

NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT

ORAL HISTORY TRANSCRIPT

ELLEN OCHOA
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is August 22nd, 2017. This interview with Dr. Ellen Ochoa is being conducted at the Johnson Space Center for the JSC Oral History Project. The interviewer is Jennifer Ross-Nazzal. Thanks again for taking some time. I know how busy you are.

OCHOA: You're welcome.

ROSS-NAZZAL: I wanted to start by asking you about the all-hands meeting that we had last week with [Acting NASA Administrator] Robert [M.] Lightfoot [Jr.]. You were talking about a couple of changes going on at the Center, one of which was the effort to combine a number of contracts. I think you even mentioned combining Orion and ISS [International Space Station contracts]. Would you talk about that effort, why that's important, and what spurred that [decision]?

OCHOA: This was all part of JSC 2.0, and it was probably about three years ago now. Every year our senior staff has gotten together and said, "In addition to activities we have going on in each of our organizations, what should we focus on as a senior staff? What are things that require support from a variety of different organizations here and really need that top-level collaboration and focus?"

So a few years ago one of those things was to change how we decide what contracts we're going to have at the Center. At the time it was very decentralized, so an organization could say, "Well, I need certain services." They could just go directly to procurement and say, "We need to start up a contract for this kind of service or goods." Then you go through a pretty involved process where you put together an initial team to look at what kind of contract you might want. You end up putting together a source evaluation board. You have procurement people and resources people and legal people as well as the technical or functional people who are actually defining what services you need.

Go through a whole process, end up selecting a contract, and then depending on what kind of contract it is, if it's something that involves an award fee, you're continuously monitoring and meeting and trying to determine what that award fee is. So the more contracts you have, the more people are involved in these kinds of processes at any one time, the more resources it takes.

If you're looking at how can you get the services and goods that you need with fewer resources invested in doing that, but still come out with what you need, one way to do it would be to have fewer overall contracts. We wanted to make sure we were doing a couple of things, that, of course, all the organizations were very involved in this process and, number two, other things that were important to the Agency and to the federal government, for example the dollars that we spend on small business, that we were preserving and considering that. We didn't want to do something where you just end all the small business contracts because that adds to the total amount. That wouldn't have been the goal.

We had a group get together, and they literally reviewed every contract we have here, which was about 120 at the time, went through the statement of work to say what kinds of things

is that contract able to provide. Then they came up with a plan over three or four years to say, “We can come down about 20 percent in the number of contracts that we have here.” They looked at when contracts were naturally going to end, how you could dovetail. Because we also didn’t want to do anything like just end a contract in the middle. We had no cause to do that. You needed to look at natural endings. Before you exercise an option, when is there a chance to do something with a contract. I should say everybody worked together. We brought that back to senior staff, and we had essentially all the senior leaders here at JSC agree to this plan, which was very specific in terms of what contracts were ending when and when we had the opportunity to combine or change things around.

We’ve put that plan in place, and really we’re coming almost to the end of that, in which we really have consolidated. You can see how the number of contracts has tracked downward over the last few years. We’re very close to the point where we’re down about 20 percent.

One organization, Flight Operations, when we started this three years ago they had 14 contracts. They looked very closely at how they could combine those somewhat differently and come out with eight contracts. We’re in the very end process of awarding those contracts now. I think the more important part is you didn’t want that to be just a one-time-only effort. You wanted to really going forward have a process, where before you put a new contract in place you’d asked yourself those important questions. Are there other contracts here at JSC that already have that content and that statement of work? You can just add money to that contract. You can avoid this whole process. Are there other contracts across NASA which have the ability to support JSC where you could get that work? Are there other mechanisms that already exist where we don’t need to start from scratch?

For example, we're just about done building a new combined heat and power plant here at Johnson Space Center. Rather than put a whole contract in place to do that, in fact it would have been almost impossible to do because you needed the chunk of money up front, we piggybacked onto a Department of Energy [DOE] construct that they had. They have these energy savings contracts where you don't actually pay up front to build these plants. What you do is once it's built you pay it back over time essentially from the savings in the utility bills that you have. DOE had set this up, and we were able to get it built under that.

We want to be looking for these things that exist other places across the federal government. But the majority of the work was really looking specifically at our own contracts.

