NASA DISCOVERY 30TH ANNIVERSARY ORAL HISTORY PROJECT
EDITED ORAL HISTORY TRANSCRIPT

CATHERINE B. OLKIN
INTERVIEWED BY SANDRA JOHNSON
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JOHNSON: Today is October 24th, 2023. This interview with Dr. Cathy Olkin is being conducted for the Discovery 30th Anniversary Oral History Project. The interviewer is Sandra Johnson and Dr. Olkin is in Niwot, Colorado, and talking to me again today over Microsoft Teams. Thank you for joining me again for another interview. I appreciate it.

OLKIN: Thank you for having me.

JOHNSON: Let's talk just a little bit more about that PI [principal investigator] position. Just in general, since you've been on more than one mission. What do you think it takes to be an effective PI for a program like Discovery or New Frontiers?

OLKIN: I think probably every PI does it differently. I don't know if you've ever read any of Janet Vertesi's work. She's a researcher at Princeton University. In fact she might be very interesting for you to interview. She studies teams and the sociology of people and she has studied the Mars rover team and the Cassini team, looking at the way the teams work. But PIs all have their own different style. I'll say I think there's many ways to be an effective PI.

My thoughts on what is the best way include some ideas that I've had over the course of my career. One is don't shoot the messenger. You need to have an open environment where people can come and talk to you. I will say that Alan Stern was really good at that. If I had to

come to him with some bad news, something wasn't going well, it would be uncomfortable, but he never got mad at me for what had happened and always was very clear that he wanted to know early if there's a problem so we have time to fix it.

People can be complex, because they can be really easy to work with in some ways and more complicated in other ways. I've seen people who've had a very open style of leadership where it's more everybody needs to agree and come in together, and then other styles where you will do what the boss says and they are open to hearing things but once the decision is made you go forward and execute. I think both styles can work, and it just depends on everyone understanding the style of the PI that they're working with too.

JOHNSON: I would imagine that goes for the project manager [PM] and everybody else as far as having different styles in the way they lead.

OLKIN: That's exactly right. Everybody has different styles and understanding how to work together. Because quite often the project manager might be at a different institution than the PI. Maybe they don't know each other well prior to writing the proposal. Or maybe if there's a change in PM-ship. The very first thing that needs to happen is building that rapport and you can't short circuit it. It's not only about going to work together but also about learning to understand what motivates each other and how each person's style is. We had a couple of different PMs on Lucy and they all had different styles but they were all very effective.

JOHNSON: Let's talk about the mission itself. Last time we were talking about getting chosen and all that buildup to that. Once it was chosen and the team was formed, and I know you had some

changes in the team along the way, but let's talk about those beginning days and designing the mission and the science you wanted to accomplish and some of those milestones along the way.

OLKIN: In the beginning it was a small group of us working on the proposal. I find that to be—so many phases of a mission development are so exciting, they all have their own different things, but it's really quite exciting at the beginning when you are making these decisions that are going to have far-flung implications, whether you are selected, and if you are selected what are you going to do for the next decade of your career.

It's a very exciting time. A small group of us would meet at Lockheed in one of their small conference rooms and just work through it, and how are we doing this, and what are we doing, and what are the instruments, and what are we going to do for a student collaboration, and how do we need to architect the mission.

One of the big decisions was making Lucy a tour of Trojan asteroids and selecting how do we figure out a tour of asteroids. It was really important that we see many different types of asteroids because in the Trojans there's diversity in the colors and the spectral types, and that gets back to the key questions we were asking, which is how did these objects become emplaced where they are today. This goes back to the Nice [model] theory[1] that of course Hal [Harold F.] Levison was key on. He was a great driving force for how to figure out how to survey the diversity of the Trojan asteroids which happens to be our tagline, and how to go about that.

What we did at the very beginning, Hal came up with a list of pairs of objects that would be great to compare. A C-type and a D-type that would be in a similar orbit. Of course people

[1] Read more about the Nice Model from SwRI: https://www.swri.org/press-release/primitive-asteroids-formed-far-from-sun

might think Trojans are all in the same orbit. But there's a range of inclinations and then there's also a range of eccentricities. Things that are in a very similar orbit. They will have seen the same processing over the timescale that they're in the Trojan clouds.

