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

MICHAEL H. NEW
INTERVIEWED BY SANDRA JOHNSON
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JOHNSON: Today is April 6th, 2022. This interview with Dr. Michael New is being conducted for the Discovery 30th Anniversary Oral History Project. The interviewer is Sandra Johnson. Dr. New is in Washington, DC, and talking to me today over Microsoft Teams.

I appreciate you taking more time out of your schedule to do this for our project. I wanted to start today by talking about outreach with the Discovery Program, and how important that is to a program like Discovery. You mentioned in an interview with Susan Niebur back in 2009 that whenever you try to design an outreach project it's totally different from designing a scientific investigation. I was wondering if you could just explain that difference a little more and how important that outreach is to keep this program going.

NEW: Sure. There's just so many more variables when you're designing an outreach program. When you're doing a science investigation you have a hypothesis you're trying to test, you want to go about controlling a whole bunch of variables, and you pick a few variables that you're going to vary and that's the scientific method. Outreach programs, you don't have very much control over who walks in the door when you're doing a public event for example or school event. You can't just assume you're going to control things as much as you think you'd like to.

There's also a whole bunch of other considerations. If you're doing a chemical experiment, chemicals don't care if you're fair. Chemicals don't care if you're equitable or inclusive. But people do. There's just this whole other set of considerations. What happened in

the Discovery Program is that as the program matured and a higher category of people came up who were education and public outreach coordinators, and their expertise was in crafting engaging educational programs, either formal or informal education, or museum kind of stuff, based around the science of a mission.

Eventually those people became important enough, and there were so few relative to the number of proposals we got, that we started holding off naming the person who was going to do that for you until after you'd gone through your first selection step. Instead of having 20 proposals each with people on them, some of whom were very good, some of whom were not, some of whom experienced, some of whom were not, we just said, "You know what, we're going to pick two at the end of this, we're going to pick three at the end of this, four, whatever it is. We're going to go into Phase A, and that's when we'll ask you to tell us who that person is, in Phase A."

We used to devote somewhere between I think it was like 0.5 to 1.5 percent of the total mission cost to education and public outreach, which was a pretty significant amount of money, it was millions of dollars, and that led to a real awakening in the public about what we were doing and how we were doing it. A lot of kids have made comets out of slushies and stuff that came out of some of the early comet missions that we did, and so on. That introduced a whole lot of students to the planetary science issues, and that also of course led to a certain amount of public support for the program, because they could connect it to oh yes, that's CONTOUR [Comet Nucleus Tour], and we did a CONTOUR experiment in my school. Yes, that was an important part of the growth of the program and was an important part of the program. Of course, times have moved on and things have changed in that area.

JOHNSON: What's changed?

NEW: What's changed is—I forget exactly when we're talking about now, but at one point I think during one of the administration's budgets it was decided that all education and public outreach for K to 12, all those funds were going to be transferred to one organization. I think it was Department of Education. NASA as an Agency got out of the education business. We were not able to continue to require that one percent of the budget be devoted to education and public outreach.

Where we've gone with it now is that we have a more centrally managed STEM [Science, Technology, Engineering, Math] Engagement Program that all of our different missions and projects can feed in to, either as projects or as providing subject matter experts to other educators. We also have an incentive for doing what's called a student collaboration. Student collaborations were originally envisioned as student-built, student-managed, student-run experiments. The prototypical example is the Student Dust Counter on the New Horizons mission, where it's a scientific instrument. It's been operating since the day New Horizons launched. It was built I believe by students, and certainly the management of it was by students, and they're the ones doing the data reduction on it.