ROSS-NAZZAL: Something else that Lightfoot had mentioned during the all-hands—a lot of people come to NASA and say, “But I didn't want to do this,” which is monitor contracts. “I wanted to be the technical person.” Have you seen people moving into more technical positions as a result of this change?

OCHOA: What I would say is we have fewer people overall and fewer hours overall spent in doing contracting in terms of each contract. So yes, I think this has helped.

ROSS-NAZZAL: You mentioned one other thing that I thought was interesting, which was providing support for mission support people to become closer to the missions. Would you talk about why that's so important here at JSC?

OCHOA: That's something we have talked on and off for years, and we have done various things over the years, even before I was Center Director. For example, we developed the POWER of One award, where peers could nominate each other for something they had done that helped the Center or helped the Agency. You got to choose some experience here at JSC to be involved in, maybe getting to drive in the rover that we have or go onto the floor of Mission Control. That was done a few years ago.

Last year as part of JSC 2.016 we were again trying to focus on connect to the mission. There were a variety of things that we did under that. One of them was to revamp our mission statement and explain our priorities more clearly and succinctly, because we want everybody to be able to know what they are, be able to say them, and understand how their own job fits into them.

We also developed a Humans of JSC Website, which is on the 2.0 Website. It's stories about different people who work here at Johnson Space Center, what their job is, why they enjoy doing that, and how that fits into the mission.

I wanted to put again another focus on it this year for a couple of reasons. First of all, as I go around doing coffees, I still talk to people who have been here 20 years or more [and] they've never been to Mission Control. They've never been in the building where we have our spacecraft mockups. To me that's just sad. That means we're not doing our job here in terms of really taking advantage of what we have here at JSC and making sure that employees get some of those experiences that you should have the opportunity to get.

The other reason I wanted to focus in particular on mission support people is, well, number one, they generally have less opportunity in their day-to-day job to get to do that, and number two, we're in the midst of relooking at how we provide those services. Whenever you're

doing a change like that obviously it's concerning for people, so it's just an opportune time to make sure people do stay connected to the mission and do get the opportunities and see and do things here that you can only see and do here at Johnson Space Center.

ROSS-NAZZAL: It's such a unique place really. That's such a shame people haven't seen those places.

OCHOA: They come in, and they're working hard day to day, but they may be in an office environment or somewhere else.

ROSS-NAZZAL: When you come in as an intern or co-op those things are always on your schedule, so you get to go see them. That's a shame that the students see them but not everyone does.

OCHOA: Not everybody gets to do that.

ROSS-NAZZAL: You mentioned JSC 2.016. Then there was another iteration, 2.017. Can you talk about those iterations? You talked about the new mission statement. Can you elaborate on that a bit more?

OCHOA: After the first year and a half or so of JSC 2.0, I wanted to think about how do I maintain momentum in really trying to continuously get people to consider how can we do things differently here. I would generally have a retreat with the senior staff near the beginning of the

calendar year, and we would try to set out a few goals, maybe around four or so, again that the senior staff would really focus on. I just mentioned what we called SAFE, which was the Strategic Acquisition Forecasting One, the one that talked about contracts.

Every year we were setting out these goals at the beginning of the year. I guess it wasn't until last year that we had the idea, I think maybe it was the External Relations Office, of branding it with the year. So instead of here's this year's 2.0 larger goals, we'll call it 2.016—and this year we followed that with 2.017—and brand it a little bit more around it and be able to give a little bit more focus on it so people around the Center could know what it was that we were focused on as a senior staff and how we were working that, and hopefully a lot of people would be involved in that as well.

ROSS-NAZZAL: I thought it was kind of ingenious when I heard it. It definitely stuck in my mind.

OCHOA: The external relations folks did a great job I think in particular last year of thinking about whether it's a JSC Features story, where they tie it into that, or the *Roundup* or then they put the decals on the doors with the four goals that we had that year to just help keep it top of mind.

ROSS-NAZZAL: I do see it quite frequently. I wonder if you can talk about some of your relationships with the other [NASA] Center Directors. I imagine that there's close ties between all of you as you work together on different missions or just talk about different struggles that you may face on a day-to-day basis.