We started with this list and looked at these pairs and then added to it. What else can we get to? What else can we get to? At first, we were only looking at going to the L4 swarm, and then Hal and Brian Sutter were looking at integrations of what happens to the spacecraft after the L4, and they realized they were very close to Patroclus and Menoetius, which is a very exciting object because it's a binary asteroid pair in the Trojans. It's a near equal size binary. Being able to see that was going to be very exciting, because there are a lot of questions about how would a binary get emplaced in the swarm. Because if it's got transferred from the outer solar system dynamically sometimes binaries could be torn apart. It was very exciting and very serendipitous that we could get to Patroclus and Menoetius, because it has a relatively large inclination for Trojan asteroids, but it was passing through the ecliptic plane at the same time that Lucy was near it, and so that's what helped have that encounter.

Some of it is really good planning, and some of it is serendipity, but you don't get the serendipity unless you are prepared to look for it. If they weren't looking at what was going to happen, they would have never seen it. Then we were able to add more objects to our list. Then once we were selected—I'm going to jump ahead a little bit because I think this is really interesting about binaries—once we were selected for flight, then there's a lot of attention that gets paid to these objects because a spacecraft is going to go there. You need to make sure that they become even better characterized from the ground.

Part of that were a series of stellar occultation observations that we on the Lucy team made, led by Marc Buie who leads our occultation campaigns, and also, we had Hubble Space Telescope

[HST] deep imaging to search for satellites. With HST data we discovered there was a satellite of Eurybates, and then we also discovered there's a satellite on Polymele.

Now all of a sudden this handful of targets, three of them have binaries. It leads me to wonder how many other Trojan asteroids out there are binary and we don't know of it because we haven't done the deeper searches. It's hard to get telescope time to do really deep searches for just random objects. It's a precious resource and totally makes sense.

It's an interesting question of binaries. For people who don't study the outer solar system, the Kuiper Belt has a lot of binary objects, and that is the remnants of the population that these objects may have come from. Maybe this is telling us more about that origin story.

Back to the question you asked. We all would sit in a room. Questions about what objects are we going to, how many objects can we get to, how many instruments can we put on the spacecraft and stay in the cost cap. Definitely we struggled and worked hard to work through questions about the concept of operations for the flybys. As we're flying by the asteroids, we want to be able to constantly be looking at them, therefore we put the instruments on an instrument pointing platform, so that we didn't have to move the whole spacecraft. There still needs to be some motion of the spacecraft, but fine detailed pointing could be done by an instrument pointing platform.

That's so that we're not exciting different modes of vibration and motion on the spacecraft that would be hard to damp out with the large solar arrays. Those are all the fun interesting questions you get to grapple with at the beginning of a mission. Then you have to live with them as you're moving forward.

JOHNSON: Because of your background you had that understanding of more the engineering side plus the science side as far as that give-and-take you were just talking about.

Let's just go ahead and talk about that time period when you were working on the mission when everything was coming together, things were going along, and then the pandemic hit in 2020. A lot of what a management team does is you prepare for the unexpected. You prepare for possibilities and different things that might happen along the way. Most people didn't see this pandemic coming. Talk about that and how that affected the planning and how that affected what was going on with Lucy at that time.

OLKIN: Yes. When the pandemic hit, you're right, you spend a lot of time thinking about contingencies. If we think there's a government shutdown, how do we make sure everybody's fully funded so that they can continue on to get through the shutdown? You spend a lot of time thinking about contingencies. But the other thing you really spend a lot of time thinking about is the health and safety of your team. Nothing became more clear than that priority when COVID hit.

When COVID first happened and we heard, "Don't come to work," or schools were being closed, I never imagined in my wildest imagination that it would go on as long as it did. I was talking to people and they were like, "Oh, maybe it'll be a few weeks." Some people thought maybe it'll be a few weeks. I was more of a pessimist and thought maybe it'll be a couple months. I never thought we would be having the impacts for COVID so long into the future.