We've expanded that concept over the years to now include things like the capstone engineering projects that the Psyche [asteroid mission] team has been introducing, as well as some of the STEAM, the artwork, programs that Psyche again has done. The other newest thing we've added is the possibility for citizen science associated with missions. Probably the first toe dip into that water was Stardust at Home. The Stardust mission collected tons of little particles coming off of a comet, and some of what they collected was also interstellar dust not from the

comet. They set up this whole thing where people from wherever could log in, sign up, do a little bit of training, a 20-minute training thing, and then they could start looking at images of various collectors and identifying particle tracks. It was a very valuable part of the project. I think that was one of our early forays of the Discovery Program into citizen science, and this was quite a while ago now, but now we have a Citizen Science Program that's up and running broadly for SMD [Science Mission Directorate]. Again, it's one of these things where we're moving to more centrally coordinated activities, which individual projects can add their unique spin to. It's kind of the Borg[1]. You will add your uniqueness to our collective kind of thing.

JOHNSON: Outreach can sometimes mean, especially with NASA, outreach to presidential administrations, because they're in control of the budget that NASA gets. I know some presidents want to put more money into the type of exploration that Discovery does, whereas some want more human programs, and that budget fluctuates. Talk about how the budgets affect the program.

NEW: Generally speaking, the program lines, so these are Discovery, New Frontiers, Explorer, their budgets may fluctuate over time, but I'm not aware of any administration or legislature deciding to kill something drastically. That's part of the strategy when they created these program lines. It used to be, and it still is for big missions, that whenever you want to do a new mission, you've got to go to Congress and go to the administration and get new money added. That particularly in the '70s and '80s was a big impediment because, '70s, right? When they

[1] The Borg are cybernetic organisms linked through a hive mind called "the Collective" in the *Star Trek* TV series and movies.

started Discovery and then adapted the Explorer Program, the way those programs were set up was we want a certain amount of money and we're going to launch. In the case of Discovery, we're going to launch one mission every two years, or 18 to 24 months I think was the original cadence. Generally speaking, the administration and Congress have continued to support that idea of here's a hundred million dollars a year from which you promise you're going to do X with. Now that's not to say that there haven't been fluctuations in the budgets. Those fluctuations have stretched out the cadence of missions, particularly Discovery missions.

Originally, we were supposed to be launching one mission every 18 to 24 months. I think we're now one mission every 48 months maybe, which is not something we're happy about. But the flip side of that is the cost of these missions has gone up for lots of reasons we can talk about, and sometimes more expensive things just take longer because we need to build up this bow wave of capital.

JOHNSON: Go ahead and talk about that. Why has the cost of the missions gone up?

NEW: A couple of reasons. The first is that a lot of the low-hanging fruit, the really inexpensive missions, were done in the first 10 years of Discovery. The second is we started getting into a place where the budget we were offering was only enough for visiting near-Earth objects, small bodies. The question came up do we want that, is that what we want the Discovery Program to evolve into, just a small body program, maybe occasionally a Moon mission? The answer was no, we don't want to do that. That meant increasing the budget a little bit.

The biggest thing we did that really increased the budget was when confronted by a broader palette of mission targets and mission ideas, we realized that we had to separate out the

cost of operating a mission from the cost of building the mission, because the cost of operating a mission depends on where you're going and how long it takes to get there. The Lucy mission, which is in flight right now, is going to seven Trojan asteroids. These are asteroids that are in the orbit of Jupiter. It's a 20-to-30-year mission. It's six or seven years before it makes its first encounter, and that's just the nature of that kind of mission, if you want to do science about the Trojans it's going to take you a long time to get there.

GRAIL [Gravity Recovery and Interior Laboratory] on the other hand, which was a mission to the Moon, made it to the Moon in 90 days, and then had three 90-day mapping cycles after that, and then it was over. In both those cases, the length of time the mission was operational after launch varied not because of anything else but because of the science and the destination. One of the big constraints we were running into was that if we were only going to give this much money for operations, you were drastically limiting the kinds of science that people could do.

One of the big things that caused an increase was separating the cost of Phase E, what we call Phase E operations, out of the cost cap. That's led to a lot of missions that are really interesting that are doing cool things, but it has increased the cost of each mission.