OCHOA: We meet periodically for Agency meetings, several different types of meetings. There's Strategic Management Council meetings, or Robert Lightfoot has one that we call the NBA, which is Non-Budget Action meeting. It was really focused on Center Directors and mission directors being the key people who can implement changes to NASA's operating model.

All the work we did on TCAT, the Technical Capability Assessment Team, which led to capability leadership, and then the business services assessment, and now the mission support architecture. Where we did a lot of the discussion around that were at these NBA meetings, so that is a place where all the Center Directors get together periodically throughout the year, along with the mission directors who of course are the other key part of the Agency.

We get to see each other reasonably frequently. Depending on what you're working on, there are certain Centers that you're working more closely. Obviously the human spaceflight centers have always been close and remain that. So I will see [NASA Marshall Space Flight Center Director] Todd [A.] May and [NASA Kennedy Space Center Director] Bob [Robert D.] Cabana much more frequently than I see some of the other Center Directors. Particularly over the last couple years we've tried to be more visible at any of the activities that are big milestones for the whole Exploration Systems Directorate: Orion, SLS [Space Launch System], ground systems. Another key Center for Orion is Glenn Research Center [Cleveland, Ohio] because they head up the partnership with the European Space Agency on a day-to-day basis. Obviously the Orion Program here is the overall owner of that but on a day-to-day basis Glenn does that. Of course Janet [L.] Kavandi is the Center Director now, and she is a former longtime JSC person and astronaut. So she's a key person there that we've had closer ties with due to that partnership with Orion.

ROSS-NAZZAL: What are some of the technical issues that you've been involved in since you've been Center Director? I imagine that you talk about some of those issues when you come together. Are there any that stand out?

OCHOA: We're in a period where there's more development going on than at any time since maybe the height of the Apollo Program, and in terms of different spacecraft more than any time ever. We're of course working the development of Orion. Marshall Space Flight Center [Huntsville, Alabama] is working on the SLS. Then along with Kennedy [Space Center, Florida] we co-manage the Commercial Crew Program. There's two new spacecraft being developed under there, and they both have launch vehicles that have to be human-rated as well. There's no shortage of technical issues as well as budget as well as schedule because any big development program like that you're working all of those issues simultaneously day to day.

For me the program managers of those programs are on my senior staff so I hear from them weekly. I also meet individually with all the program managers usually on a biweekly basis where we talk more specifically. It could be technical issues, could be schedule, budget; it's usually some combination just based on what's gone on in the last couple weeks or what's coming up.

I also meet weekly with the directors of all the technical organizations here, and so often there may be a particular technical issue with one of these programs that is the issue of the moment and we may use that meeting to discuss it and hear from Engineering, Safety, Flight Crew, and Human Health and Performance. White Sands [Test Facility, Las Cruces, New Mexico] may be involved in some of the testing. That's another opportunity.

There's just so many, it's hard to pick out just one, but it's really a very very busy time for us.

ROSS-NAZZAL: I can imagine. I didn't realize that this was such a busy time.

OCHOA: Yes, it absolutely is.

ROSS-NAZZAL: When you talk with other people they think NASA is very quiet, we're not launching, so therefore we're not doing—

OCHOA: Oh my gosh. Nothing could be further from the truth.

ROSS-NAZZAL: I wondered if you would talk about politics. You mentioned when we were chatting before we turned on the recorder about going up to the Hill. Would you talk about your relationship with politicians, local, state, national, how all that works as Center Director?

OCHOA: Sure. Center Directors play a key role really in being a liaison to all the elected officials that are important to our region and to NASA in general. So I do that as do other Center Directors. We do have a legislative affairs person here who's part of our External Relations Office. Usually we try to have a second person either part-time or full-time as well.

I would say day to day they keep in contact with the offices of our elected officials, and particularly ones who have leadership roles on our key committees in Congress. We have four key committees, the authorization and appropriations committees for space on both the House

and the Senate side. Three of those are led by Texas legislators, so clearly we want to stay in contact with them.