That also made it hard to plan because you had no idea of the timescale. There was no historical precedent. Of course there was the Spanish flu or there was pandemics in 1918 but the world was a different place. You didn't have computers. You didn't have telework. There was

no analogue here. We did the best we could day after day, trying to be really open-minded, being really clear about what our priorities were.

The health and welfare of the team was first and foremost. But we couldn't just say, "We're going to stop building the spacecraft." We were in a very difficult time period for the pandemic to hit. Our instruments were not yet delivered to Lockheed. They were still at their home institutions. That was challenging. If everything had been at Lockheed during AI&T [Assembly Integration and Test], then there would be one area to have to figure out how to manage the flow of people and keeping people safe and healthy.

We ended up having basically cohorts for those people who had to eventually be doing touch labor, like two different teams, and you would work with them, and you wouldn't mix with other people. At first, we went to doing just telecons and moving analysis forward and doing the work that you could do without being in person. But then ultimately there was in-person work that needed to happen. Goddard Space Flight Center [Greenbelt, Maryland] was shut down as were all the NASA facilities. But the Ralph instrument was at NASA Goddard. It needed to be completed. I believe it was June of 2020, somewhere around there. There was the ability to get small numbers of people into Goddard to do work in a safe environment. There were lots of reviews and basically plans that needed to be made and then approved by Goddard leadership to say that this is the right thing to do, to make sure that we were keeping our team safe and that that was a priority.

I can't remember if it was the deputy PM or the PM for the instrument that had more than a full-time job every week making plans for what needed to be done, which people would need to be on lab, where they would need access for, and then going through that review process, because it was a weekly process. Then people were able to go into work and move the instrument forward.

Then in the fall of 2020 we got to doing the optical testing for the instrument, and this is a time period when we'll usually have a lot of people around. But we couldn't have a lot of people around because we were still very much in the pandemic. We were always very clear that if you did not feel comfortable or safe, or your health or your loved ones' health would be compromised by this, because even if you're young and healthy, if you're living with someone who has any sort of compromised situation you can't risk bringing this disease back to them. We're living with it now in a different phase. But at the time it was deadly, and it still is to people who are compromised. But it was killing many people at the time, and so we were trying to make sure that there was no pressure to have to go into work.

We were doing 24-7 operations with our thermal vacuum optical testing of the instrument, and so because we were shorthanded, I said, "I can come out and do the testing." I flew out in the fall of 2020 to Goddard, and there was almost no one on the airplane. I had chosen a seat that looked like it would give me a little more space from others on the plane, but I got on the plane, there was no one on it. I was wearing latex gloves, and then I had two masks on and a face shield. Because there was so much unknown and the last thing I wanted to do was travel and then show up at Goddard and get people sick. Not only my own health but everybody else's health.

I took all these precautions and then I land, I get in a rental car, and I turned on the car, I rolled down the windows, I blasted the air-conditioning, and I stood outside and waited for all the air in the car to get out.

Then I drove to the hotel, and there was no one at the hotel. People weren't staying in hotels back then. It almost seemed like some postapocalyptic thing because this is like no one was around, it was kind of dark, and it was a hotel I stayed at all the time. Then I went to Goddard.

The guards were surprised to see me. It had all been arranged in advance but still it was unusual that I was there but not an employee.

We did it very safely. The science group, the area where I was working, commanding the instrument, looking at the data, was in the back corner. I was in my own little corner and all the other people were spread out really well who were there testing the instrument. We managed to all stay safe, but it was quite an experience.

JOHNSON: Definitely not anything you could have foreseen happening during that testing.

OLKIN: That's right. We eventually got all the instruments to Lockheed. Ralph was the last one to arrive. Back to your comment about PMs and contingencies, all along we're modifying the schedule and the plan. How can we have AI&T go forward?

We had so many different plans. At one point I believe we had a plan that was called the peace and love plan. Because Lucy is named after the song [Lucy in the Sky with Diamonds and a fossil] and so there's a very strong Beatles vibe. The AI&T lead at Lockheed had made a tie-dye cover slide for the meeting. It was all peace and love.

