trust with Russians or some of our other partners?

CABANA: Sure. First off, it was learning their culture. It was learning their language. I had one of my Russian friends that work in Mission Control—he spoke excellent English. He would not speak English with me until my Russian got good enough that I could converse with him in Russian, and then he'd speak English with me. English is the international language of the Space Station, but for our crews to be successful [they have to speak Russian]. They're riding on a Soyuz rocket. They're working Russian systems. Obviously, we have to know Russian in order to work together, just as they have to know English. So I think that goes a long ways toward establishing trust.

Whatever country I've traveled to—and I traveled to Japan—I always learn enough of the language to be polite. That goes a long way towards knocking down barriers and establishing trust. You've got to be true to your word, too. If you say you're going to do something, then you've got to follow through and do it. It's getting to know one another and establish those relationships that then can help you become successful, and I was able to do that.

Fortunately, as chief of the Astronaut Office, working together with our crews over there, putting agreements in place—how much training needed to be done, how we were going to do it, working through the medical issues—all those things, establishing those relationships, then, when a problem came up, you could work through the problem together.

WRIGHT: Okay. Well, thank you.

[End of interview]