Of course we're not allowed to lobby. But we do want to make sure they stay informed, and they often are asking us questions as they are going through the work of their committee. There's more constant interaction from our Legislative Affairs Office with their staffs, and then occasionally throughout the year more face-to-face meetings between me and the elected officials. There's actually been quite a bit of interaction lately. Earlier in the year both House and Senate were working on the Transition Authorization Act, and both [JSC Deputy Director] Mark [S.] Geyer and I were up in Washington right at the time that they were working on and looking to pass them through their committees. We were actually up there for an Orion/SLS suppliers conference. There were about maybe 200 folks from around the country who work in or head companies that supply components to those programs making sure their elected officials know, "Hey, we support NASA. There may not be a NASA Center anywhere in our state or anywhere near us, [but] here's how we support NASA." Mark and I were also up there talking about Orion and SLS but also about NASA in general. It was right at the time they were working this authorization act, so we met with several elected officials at that point.

We had some come out when James Webb Space Telescope arrived here, a little bit earlier, and we had the chance to view it before it actually went into our chamber where it is now being tested.

Of course we had the big event in June where we announced and introduced to the world our 12 new astronaut candidates, and we had quite a lot of elected official support for that from the Vice President to senators. [United States] Senator [Ted] Cruz was here, other House officials. We had the governor of Texas, and we had some local elected officials as well.

I was up on the Hill [again] last month for the ISS Research and Development Conference. It was in Washington, DC. It's in different cities every year. This year it happened to be in Washington, DC, so we had members actually come over to the conference and speak, and then we had a reception on the Hill, another opportunity to talk to our elected officials and again keep them up to date on what we're doing.

Those are the kinds of activities that I do and that other Center Directors do as well.

ROSS-NAZZAL: Do you find that type of work challenging, working with politicians?

OCHOA: I think you just have to understand what you can and cannot do. A lot of times we refer certain types of questions to our Headquarters Office of Legislative Affairs. But there's quite a lot that we can make sure they're up to speed on in terms of what we're doing here at JSC or give them some information about impacts of certain things. It's obviously very important. Congress authorizes our activities, and they actually appropriate the money. So it's an important part of the job.

ROSS-NAZZAL: You mentioned that the governor was here. Would you talk about your relationship with state officials?

OCHOA: In terms of funding support, almost all of it comes from the federal government. We do have one particular education program which has been supported by our state legislature. That's our Texas Aerospace Scholars Program, which funds a program where we reach out to high school juniors in Texas. They have an opportunity to sign up for and do online work during the

school year. If they pass that successfully with a high enough grade, they can get high school credit for it, but then they are also invited here to Johnson Space Center for a week during the summer where they, of course, get to meet scientists and engineers here. They get to tour around, but they have some very specific activities about planning a mission to Mars during that week and then a report-out at the end. I get a chance to see some of those report-outs. That is something funded through the state of Texas. We do get funding other places, primarily from the Houston Livestock Show and Rodeo. So we combine those and support that activity.

Every two years when the legislature is in session NASA goes up [to Austin]; we call it Space Week. There's usually a particular day or two in the middle where again the Center Director goes up, and I'll visit with several members of the state legislature, which I did this year.

In general, we haven't had a whole lot of interaction with the governors. Usually if possible, when we go up to visit the state legislature, we'll visit with the governor. We didn't this year, but I have in years past. This is really the first time I can recall that the governor has actually come to Johnson Space Center since I've been in management.

ROSS-NAZZAL: What about the mayor of Houston? Do you have any contact with them or city council?

OCHOA: Yes. Our current mayor Sylvester Turner and our previous mayor Annise [D.] Parker have both been really great supporters of NASA. Previous to that I think it's been a little bit hit-or-miss, but they have both been very interested in NASA. Sylvester Turner was down here for an event at Space Center Houston that involved me, and it was associated with the new display

out there, Independence Plaza and the Shuttle Carrier Aircraft. It was literally maybe three weeks after he took office, something very close to that. He's been a strong strong supporter and has included NASA as he talks about the city and really, I would say, embraces JSC as a unique and important part of the city.

Of course Houston was the focus of attention for the Super Bowl earlier this year, and we were a part of the host committee for that. We had a lot of opportunity during that 10 days where the focus was really on Houston to showcase what we're doing here and to show up several places with the mayor and with other leaders of Houston. So that was a great opportunity to be part of that event which was so important to the Houston community here.

