NASM AirSpace Season 3 Ep. 4 The Greatest Discovery Final Transcription

Matt Shindell: Come on Emily. I'm waiting for you to tell me like, what robot am I gonna collect next for this museum.

Emily Martin: (Laughs).

Nick Partridge: And I'm disappointed to hear that the competition between them doesn't involve building the robots first, and then having them try to out science each other.

Matt Shindell: Oooo. Yeah. Right?

Nick Partridge: (Laughs).

Emily Martin: Like Battle Bots?

Nick Partridge: Yeah!

Matt Shindell: Yeah!

Nick Partridge: Umm…

Matt Shindell: Can we make a place for that at the museum? We can do that. Yeah!

Emily Martin: You're the Planetary Science Curator over there Shindell, so…

Matt Shindell: (Laughs).

Emily Martin: So, um, I think you should ask yourself that question.

Matt Shindell: (Laughs).

[MUSIC]

Matt Shindell: Welcome to AirSpace, from the Smithsonian's National Air and Space Museum. I'm Matt.

[MUSIC]

Nick Partridge: I'm Nick.

[MUSIC]

Emily Martin: And I'm Emily.

[MUSIC]

Nick Partridge: Today, we're talking about some of NASA's lower budget projects, but I want to avoid that sounding like we're calling them cheap. Discovery-class missions are really cool science missions like the Lunar Reconnaissance Orbiter that launched in 2009 and is still circling the moon or Insight, which landed on Mars in 2018. They're a bit like the indie movies of space exploration. They've got lower budgets, but they're where a lot of bold ideas come from.

[MUSIC]

Emily Martin: There are four potential missions up for consideration right now to be the next Discovery missions. Depending on which are chosen, we could be exploring Venus, Jupiter's moon Io or Neptune's moon Triton.

[MUSIC]

Matt Shindell: And because of the relatively small budgets, these teams have to get creative to find ways to do really incredible, meaningful science, sometimes for the first time ever in the solar system, in a way that costs millions with a, "M," instead of billions with a, "B." We'll get into that process and speak with scientists in charge of the potential Discovery mission, "Trident," today, on AirSpace.

[MUSIC]

Nick Partridge: So, what would you guys do if you had $500 million to pay for a space mission?

Emily Martin: (Takes deep breath) It's a lot of money, especially if you're gonna build a robot and send it to the Moon or Mars, but you all know I want to go further out, like Jupiter and beyond, which eats up a bunch of that cash because it's really far away. And for that kind of money, I'm gonna say Enceladus, one of Saturn's moons…

Matt Shindell: Hmmm.

Emily Martin: …because its environment is a little bit more hospitable and it would probably be a mission that flies by Enceladus a bunch of times, taking super high-resolution images.

Nick Partridge: Umm…

Emily Martin: What would you build Matt? Mine's a little bit, like very specific cuz you…

Matt Shindell: (Laughs).

Emily Martin: …like, I'm in the wheelhouse of like, thinking towards the future…

Nick Partridge: (Laughs).

Emily Martin: …but like…

Nick Partridge: Emily, it's almost like you're a Planetary Scientist.

Emily Martin: It's almost like…

Matt Shindell: Yeah. Yeah.

Emily Martin: …I'm a Planetary Scientist, but Matt, like you have a really strong, personal connection to a lot more robots than I do.

Matt Shindell: (Laughs). Well, and I think…

Emily Martin: So, I feel like your perspective here is better.

Matt Shindell: Well, no. I don't think so because I think everybody knows that what I would do is build, essentially like, a robot curator to go to Mars and take care of the robots that are already there…

Emily Martin: (Laughs).

Matt Shindell: …which, you know, NASA doesn't really want to fund that.

Nick Partridge: Aw, that's really sweet!

Emily Martin: Not yet!

Matt Shindell: (Laughs).

Nick Partridge: Mine was going to be, um, mine was going to be a drone on the Moon to fly over the Sea of Tranquility site without disturbing any of it, but I like yours too! That's really nice, caring for the other robots. Not that your relationship with robots is untoward for anyone that doesn't know Matt…

Matt Shindell: (Laughs).

Nick Partridge: …curates our planetary exploration collection, which is where a lot of our robots live at the museum.

Emily Martin: Can I be nerdy about why you can't fly a drone on the Moon or should we just, like brush right pass this cuz it's a total hypothetical?

Nick Partridge: Oh…. This is where you find out that I'm not a space scientist.

Emily Martin: (Laughs).

Matt Shindell: (Laughs).

Nick Partridge: That's fair.

Emily Martin: But you know, this is a hypothetical. If you want a drone on the Moon Nick…

Matt Shindell: (Laughs).

Emily Martin: …you get a drone on the Moon.

Nick Partridge: So, science fiction drones or robot curators or serious space science.

Emily Martin: (Laughs).

Nick Partridge: Let's talk about serious space science.

Matt Shindell: Aw. Ok.

Emily Martin: It doesn't have to be too serious because I think that's why Discovery missions are so cool. There's a little element of science fiction that you have to employ when you use these (relatively) small budgets in order to put together a scientifically meaningful and scientifically unique mission.

Nick Partridge: To the metaphor that we cited earlier about them being like the indie movies of space exploration, something like the Curiosity Rover on Mars is on the order of multiple billions of dollars. $500 million is still a lot of money, but in terms of scale, it's a lot more approachable. And because it's a lot more approachable, you get a lot more proposals and those proposals get pretty creative. That's like one of the hallmarks of the Discovery-class, right?