There were all sorts of things that we did during the pandemic to try and help people. It wasn't just leadership trying to help people. The whole team was trying to help everybody. I remember being on a phone call one morning and somebody's young daughter came and sat on his lap and she must have been like three years old and told us a joke. It was kind of just what you needed when you're all so isolated.

We would have virtual happy hours. I'd be on conference calls all day, just as we are right now, and then we'd say okay, now we're going to go have a happy hour. We had these suggestions

for everybody and our systems engineering staff put them together. You need to go to a different room and we're not going to talk about work. We did these things to try and maintain that cohesiveness that we had as a team through this pandemic. It certainly wasn't anywhere near being together but it was, I think, better than not trying.

JOHNSON: That's so important with a team, keeping that team cohesiveness, that feeling of everybody's working toward one goal. I know it was challenging during that time to keep that going. But I think people have been very inventive as far as like you said the happy hours and the different things to do and kids in the background, animals too. I notice that everyone likes to show off their pet. Everybody's pets are at meetings now. Sleeping.

OLKIN: That's right. I love that.

JOHNSON: I do too. I think it humanizes people a little more maybe and lets you have a little window into their life when you see them in their home. I think it was an interesting time, but for NASA especially it was a learning time. A lot of companies have had that same experience, on how to keep people.

OLKIN: Now I'm at a company, I'm a remote employee. I was hired remotely. The company is in California, I'm in Colorado. That wouldn't have been a thing in the past really. Maybe a small number of companies were doing it, but it certainly wasn't something an aerospace company would do.

JOHNSON: Yes. It's definitely changed the way people work nowadays. I don't think it's necessarily a bad thing.

That focus and keeping people focused on that final goal and that launch. I know Lucy has gotten a lot of praise because you came in on time, first attempt, under budget, even though some of that money had to be used to I believe add another shift as you were building. How do you think that focus continued even through those kinds of situations to ultimately have that goal happen the way it did?

OLKIN: Yes. As a planetary mission making the launch opportunity is huge. It was really important to be able to accomplish the objectives that we set out for Lucy. Even well before the pandemic, we used to say regularly that schedule is king. This was something we said quite often at our PIMRs, our PI monthly reviews. Schedule is king. It was part of the team culture that we need to get the job done, but we also need to get the job done on schedule and on time. Of course everybody says that, but we had this huge focus on schedule. It was already part of our culture.

Then saying, when the pandemic came, "We are not going to just say we're going to slip." We had conversations about it. What's the right thing to do? We had a backup launch opportunity. There were reasons that the first launch opportunity was the better one. Much of it has to do also with cost. There were conversations among the leadership group of what's the right thing to do. But we came down to every time we need to continue to maintain the prime launch window as long as possible. That was our attitude. That attitude allowed us to make it to launch in October of 2021 when we had originally planned to launch because every day, we kept fighting for a way to do this.

It goes back to how we were constantly revising the schedule during the pandemic. Okay, what instrument is going to get to the spacecraft and when? How can we change AI&T? How do we change the staffing? What work can we get out ahead of? Our AI&T group at Lockheed was amazing. They were outstanding to work with because they had to replan. We were replanning at the mission level but all of that work has to be supported by their plans, their ability to execute. How do we do this? It added a huge burden to everybody but especially the AI&T team and the leads to figure out how to do this over and over again because the situation just kept changing.

Real kudos to them for being able to keep planning and stay ahead and identify paths that would get us there. It wasn't only the AI&T leads. There were the PM at Lockheed as well, and the whole team really for the replanning and then being flexible about okay, things are different today, things are different this week, we're going to get this particular job done because we can't do that one yet. Sometimes parts aren't in. Just kept moving things ahead.