ROSS-NAZZAL: There are other events that are so important here at JSC that are traditions like the chili cookoff and the Houston Livestock Show you mentioned and then there's the trail riders that come through. Would you talk about some of those traditions and what value you see them producing for the Space Center and why they need to continue?

OCHOA: We're fortunate to be in a city like Houston, where it's the fourth largest city; I think we're coming up to be the third before too long. It's hugely important to the state, it's hugely important to the nation, because of the industries that we have here with oil and gas, with the Texas Medical Center, the largest medical center in the country.

We have a big petrochemical industry, we have the port, and we have NASA and the aerospace community. To me to make sure that whenever Houston is talked about as a community we're one of those things in that list that I just mentioned of these important industries and activities. I just think we're really fortunate to be in Houston and to be one of

those. So being visible in the community I think is a large part of making sure we're part of that communication.

Houston Livestock Show and Rodeo, anybody that lives in Houston knows how big that is within the Houston community, and so we do have a partnership on that. Trail riders generally come through here every year, and we support the longhorn viewing up there as well as, as I mentioned, they support us with some of their scholarship money for the Texas Aerospace Scholars. As well as there are people who come here as maybe college interns who have scholarship money from the rodeo as well.

ROSS-NAZZAL: One thing we haven't talked about are Expedition missions, and I wanted to ask you about your involvement as Center Director. I know you travel a lot. Do you spend a lot of time going to Russia or working with some of our international partners elsewhere around the globe? If you could talk about some of those things.

OCHOA: We definitely, from the Center Director Office, support every launch over there. Either I will go or Mark Geyer or Melanie [W. Saunders] as the Associate Director goes to every launch. Typically, I've been going once a year and then the other three are covered by Mark or Melanie. Of course it's really Kazakhstan, not so much Russia. We stop in Russia in order to get on the charter flight that's arranged for us there to go to Kazakhstan, but we actually spend most of the time in Kazakhstan at the launch.

I think that's incredibly important. It's our people that are launching there, and of course we, [JSC], play the key role in coordinating all of the International Space Station activities. I

think having that presence is important for the crew to know that we are paying attention and that this is a huge deal, and then just for the Program in general.

ROSS-NAZZAL: Any traditions that you participate in when you go over there? I'm sure that there's quite a few.

OCHOA: We are present at the state commission that happens generally the day before launch. There's usually some toasting that goes on after the commission, which is an important part of any Russian endeavor. Of course we participate in that. Then we're out at the launch [viewing] site for the actual launch participating in that.

ROSS-NAZZAL: Were you out there for the launch of [Scott J.] Kelly or Peggy [A. Whitson] on the recent flights?

OCHOA: I was at Scott Kelly's first Expedition launch but not the one that launched the beginning of the one-year mission.

ROSS-NAZZAL: Beginning of the one-year mission, yes. For Peggy were you there?

OCHOA: I wasn't there for Peggy's, no. I forget who went to that one.

ROSS-NAZZAL: Would you talk about some of your relationships with our international partners?

OCHOA: In terms of really putting together the plans and meeting, the program managers meet, and of course [include] many layers under the programs. When I was head of Flight Crew Operations, I headed up the Multilateral Crew Operations Panel. That met periodically, and it was really the heads of all the crew offices of the five agencies that make up the partnership. We talked about upcoming crew assignments and how we were doing the increments. Any time there was any changes to the process or how that would happen we would talk about those. I would say it was really in that role that I had more of an in-line role where I actually needed to make decisions and get the group to come to consensus and bring that forward to the Program for approval.

Now it's really just staying on top of what the Program is deciding. The program managers around the world will meet and then bring their recommendations up to Bill [William H.] Gerstenmaier's level [Associate Administrator for the Human Exploration and Operations Directorate] and then it actually goes up to the heads of Agency level as well. So [I'm] really kept informed. I asked questions. If there's anything I felt like we needed to discuss I could either talk with [ISS Program Manager] Kirk [A.] Shireman or with Bill Gerstenmaier about that but I'm not right in the process of negotiating. That really happens up through the Program level.