Finally, the other thing we did, there are two things that happened with launch vehicles. The first is that in the early days of Discovery we had an abundant and relatively inexpensive supply of Delta II launch vehicles. They went away. The only launch vehicles now that have been available since 2014, maybe even 2010, have been either the Delta IV Heavy, the Atlas V, and now the Falcon 9. They're expensive, they're more expensive than a Delta II used to be. For a while before we had a lot of price competition between SpaceX and United Launch Alliance, which makes the Delta and the Atlas, for a while prices on launch vehicles were wildly

unpredictable. We wound up before we did anything else, we pulled the cost of the launch vehicle out from under the cost cap. That was just something we did because we were beginning to penalize missions, cutting their science budgets basically, for something that was completely outside of the control of the mission, which was how much it was going to cost us to put it on a rocket.

You start adding up, pulling out the rocket. You add pulling out the Phase E, the operations budget. You add maybe we give some incentives for new technology, to try new technologies. With Phase E now unbounded you can have missions like Lucy that will take 20 years or whatever. The total soup to nuts cost of a Discovery mission has gone from sub $300 million now to $800 million, $900 million. Because it's increased so much, if the budget doesn't keep pace with that, what we wind up doing is stretching out the cadence of missions, how often we solicit.

Some of it we did ourselves, but a lot of the decisions were made in order to keep the program vital, keep it doing interesting things. That just wound up costing money.

JOHNSON: Was there any pushback when you were doing that, when you were taking those Phase E and those launch vehicles out? Did it have to be approved?

NEW: No. Oh, sure, it had to be approved, yes. But there was no real pushback because each step was logical. Okay, look, we have these massive swings in the unit price of a launch vehicle, we're basically penalizing some missions for something they can't control. We should separate. It's really a programmatic risk. Okay, so now we're now punishing missions because they've chosen to go to Mars versus going to a near-Earth asteroid versus going to Jupiter or something.

Do we really want to do that? No. We want the best science we can afford. We shouldn't punish them just because it takes them six months or it takes them six years to get to their destination.

Every step of the way you could point to a good reason for doing it. The cumulative effect over the course of 10 years maybe has been that the cost of Discovery missions have gone up and therefore unless the budget kept pace, the cadence of mission calls, of solicitations, got longer.

JOHNSON: Is there ever any consideration, this is just out of curiosity, when selecting missions on how much interest they'll generate in the people that make decisions about budgets but also in the public? Because the general public pays attention more when things happen on Mars as opposed to things that they can't necessarily visualize happening way out there.

NEW: It's never been a primary or even a secondary factor in making selections, but it's certainly something we do think a little bit about. We're never going to say, "Well, we're going to do this mission over that mission because people care more about Mars than they care about Eurybates." That's the name of a Trojan asteroid. But as we go down and say, "Well, the science is really strong on this mission and the development risk seems to be manageable and the team is really well balanced in terms of all the variables you might think of and it's got good people and good institutions behind it, and oh, by the way, we could definitely make a story that people will want to listen to about this." It would be wrong to say that some missions aren't more romantic than others. Dragonfly, which is not a Discovery mission, it's a New Frontiers mission, that's going to fly a quadcopter on the surface of Titan. Incredibly straight out of a

1960s, 1970s science fiction story. If it hadn't been great science, if it hadn't been technically feasible, if it didn't have a great team and a great set of institutions behind it, we wouldn't have selected it for that reason. But selecting it, we now can say, "Yes, we got this really cool mission we're doing," and people get into it. It's not a primary consideration or even a secondary one. But we think about it at some level.

JOHNSON: Last time we talked a little bit about the Planetary Missions Program Office and I know they're located at Marshall [Space Flight Center, Huntsville, Alabama]. In 2014 they combined the program offices for Discovery, New Frontiers, and Solar System Exploration missions to have this common management system. You talked about how the external program office works with the Headquarters team, which includes a program scientist, program executive, and program analyst, to monitor the science, engineering, and the cost accounting. But I was interested in that relationship. First of all, why Marshall? Why are they separate from Headquarters or not located at some of the Centers that you think about more with these missions? Talk about that relationship between Headquarters and the program office and then the people running those teams.