JOHNSON: Let's talk about before the launch. I saw that you were doing some press interviews or you were made available to the press for those interviews. Talk about how you prepared for that. How much interest was there at that point in the launch as far as press? Like you said right now it's like the autumn of asteroids with Psyche[2] launching and OSIRIS-REx[3] and all the things happening right now. It is pretty amazing. Then November 1st is Dinkinesh [asteroid flyby]. It is pretty exciting right now. But at that point with everything else going on in the world and the

[2] The Psyche spacecraft is traveling to a unique metal-rich asteroid with the same name, orbiting the Sun between Mars and Jupiter.
[3] OSIRIS-REx is the first U.S. mission to collect a sample from an asteroid. It returned to Earth on Sept. 24, 2023, to drop off material from asteroid Bennu.

pandemic still going strong, talk about that buildup and maybe the interest of the press and doing those interviews that you did.

OLKIN: Yes. I was very happy to be talking to the press. I was ecstatic that we were launching on time, and that we were able to have our team and our friends and family there at the launch. As we were moving towards the launch there were questions of can we have people at the launch site. I was in all the meetings advocating for having friends in family at the launch and pointing out that were we're going to be outside, let's try and do it safe. I really wanted our team to be able to be there and enjoy that after all their hard work.

I didn't want them to lose the opportunity to actually embrace that moment with their friends and family. I led an effort on the team to make sure that we had the opportunity for people from all across the project to come to launch and to bring their friends and family. I was regularly trying to help make sure that the logistics would work for this.

We also had our L'SPACE Academy. These are college students who had been virtually on this journey with us. This is our student collaboration, and thousands of students had gone through the student collaboration. From the very beginning I had told them when I met with the L'SPACE Academy students every semester, "We will invite you to launch. We can't pay for you to come, but you will be invited to launch." Of course at the time I had no idea a pandemic was going to come, but I wanted to make sure that we could keep that commitment to the students. This all became a lot of pressure with the pandemic and how are we going to do this. It's thousands of people.

We worked really hard, the team at Kennedy [Space Center, Florida], their visitor ops team, how can we do this and how can we do this safely. The L'SPACE Academy students were on the

causeway watching and then the mission team was by the [Apollo/]Saturn V Center. We had the ability to have our friends and family and our team there.

By the time I got to the launch and the interviews with the press I was just ecstatic to talk about this, because we were getting to celebrate it with everybody who was a part of it. To me that was so important. I wanted to share it with the press because I wanted to share it with the public. This mission wouldn't happen without taxpayer dollars. Nothing at NASA would happen without taxpayer dollars. It was our responsibility to share that excitement, not only with our team and our families and friends but the American public who paid for it.

I'll say one other thing. I think it's also great to talk about something that maybe a lot of people don't know about. By that I mean Trojan asteroids. Often I would start a talk by saying, "I'm going to tell you about Trojan asteroids. You probably never even learned about them in school. You learned about the planets; you learned about main belt asteroids. Comets. Depending on when you went to school, maybe the Kuiper Belt, maybe not. Depending on what you studied as well."

But very few people in the public were aware of the Trojan asteroids and why they're interesting. I felt like it was really important when speaking to the press at launch to tell people why these objects are so interesting, and the diversity of the objects, and what we're going to learn from them, and that we've never seen them up close. We've never been able to map the composition across the surface and look at the geology. All of that will be enabled by Lucy. Those were some of my thoughts when I was talking to the press. I enjoyed the interviews.

JOHNSON: It's always good to have someone that's excited about what they're talking about to try to explain it to the public. It makes it a lot easier for people to understand.

Talk about the launch. Were you out with your family? Or were you in the control room during the launch?

OLKIN: There was a lot of back-and-forth about where I would be at the launch. Hal was out near the launchpad. There's a control room that's closest. Hal was there. At one point I was going to be there with Hal. But then they decided that I should be in the backup site, which is just across the causeway on the Space Force side. Such a cool room, all the screens and all the different people, and you're on the headset, and you hear all the reports coming in. I was his backup. If he couldn't give the approval for whatever reason then I would be at a different location and could give the approval if needed on his behalf, which of course didn't happen. He was fully capable and ready to do that.