ROSS-NAZZAL: One of the things I wanted to ask about—we talked a little bit about this last time in terms of challenges that you face in terms of maintenance budgets—was the closure of the Arc Jet Facility that was a big concern for some of the folks who had worked out there for years. It's my understanding that budget was a major concern. [I] wonder if you could talk about what role a Center Director might play in deciding what buildings have to get demoed and

why they're demoed, and then also your work with the congressional leadership about the decision to close it and why that decision was made and if there were any lessons learned you might share about that.

OCHOA: It's timely that you're talking today because today we're hosting a visit from several folks at [NASA] Headquarters [Washington, DC] who are involved in approving our Center master plan. Every Center needs to have a master plan. We have to update it every five years. The one that we are working on right now I think is more specific than we've had in the past in terms of how much square footage we need to cut from our Center footprint.

We need to do that in conjunction with the Agency as a whole, right? Because you have to look at what capabilities we have at this Center compared to what capabilities other Centers have, making sure that we maintain those capabilities that are unique to JSC and that the Agency has agreed need to move forward so that we still need to have them 20 years from now. These master plans are really 20-year looks into the future. That's a very difficult thing to do, of course, because administrations change and things change in terms of what we need to provide. But we have to do the best job that we can in terms of looking forward and saying, "Based on where the Agency is headed and the overall Agency plans and the human spaceflight program in general, this is how we see NASA's facilities." We also obviously talk workforce and skills, but the master plan itself specifically has to do with the facilities that support it.

So it looks at what should we be demolishing, what should be renovating or potentially changing into something different, and what should we be building. We are in the midst of moving into a beautiful new building, Human Health and Performance Building. Part of our master plan from a few years ago was getting the funding for building this building, and then that

gives us the opportunity to demolish seven other buildings on site. One main one that's been here since the '60s which is really unfortunately in really terrible shape, as well as six smaller buildings that in some cases are the smaller metal shed buildings that we had the opportunity to build over the years, but none of them really ideal for the purpose that they were being used for. One new building, seven going away. One of the stipulations of building the new building is that it was going to have, if I remember right, 15 percent less square footage than the space that we were then going to be able to demolish. That's part of the overall plan.

This is really not just a NASA plan but an overall federal government plan of looking at the footprint of federal agencies across the country. You have to consider what are the actual capabilities we need, what kinds of facilities do we need to have them, what do we have now, what do other Centers have.

In the case of the arc jet, there were two Centers that had arc jets. The capabilities didn't exactly overlap, but in the end there really wasn't the funding to keep both of them going. The Agency made the decision to keep the one at Ames Research Center [Moffett Field, California], to actually move some of our equipment from here at Johnson Space Center over there. Then our folks were asked to help set up and upgrade these new capabilities that they hadn't had before at Ames based on our expertise and our equipment here.

In fact, we just recently, maybe a month ago, finished the demolition of the building that we moved out of. Absolutely it's hard when you have a capability to give it up. You really have to look at the larger picture of what's going on across the whole Agency and just say, "In the name of really trying to support the overall goals of the Agency." You get some things like a Human Health and Performance Building, and some things get moved.

In some cases, things are just demolished. There have been wind tunnels at other Centers that have been demolished, and they didn't build new ones at NASA. They looked to either other wind tunnels that exist, that corporations have, or changing the way in which we do certain kinds of research.

ROSS-NAZZAL: Was Congress, once they heard the reasoning behind it, supportive of the idea? Or did you still get a lot of flak from the Texas delegation?

OCHOA: I had a number of different conversations about it but again really tried to put it in context. The decision was actually made when Mike [Michael L.] Coats was Center Director. He was really the one that was interfacing with them initially. I would say I just continued to get some questions after I became the Center Director and really tried to talk about the process that the Agency was going through at that time. I will say the arc jet decision was made a little bit ahead of the whole Technical Capability Assessment Team, but it was leading into that.

ROSS-NAZZAL: Are you getting any flak about tearing down the LRL [Lunar Receiving Lab, Building 37] given its historic qualities? I know that the building is in bad shape. My understanding is the foundation is splitting in two.

OCHOA: Whenever we do anything where there was something historic that happened there we do work with the State Historic Preservation Office. Usually you try to collect a bunch of information, whether it's blueprints, photographs, and put together information before you do something like that.