NEW: That's a big topic, let's see where to begin. The original Discovery Program Office was at JPL [Jet Propulsion Laboratory, Pasadena, California], and it was I think part of the NASA Management Office at JPL. Shortly after I came to Headquarters, so that would have been around 2002 to 2004 ish, the decision was made, I don't know by whom or why, to move the Program Office for Discovery out of JPL. One of the reasons potentially why was because JPL was a major competitor in Discovery, still is. It's a little odd to have your program office which

is supposedly representing the Headquarters perspective be resident at an institution that is being managed by them in some weird way.

In any case there was an internal discussion. I don't want to say competition because that's probably overblown. But at the end of the day, it was decided to put it at Marshall. Initially that was a head-scratcher for a lot of people. Marshall was and is known for its human spaceflight work, particularly its launch vehicle work, engine work. There were some real questions about how this would all work out. It worked out really really well because the first sets of program managers that Marshall assigned were just phenomenal. I don't know if Todd May was the first one, but there was Todd May, and he was succeeded by Paul Gilbert, who was succeeded by Dennon Clardy. These guys all really were committed to enabling PI [Principal Investigator]-led science missions. That was their goal. They built up this series of processes and this tradition of working with the science community on managing these missions. Much to their credit.

When we stood up the New Frontiers Program Office it was natural to say, "Well, why don't we put it at Marshall?" Then there was another program called Lunar Quest that lasted for a short while. We put that there at Marshall. What was happening was that a lot of the same people who were at the Discovery Program Office were also working in Lunar Quest or New Frontiers. Or they would transfer from one program office to the other program office. They all used the same kinds of processes that had been developed by the original Discovery Program Office. David [C.] Schurr was the Deputy Division Director at the time. He said, "Why can't we have one?" Was it one program with three program plans or something like that under it? That was for Discovery, New Frontiers, and Lunar Quest. That's when we started admitting that these are really one big office that has three flavors in it. Lunar Quest eventually went away.

Then we started needing a program office to help us deal with a few of these big strategic missions like Europa Clipper. That's when the Planetary Missions Program Office was born out of that. It was a natural organic evolution of responsibilities based around proven competence.

As to why program offices are at [NASA] Centers, you can thank Dan [Daniel S.] Goldin. I'm told—I was not at Headquarters at the time—originally Headquarters occupied multiple buildings around the [National] Mall. When Goldin wanted us all to be in one building, the building Headquarters currently occupies, 300 E Street, and that meant moving certain Headquarters functions out of Headquarters, so all of our grants administrators moved out to Centers. All of the program offices, the program managers, they all moved out to wherever. That's why program offices are at Centers. One of the first, maybe five years ago, four years ago, there was a big management study done, led by Dennis [J.] Andrucyk, who's now the Center Director at Goddard [Space Flight Center, Greenbelt, Maryland], on program offices. What they basically completed was that mission program offices exist as extensions of Headquarters. That's why they work the way they do. The Marshall Program Office, because Marshall really isn't a big player in Discovery missions, putting the Discovery Program Office at Marshall worked out to be great because they really have no dog in any of these fights essentially. They really don't have any equities. Their institution doesn't have any equities in any of the decisions they're making. They really can be a fair arbiter. That's why Marshall works. That's how it got to Marshall. I won't tell you why it's at Marshall.

The way that the Discovery Program Office works with Headquarters, it used to be, I don't know what it is nowadays, but as of five years ago there were weekly tagups between the Program Manager at Marshall and the lead Discovery [Program] Scientist and Discovery Program Executive. There were other routine meetings about management issues, how missions

were going, things like that. Each mission gets a mission manager at Marshall, and the mission manager at Marshall communicates routinely on a weekly basis pretty much, sometimes daily basis, with the Headquarters Program Scientist and Program Executive assigned to that mission. Back before COVID we would go down there sometimes. They would come up to Headquarters often. It developed into a very collegial relationship. Again, they really committed. Marshall really committed to serving the PI-led science community.

JOHNSON: You said last time that they were assigned when the concept studies first started.