But then also, as is common with missions—I want to say OSB II [Operations Support Building], the building where all the VVIPs are, and there's that balcony where everybody watches the launch from. There was a briefing that needed to be given to the VVIPs and there were a number of people who did the briefing and I was one of them. I went over, I sat through the calls for the "GO" and then at a certain time they decided okay, you can be relieved from your station. We had to coordinate all this, because it's important to know where everybody is and who had decision authority. Then I drove over the causeway and gave the briefing, and then I got to watch the launch from that balcony, which was awesome. My husband was there with me, and then I got back in the car and drove across the causeway and then reengaged with the rest of my responsibilities right afterwards. That was very exciting and a great way to watch the launch.

The rest of my family were in the stands at the Saturn V Center. I could have probably had them be with me but I wanted them to be with everyone, the big crowd, and the big crowd was so

excited. I saw videos of the team and their families and friends on the stands watching the launch, and the energy there was just great. I was really glad that my parents and my kids got to experience it there.

JOHNSON: It was a beautiful launch too. It was so impressive, going through the clouds and lighting everything up.

OLKIN: Yes. All that I really needed was for it to launch. But it was so beautiful. It really was. I've seen quite a number of launches, and that launch just took my breath away. Part of me thinks is it because I was so close to the mission, but no, it was just really a beautiful launch. It was in the morning right before dawn so it was dark, and there was a layer of clouds. You see it launch and then it goes behind the clouds, and then you start to see light come out like almost a movie scene above the clouds. Then you see it continue on, because it was a thick layer of clouds so you couldn't see through it but it was contained spatially vertically. It was just an absolutely beautiful launch.

JOHNSON: I can imagine that was pretty satisfying, seeing that sight after everything you had to work through.

OLKIN: It was.

JOHNSON: Let's talk about the problem with the solar arrays that unfortunately happened not long after that. Where were you when you heard about it? How involved was the science team? Were

you then having to try to make some contingencies in case they didn't open all the way, that you might be limited to what you could actually go to? Talk about that for a few minutes.

OLKIN: Yes. After the launch, like I said, I went back across the causeway and got back on station with headphones on. I was listening for the different calls of when telemetry came in. I heard the latching for one side, but I didn't hear the latching for the other side. So right away I was not so sure. I'm like, "Did I miss it?" Keith [S.] Noll was in the same room with me and I got up and walked over to him. I'm like, "Did you hear it? I didn't hear it." He didn't hear it either.

So I was concerned. After a little bit I thanked everybody in the room when we were ready to leave. Then drove over to try and find out, to get back together with Donya [Douglas-Bradshaw] and Hal and like what's going on. We met in one of the conference rooms at Kennedy. It was clear that the array hadn't latched, but it was very early, and so we didn't know even a small amount of what we know today.

It was really very difficult because we knew this was a risk on the mission, and we had worked to mitigate it all across the whole lifetime of the mission. These solar arrays were large. They needed to be deployed. It ended up that we worked for months and months and months on this. The answer is actually not a bad answer in the end. The one array is almost entirely deployed but it did not latch. We have enough power from the solar arrays to not affect the targets that we go to.

We got the team together and got lots of outside experts. NASA is excellent at pulling in experts across the Agency who have knowledge and can bring to bear their knowledge on the questions, and so we did that. We spent a lot of time testing on the ground with flight-like hardware to understand what could have happened. We spent a lot of time doing analysis. Then we did

some tests on the vehicle also to see how it responded to give us even more insight. We did tests like pointing the solar array to the Sun and seeing how much power we got.

It was a really concerning time for a long time. But I think we're in a good place right now. We've gone past our first EGA [Earth gravity assist]. That was also something that we had to look at, that Earth gravity assist was low altitude, and so you're in the rarefied part of the atmosphere with the large solar arrays. We obviously came through that perfectly fine. I think it's all good but you can't take your eye off the ball, you need to be conscious of anything that might happen, because we are not in the nominal state that we intended to be in.

JOHNSON: Let's talk about the first encounter that's coming up with Dinkinesh. Dinkinesh was added later on, and it's in the main belt asteroids, so it's not the Trojans yet, but it's going to be that first encounter. Talk about the plans for that and what you're expecting to happen.