But we've got to move on. Believe me, if you saw the difference between the old and the new, you'd realize how excited people are. They're moving in as we speak. Really really excited to be able to operate in the new building.

ROSS-NAZZAL: Yes, no doubt.

OCHOA: It really supports what we've been trying to do under JSC 2.0 about collaborating more across divisions and organizations and not being as stovepiped with the way the labs are set up there. Here we have labs in seven different buildings. If you work in the one lab you may never see anybody that works in another lab. We have more of an open lab concept over there, and people who use certain kinds of equipment can actually share them instead of labs having separate ones, which just adds to the cost. You get more of that dialogue between the different scientists and researchers as well, which we think will really enhance our ability to produce good science.

ROSS-NAZZAL: Yes, and it's a beautiful building, it really is nice.

OCHOA: Yes.

ROSS-NAZZAL: Last time we talked about partnerships. I wonder if you would talk about some of the more successful partnerships that have come about as a result of [JSC] 2.0 and why you think they've been so successful or why you're so proud of those.

OCHOA: We have literally hundreds of different partnerships, and they span a wide range. Starting several years ago when I was Deputy and Mike Coats was Center Director Robotics and Engineering started working with General Motors [Company]. Again you often think of partnerships with aerospace companies. This was an automotive company, but they actually sent money and sent engineers out here who lived out here two or three years and worked in our labs. We were able to make progress on Robonaut, which is our humanoid robotics program, much quicker than we would have just on the resources that we had on our own. We were interested in that technology to support astronauts in space, and they were interested in humanoid robots who could work alongside humans in factories and prevent things like repetitive motion injuries. That was a very interesting partnership.

Another partnership is in our Flight Ops Directorate. One of our main facilities is the Neutral Buoyancy Laboratory. That's our big underwater pool. We have a contract that essentially helps operate it; Raytheon runs it. A few years ago when we competed that contract one of the things we really wanted to incentivize was can we find partners to use that facility.

In this case again it was really a cost sharing activity, because once the Space Station was built, although we still need the facility, we use it all the time to learn how to do and to practice space walks, we didn't need it nearly as much as when we were actually assembling the International Space Station. So we had the opportunity to time-share and cost-share that facility.

We have found some very good partners, primarily in oil and gas, the offshore part of that industry, doing training for people. The first big training partnership that we had, a lot of it was actually in response to Deepwater Horizon where they wanted to make sure people had the appropriate training in case a helicopter ditched in the Gulf. It wasn't just that we had water, but we had trained safety divers, we had test conductors, we had people who could put together

scenarios and carry them out in a simulation environment. We had crane operators; we had doctors on call. All of that supports what we do and that's exactly what you need to support some of that training. Put together that partnership with the help of our contractor partner Raytheon.

Then we've done a variety of other things generally all supporting oil and gas people who are using remotely operated vehicles underwater either for some kind of construction or some kind of repair activity. They can try out those kinds of activities in our pool. So that was another kind of partnership that we had.

Some of our technical folks have worked with all different kinds of industries. People at the Texas Medical Center, again oil and gas. I had a nice note [recently] that passed on thanks from the head of Shell UK because some of our folks helped develop an inspection device for some of their underwater tanks where they had to understand the situation inside of these tanks for part of environmental remediation.

Then there's more outreach kinds of partnerships. I would say the partnership with the Houston Super Bowl Host Committee is one of those, where it was a great opportunity for us to be part of that whole outreach effort. So those are just a smattering of partnerships.

We also, of course, have either contracts or partnerships with just about every aerospace company imaginable, including all of the newer ones. Obviously a big one with SpaceX, [also a partnership] with Blue Origin. We've had partnerships with Virgin Galactic in the past. I think we still do, I'm not sure. Almost every company that you can think of we probably have some kind of Space Act agreement. Often with no exchange of funds but where we do some kind of technical review of something that they're interested in having us review, where we get some of our experts together. Really just a wide variety.

We have a partnership with the Houston Airport System regarding the spaceport at Ellington.

ROSS-NAZZAL: I was hoping to talk about that, but I know we're running close on time today. I wonder if this might be a good place for us to stop. You've got a lot of things to be proud of.

OCHOA: Okay. All right.

ROSS-NAZZAL: Thank you.

OCHOA: Thank you.

[End of interview]