NEW: How did they get involved? Yes. Okay. Yes. When proposals come in—let me back up. The program office does not have a role to play in writing the solicitation, the AO [Announcement of Opportunity]. We may consult with them about things that they feel worked or didn't work with other missions, but they don't actually get involved with writing the AO. We run the competition. We get the proposals. We evaluate them. The program office has absolutely no role in the evaluation or selection.

Once we've selected three, four, five missions to do Phase A concept studies, that's when the program office gets involved. The common practice today is that the technical, management, and cost evaluation team [TMC] will actually go to the program office and give them a day, or two days even, presentation on the evaluations of the missions they've just inherited. What TMC thought were the major risks and so on. When we do the Phase A study kickoff, which is what starts everybody's clock, the program office is introduced to them there. We often have initial program office project meetings right then and there. From that point on, the program office has an involvement. They have to get the Phase A contracts together. They have to work

with the now concept studies to generate their initial statements of work. The way it's worked in the past in Discovery is we would usually assign one mission manager to be the one point of contact for all the Phase A studies.

We would usually have that, or maybe one or two mission managers, observe, not participate in but observe, the concept study reviews. The technical, management, and cost evaluations particularly, the site visits. We'd make our downselection at Headquarters, hand those missions off to the program office, and at that point the program office has some minimal relationship with the team and knows pretty intimately the design and the issues and they've seen the teamwork at site visits. At that point it's pretty much all them. They're the day-to-day contact with the team.

JOHNSON: They're in between the team and Headquarters. They work that connection.

NEW: Yes.

JOHNSON: Okay. I appreciate you clarifying that for me, it helps to have it explained when you're outside trying to understand it.

NEW: My pleasure.

JOHNSON: Based on your experience at NASA and now with the Discovery Program, what do you think the lessons learned are with that program?

NEW: That scientific and engineering communities are incredibly innovative, that when you give them a challenge and you present them with some constraints, they will rise to meet the challenge and to work within those constraints. That not every institution is really capable of supporting the development of a high-quality mission proposal. Those capabilities probably ought to be spread around a little better than they are.

But a corollary to the first is that NASA does not have a monopoly on good ideas for missions in fact. The strength of the Discovery Program and the Explorers Program is that we get to mine the best ideas and the best engineering talent in the country to produce these missions of Discovery that by ourselves sitting in our rooms NASA might never have thought of. Think about Deep Impact, where we slammed a refrigerator mass copper ingot into a comet. Or Stardust, where we followed behind a comet with this big catcher's mitt of aerogel collecting particles. Or GRAIL [Gravity Recovery and Interior Laboratory] where we sent two spacecraft going around the Moon measuring at incredibly high levels of precision the variations in the lunar gravity field so well that we were able to map objects under the surface of the Moon with incredible resolution. I don't think NASA would have come up with those, or any organization by itself would have come up with those ideas. I think it says something positive about the engineering and science community. I think it also says something about NASA being willing to trust the engineering and science community, often with fairly hefty sums of money. Discovery mission cost cap is $475 million. The actual soup to nuts cost is probably closer to $1 billion in some cases. We're vesting that power, the authority to spend that money, to a university professor usually, to maybe a NASA Center, maybe not a NASA Center, for doing the management. That's a gut check. If you're a bureaucrat handing over $1 billion of taxpayer money and looking over their shoulder but not actually telling them directly what to do is wild. I

think that that's also part of it. It says something about NASA's willingness to trust the scientific and engineering communities.

JOHNSON: Those relationships that NASA has with universities, as this program has gone on, I'm assuming that those relationships have gotten stronger, and that trust, has it gotten better? Is it easier to trust now compared to the beginning?