OLKIN: This is very exciting that we have an opportunity to fly by a small main belt asteroid prior to DonaldJohanson which is also a main belt asteroid that we'll be flying by. Dinkinesh was an asteroid that had been discovered but it didn't have a name. Members of the team named it Dinkinesh, which is the Ethiopian name, the Amharic word, that's the name that they called the Lucy fossil, and it means "you are marvelous". I really love that tie back to Lucy, and to honor the Ethiopian name of the Lucy.

One of the most important things we're going to do when we fly by Dinkinesh is we're going to exercise our closed loop pointing system for changing the attitude of our instrument pointing platform. The instrument pointing platform allows the instruments to stay pointed at a target as we fly past it, and there are two terminal tracking cameras on the instrument pointing

platform. These terminal tracking cameras provide images of the field and the images go into a controller and logic on the spacecraft that identifies an extended object and then says, "We want to stay pointed on that extended object."

Dinkinesh is small and so it doesn't become an extended object until we're relatively close to it, but it has a good solar illumination. It's going to be a great test of doing this control of our instrument pointing platform. In addition to that, we're going to get science. We're going to have our scientific instruments operating during the encounter so it's going to be really exciting; I am so excited for the Dinkinesh encounter.

JOHNSON: Do you still have access? Are you still going to be involved when you see that? You'll still be able to participate as far as seeing what's going on?

OLKIN: That's right, yes. I'm still a coinvestigator on the science team. I'm looking forward to spending November 1st at the Southwest Research Institute with a number of the team members to see the first telemetry come down.

JOHNSON: That's exciting. Talk about that. The first telemetry is coming in and you're getting the information. What is the plan as far as that information, disseminating it to the rest of the science community with this and with the other asteroids as they happen? Is this going to happen relatively soon? Or is it something that they'll be waiting on for a while until everything is gathered?

OLKIN: I can speak to what's going to happen inside the Lucy science team. We have a science team meeting just two weeks after the Dinkinesh encounter. We have daily meetings for our subteams. There's a surface composition team, there's a geology team and other teams as well. We'll have weekly meetings so that as data comes down, we can look at that and talk about it. Then about two weeks later we'll have our science team meeting where we can all get together and talk about the science results.

Regarding sharing with the larger public, I don't know what the plan is in my current role. But I am confident that the public and the scientific community will be seeing the data, it's just I don't know the timescale.

JOHNSON: Based on your experience with Lucy and being part of that team and going through the proposal process twice with Lucy, what are some of the lessons learned about the Discovery missions and the Discovery Program and taking a mission like Lucy through that process?

OLKIN: NASA does a great job of lessons learned reviews, and so we've had so many lessons learned and I think there's a lot of lessons learned, so I'm trying to think of what rises to the top for the Discovery Program. One thing that I'll say I think rises to the top for Discovery, and I'm not really sure if this is lessons learned, but it's so important, is that having the Discovery class of missions where people can propose any idea to the opportunity allows people to bring their best and their brightest and all sorts of potential crazy ideas, and sometimes that informs other missions. I think maybe the lesson learned really is that ground-based astronomy provides that strong foundation for asking the next level of questions. If we hadn't had surveys of the Trojan asteroids to look at their colors and their general spectral characteristics and their orbits the Nice model

wouldn't have been informed in the same way. Then the Lucy mission wouldn't have been informed. It all builds on that foundation of astronomy.

Then the next level is that Discovery-class mission where anything can feed into it, and then we ask even more refined questions. Of course with more refined questions things become more complicated, more expensive, maybe you're bringing samples back, maybe you're going somewhere super far away like Pluto. That's the next class. Then of course flagship where you're doing something amazing like Cassini and just a really deep understanding of the Saturn system. I think my lesson learned is the importance of all of those pieces tying together to support the fundamental questions that NASA is asking.