NEW: It depends on the institution. We definitely have institutions that are repeat offenders. But that's the other interesting thing, is that while we certainly have some institutions that have a lot of involvement in Discovery missions, it's not a given that they will only be the ones. In the case of Psyche, the PI there is from ASU [Arizona State University], Dr. Lindy Elkins-Tanton. I don't think ASU has been the lead institution on a Discovery mission before. I know Lindy hadn't. Hal [Harold F.] Levison, who's the principal investigator of Lucy, is at the Southwest Research Institute, which isn't even—it's nonacademic nonprofit, it's not a university. While New Horizons' PI, [S.] Alan Stern, he's also from that institution. In the Discovery Program I think that's the first one we've had from there. We get a lot of missions that are flown by JPL or Goddard or APL [Johns Hopkins University Applied Physics Laboratory], but often PIs are not from the same institutions.

Yes, there's definitely been some trust building with some institutions, but it's also been I think a positive thing to say that we don't have the same institutions as PIs all the time. It's not like it's always MIT [Massachusetts Institute of Technology, Cambridge] or it's not like it's trading off between MIT and [University of California] Berkeley. It's different every time.

JOHNSON: You were talking about the ideas that were coming out of these institutions. When looking over these ideas after those AOs and those respondents, were you ever surprised? I know you said some of them would never probably have come out of NASA. But was there any that stuck in your mind that really surprised you that someone had come up with this idea?

NEW: Oh yes. There were a lot of them. If we didn't pick them, I can't tell you about them. But there were a lot of them that were just you look at it and go, "Damn, that's a really creative idea." Absolutely, yes. Got the combined brainpower of, I don't know, several hundred really smart people. They're going to come up with some pretty cool things. And a few stinkers. You get a few stinkers too. But yes, they're surprising, absolutely.

JOHNSON: Since you can't tell me you may not answer this either. Are there any proposals that didn't make it that, considering your background and the things you're interested in, in your own personal career, are there things that didn't make it that you would have liked to see?

NEW: Absolutely. In the 2014 AO, I can tell you because it's public knowledge that we selected one thing that was called TiME [Titan Mare Explorer], I think. It was basically an instrumented raft that would land on a lake on Titan, and again a romantic mission, sailing the seas of Titan. Really exciting scientifically. Did not make the trip for a bunch of reasons. That was very disappointing. There have always been a few proposals that make it through step one into step two that are really cool, exciting, and then just don't quite close it at the end for a variety of reasons. Some of which are technical, some of which are not. At some level when you get to

that point a number of intangibles start becoming important like how well does the team work together for example.

You go to do a site visit or you spend eight hours with the team somewhere. You get to see how they interact, and sometimes you look at them and go, "Yes, they know what they're doing." Not just they know what they're doing but they're interacting well. Sometimes you go and maybe it's a technically very proficient concept study report, but you go and you see them and you're like, "Oh no. No way the guy is going to pull this off." Not because technically they're not competent but because they just haven't jelled, they're not a team. I've seen it go both ways in Discovery. But yes, there's definitely ones that break your heart.

JOHNSON: I know in that interview with Susan [Niebur] that you did you both talked briefly about those teams and how that relationship is important. She mentioned that she's had PIs, more than one, tell her how surprised they were by how much engineering they had to learn, and how much they had to work with contractors, and all those things that as an academic wasn't something they ever thought they would be doing. Did you see that too?

NEW: Oh yes, oh yes. We've spent a lot of energy over the last four years thinking about the role of the principal investigator in a mission. This is now not with my Discovery hat on, but with my Deputy Associate Administrator for Research hat on. One of the big recognitions has been that most of what a mission PI does is nothing like what they were trained to do. We've been trying to come up with ways to fix that gap, fill those gaps. Most people never think about what is a good requirement, what is a requirement, what is a good one, how do you write them. Big part of the early stage of any mission development. Most academics, if they can manage

their accounts using Excel, they will. But earned value management? Could be speaking Swahili or something, it's a new language. What you call the soft skills of managing a multi-institution, multidisciplinary team spread out over half the country sometimes is also something that's not what most academics know how to do.

Because it's one thing to manage a group of ten grad students and three postdocs or whatever. It's another thing to be supported by 100 engineers at Jet Propulsion Laboratory in California and 20 scientists across the country and a launch vehicle provider in Florida, or whatever, and trying to keep all those links up and alive and keeping track of where things are. Certainly, in the last few years we've been trying to think much more closely about the emphasis we need to put on the leadership aspects of being a mission PI as opposed to the technical stuff.

Yes, a lot of technical stuff, I just mentioned some of it. Requirements management, requirements definition, earned value management, budgeting. But at the end of the day as a PI of a Discovery mission or New Frontiers mission you can hire people who have those technical skills. What you can't do is hire people to lead for you. That's the big *undiscovered country*[2] of being a PI, is not just seat-of-the-pants how do I manage my twelve students or how do I manage my five students. It's how do I manage a real honest-to-goodness team of contractors and subcontractors with competing demands, competing needs, schedules that maybe will wind up being incompatible. It all falls on them, along with their project manager. But ultimately, it's the PI's responsibility. Yes, we've been definitely focusing a lot more on those kinds of issues in the last five years or so.

[2] The *undiscovered country* refers to the unknown, originally from Hamlet, Act 3, Scene 1, Soliloquy, by William Shakespeare. "The undiscovered country from whose bourn no traveler returns."

JOHNSON: Have you come up with anything that you can share to try to help with that? Or is it that they need to take management courses? Or are they given more awareness now up front before they get too far into it?

NEW: A lot of our focus to date has been giving people a better heads-up about what's in store. A few years ago, we started doing these one-hour talks at conferences entitled, "So You Think You Want to Be a Mission PI, Huh?" It's intended for people who are relatively early in their career, just saying, "Hey, these are the kinds of things that mission PIs have to worry about." Then for slightly more mature audiences we've started doing these things called PI launchpads. We've done two to date and we'll probably do another one pretty soon. The first one was a two-and-a-half-day in-person intensive event. The second one, because of COVID, was more like a two- or three-week virtual event. There we're focusing on a small number of skills.

We focused on things like the role of narrative in crafting a science story that's compelling. How to go about finding partners. How to go about making partnerships. We've had networking sessions as a part of these with aerospace companies and NASA Centers for these people who are early career researchers who have an idea for a mission, to get to put names and faces together, "Oh, that's the Ball Aerospace guy." The Ball Aerospace guy gets to put a name and a face to the person who has an idea for this mission.

We've talked about getting inclusive teams and how do you do that, and how do you put together a team, things like that. Ultimately after we've done two or three of these PI launchpads we want to do something more of a PI incubator approach, where we'll focus on some harder skills. Focus on how do you craft requirements, how do you think about scheduling, how do you

think about budgeting. Also, some of the softer skills like what makes a good elevator pitch and how do you deliver it. Things like that.

We've done some of that already in the PI launchpad, but we probably would want to do a little more intensive work in an incubator environment. Yes, we're trying to broaden and enhance the capabilities of our future PIs, and broadening that pool is actually really important to us.

JOHNSON: I can see where those might not be skills that any scientist working day to day at a university would ever think they would need.

NEW: Yes. Although the dirty little secret of being a professor that nobody tells you in grad school is that becoming a professor is basically becoming the owner operator of a small business. You got money going in, you got money coming out. You got employees, you got benefits. You've got whatever. The two jobs are much more similar than I think most people really want to admit. This is just taking it up to another level, because now, as a big business, instead of a $2 million or $3 million lab it's now a $200 million, $300 million, $400 million organization.

JOHNSON: What do you think the Discovery Program's impact on society is. How beneficial for society. A lot of times people ask the question, "Why are we spending money on this, when people need things here on Earth?"

NEW: Ed [Edward J.] Weiler, who was the AA [Associate Administrator for Space Science] when I came to Headquarters, used to say that we're not launching giant crates of $20 bills into

space. Every dollar we spend on a space mission is a dollar we spend in the United States, usually on fairly high-paying technical jobs. Whether it's somebody who's a janitor or somebody who's a designing engineer or whatever, those dollars are being spent on Earth in the United States. That's one answer.