I also think that in my opinion it's worked really well to have these different organizations come together to all work on a mission. Of course no one organization flies a large mission. There might be a PI institution and then a PM institution and there might be the spacecraft provider institution and somebody else does navigation and somebody else does the instruments. I think that helps to bring in a diversity of knowledge and that's really powerful.

JOHNSON: You'd mentioned last time that clean slate and how it helped the Discovery that it was a clean slate as opposed to even New Frontiers. Thanks for adding to that.

I want to go back and just ask something we touched on last time, your outreach and education involvement that you've had. I know you've participated in a lot of public engagement on your own and with the storytelling and that sort of thing. Also the STEM [Science, Technology, Engineering, Math] work for girls. I think you worked with FIRST [For Inspiration and Recognition of Science and Technology] Robotics [Competition] and the L'SPACE Academy that you mentioned. Talk about why you think that's important, especially for someone in your

position to be that role model and to also inform people, STEM students, young girls, trying to decide on the career that they may choose.

OLKIN: Yes, I spend a lot of time doing outreach and supporting STEM activities. In fact that's why I couldn't read what you sent me last night, because I was at Robotics. I was at Robotics on Friday night, Saturday, Sunday, and Monday.

JOHNSON: That's great.

OLKIN: Yes. I think there's two pieces to it. You hit on one piece, why is it important, and I can speak to that. But I think also I'll say that I get a lot from my engagement with the public and with young people. It's not just one-sided. I love the energy of the young people and the curiosity and working with them and helping them.

Sometimes I'll help tutor them in calculus if they're people on a robotics team. Or sometimes hey, this is a big difficult problem. How are we going to break it into pieces and solve this? My husband and I just ran a training on teamwork and leadership with the students all day on Saturday, and bringing together how do you make decisions when things are complicated and how do you do these challenging things, and how do you make sure that you're working together in a team that's respectful of everybody.

I enjoy teaching some of that content because it refreshes me and reminds me yes, I need to keep this in the front of my mind all the time as well. I'm going to be doing a Girl Scout Badge Day in November as well teaching robotics programming and robotics design to Brownies and Juniors. That's really exciting because I get to bring STEM technologies and hands-on activities

to people who've never seen it before. I personally enjoy it but I also know that when I was a young girl there were certainly no role models that I knew who were women engineers and scientists. It would have been great if I would have had that. Obviously, I could be successful without that. But also for FIRST Robotics, which is what I mentor, I would have loved to have been part of a team. That would have been something that as a middle school and high school student would have been so exciting to me.

When I started the first robotics team that I ever started, it was because my kids' school didn't have robotics and I wanted to be able to provide that for them. Not only my kids but their friends, their classmates. So I started a team at the school. I feel like you have to enable what you want to see in the world. I could sit back and say, "Oh, these things should all happen." But if I'm not willing to put in the work then that's ridiculous.

There's many reasons I do it. I get a lot of satisfaction out of it. But it's fun. I would encourage everyone to find something that they enjoy and reach out and teach others and interact with others to bring that excitement to them, and we'll all be better off for it.

I find I'm close to the students that I've mentored even years after they graduate from high school and they go on to college.

I was just at a wedding earlier this month of a student who graduated from our robotics team and she's obviously a young adult now. Having those connections to people, that makes my life fuller as well. I think there's so many facets to it and it's just innately how I want to spend my time.

JOHNSON: Very worthwhile because you are inspiring that next generation which is good for exploration. It's good for companies that work with NASA. It's good for NASA to have this interest continue.

OLKIN: There's one other thing I want to add though because it's interesting. People talk a lot about inspiring girls, and I'm all for inspiring girls. I also think being a role model for a scientist and engineer to young men, boys and young men, then they're going to see that the women they grow up with can be these things. In your life you're with a partner and however that works out, great, but you want a partner to respect what you do. It's not only about enabling the girls to have this vision but it's also about enabling the boys not only to have the vision that they can be engineers and scientists but that their partners can be engineers and scientists as well.

JOHNSON: That is very important, yes, if you want things to change, you have to teach people. Like you said enable what you want to see in the world. I think that's probably a good place to stop.

OLKIN: That sounds great.

[End of interview]