I think the other answer is that because Discovery missions are so varied there's something for everyone. If you're into comets we've had a bunch of comet missions and seen pictures of comets up close and personal. If you're into asteroids, ditto. If you're into the Moon we've got Moon missions and so on. We basically turned the entire country on to the fact that Mercury is a cool planet with MESSENGER [Mercury Surface, Space Environment, Geochemistry and Ranging]. There are also the people who are more technologically interested, and there's a lot of technological stuff that's gone on that people have been interested in. The use of aerogel in Stardust as a capture medium. Aerogel has gotten a lot of press since then. I think some of that has to do with the fact that we used it for that purpose.

I think it's gotten some parts of the people of the United States interested in various scientific aspects. I'd like to think that the idea that it's not a government agency telling you what we're going to do, it's the American scientist and engineering communities telling us what to do has a certain value too.

We're not curing cancer but we're doing a lot of other stuff.

JOHNSON: And hopefully inspiring.

NEW: Yes. Inspiration is a big goal. That's one of the reasons also why we've been trying to figure out how to diversify our mission teams. Discovery has actually been very very good in

the sense that maybe we're at this point that about a quarter of the Discovery mission proposals are led by women. We don't have good data on other demographic variables. But at least for women the Discovery Program has been pretty equitable. But 25 percent obviously isn't 50 percent, but the fraction of proposals we get, just grant proposals in planetary science, with female PIs is also about 25 percent. So, we're capturing that population pretty well. Some of the other PI-led mission programs in the directorate are not so gender-diverse.

JOHNSON: You mentioned that you're Deputy Associate Administrator for Research for SMD now. Talk about what you do.

NEW: What the hell do you do all day, New? No worries. My responsibilities are to ensure that what we call the scientific competition processes are fair, equitable, efficient, and as transparent as possible. By scientific competition processes I mean the ways in which we pick which research grants to fund and which PI-led missions to select. That gets my hands in a lot of pies. How we do certain kinds of evaluations. Do we want to start looking at the diversity of a team, do we not? How do we want to deal with bullying in various circumstances for example? That's now something that's in my job jar.

What process do we want to have if we want to remove a science team member of a mission for cause? Either because of harassment or discrimination or bullying or not answering the mail and NASA calls. Not picking up the phone when NASA calls. All that kind of falls on my current job.

Having been the Discovery Program Scientist for whatever it was, 2006 to 2014, and having run the exobiology grants program for 15 years as well, I have a lot of experience in both

of those areas, both new research grants and in mission solicitations. All that experience really builds into what I do now for the directorate.

JOHNSON: A little bit different, even though your experience leads to that. But it is a different idea that you have to be that person that helps when things aren't going right.

NEW: Yes. But the nice thing is I ran exobiology for 15 years. I've seen a lot of things in panel reviews and in managing grants, administering grants. Similarly, I ran three AOs for the Discovery Program. I think it was three. Wrote them and ran them. I've had to grapple at a very personal level with how am I going to do this, how should we do this, what's fair, what's equitable, what's efficient? What do we really need to know to make a good selection decision? Things like that. I dealt with them at the level of an implementer. Not at the level of policy capital P. So now I'm dealing with it at the level of policy capital P. But I can draw on my experiences being on the other side of those policies. That's kind of what I do.

JOHNSON: That's interesting. Is this something that somebody had in this position before you?

NEW: Yes. Before me was a guy named Jeffrey [S.] Newmark. Before him was Marc Allen. Then before Marc for a very long time was Paul Hertz. Paul was originally called the Chief Scientist position. He's now the Division Director for Astrophysics. Yes, there's been somebody in the front office who's been responsible for making sure that the i's get dotted and the t's get crossed and that the Associate Administrator doesn't go to jail. At least for as long as I've been at Headquarters.

JOHNSON: That's good to know. Is there anything we haven't talked about in the last two interviews that you'd like to mention?

NEW: Not really. Not about the program. It's a great program. I think it's doing great science, encouraging a lot of interesting ideas. I wish it was able to be offered more often nowadays but that's out of my control.

JOHNSON: I appreciate you talking to me.

NEW: Of course.

[End of interview]