Emily Martin: Yeah. I think you're right Nick. I think part of what makes Discovery-class missions so special is the room that scientists have to ask a science question and then go try and test it with a robot. In addition to the complexity of the science questions that you want to ask, you'll also have to take into consideration the space environment you're trying to send that spacecraft. So, some of these missions are going out towards Jupiter. The environment out at Jupiter is a whole other ball game.

Matt Shindell: Yeah. And Nick, you mentioned how much competition there is for these. You know, they do get a lot of proposals for Discovery-class missions. So, it really helps if you can align that with, you know, things that haven't been done before in the solar system, and with, you know, priorities that have already been set for NASA in terms of what are the important questions left to answer. And so, these missions end up doing some pretty incredible stuff. Like, for example, the Stardust mission to return samples from the comet, Wild-2, which flew all the way to the comet, collected material, and then returned those samples back to Earth for study. Like, nobody had ever done anything like that before and, you know, that was a Discovery class mission, which was relatively low budget, but really big science goal.

Nick Partridge: Another example would be a Discovery mission that wasn't picked, but was proposed and developed was the Titan Mare Explorer, which is abbreviated, "TiME." And that would have been a boat that literally explored the liquid seas of Titan. So like, we're really talking about deep, blue exploration stuff and since this is a peer review process, at least on the outset for some of these proposals, I guess the way that you get attention is to propose things that even space scientists think are really, deeply cool and they say like, "We've got to try this, if we can do it."

Emily Martin: There's three big classes of missions and they're based on size. You can think of them as small, medium and large. Today, we're talking about Discovery class missions, which are the smallest, impart because they are so small, relatively speaking budget-wise. You do have to be exceptionally creative and there's an element as Nick alluded to of competition with the sort of small and medium Discovery and New Frontiers class missions. There's a level of competition there where the team who comes up with the best science questions that need to be answered, how they're related to what the community, this planetary science community, thinks is really important to answer, and how they can do something novel in a way that's really, and this is the kicker, low risk. Flagship missions, the largest class missions, those happen every ten years or more, which means there are enormous community-driven efforts where the planetary science community has to say, "In the next decade, these are the most fundamental questions we need to answer to advance our science. The flexibility that New Frontiers and

Discovery, the sort of small and medium class missions, have is they get to say, “Well, we need to get a little bit more creative here and we’re gonna make our case to you.”

[MUSIC]

Emily Martin: Because the Discovery Missions are competed against one another, the competition comes in a lot of different phases. The first one being the Open Call. Everybody puts together their proposals and submits them to NASA for review. Then, NASA downselects the missions. And it’s a good thing to be downselected because it means that you are essentially a Finalist in this selection process in this competition. So, there’s four missions. They are called, DAVINCI Plus, which is a mission to Venus specifically to study its atmosphere and atmosphere chemistry. The other Venus mission is called VERITAS, which is totally different than DAVINCI Plus in that its purpose is to look much more at the surface of Venus and the reason this is not straight forward is Venus has an incredibly thick atmosphere and so you need special cameras to actually look down at the surface through the atmosphere. So, it’s totally not trivial. And then, IVO, which is the eye of the Volcanic Observer. It’s the most volcanically active body in the solar system and we know very little about it. We haven’t been there since the Galileo mission was orbiting Jupiter. And so, that’s gonna learn a lot about why Io is so stinkingly active. And then the last one, which is my personal favorite because I’m involved in it, is the Trident mission to Neptune’s moon, Triton. And it’s going to look for a global liquid ocean, and study Triton’s ionosphere. So, sometime Spring 2021, NASA will announce one or two missions that it’ll select from these four.

Matt Shindell: These missions are smaller and cheaper in some ways than the bigger missions, but in terms of like, the human devotion to these missions, it’s just as high. So, scientists devote most of their careers sometimes to these missions. The people who run these missions are incredibly dedicated to them.

Nick Partridge: If you can imagine how many years of work would go into writing a proposal, thinking through an entire mission, building a spacecraft, getting it to the launch pad, and then launching it, I think you really easily could run into the timespan of a really rich, rewarding career because, Emily, as an example, what would be a possible flight time to Triton?

Emily Martin: This particular mission, the cruise phase, so the launch to sort of arrival, is about 13 years.

Nick Partridge: So, somebody’s on that mission all 13 of those years, waiting until you get to the Neptune system and you can actually begin doing the science and that 13 year countdown doesn’t even begin until you have proposed something, gotten funding, built the team, built the spacecraft, and launched with the rocket.

Emily Martin: Exactly. But the other thing that’s worth noting is these are really large teams of people that are involved in these four different missions. And Discovery missions and New Frontiers class missions are in addition really unique, are both led by an individual called a Principle Investigator. For the Trident mission, the P.I. is Dr. Louise Prockter and she’s been working on the mission for years, getting it to the point where it’s one of the four Finalists. If Trident is chosen, it will still be a few more years before the mission is ready to launch. And then, it will be another 13 years before the mission actually reaches Triton. You have been part of many missions, how different has this process been as the P.I. of a Discovery mission?

Dr. Louise Prockter: (Laughs). Oh, that’s a… (laughs) yeah.

Emily Martin: (Laughs).

Dr. Louise Prockter: Quite different.

Emily Martin: (Laughs).

Dr. Louise Prockter: I mean, you know, I've worked in missions since I was in graduate school where I was the, you know, like the lowliest person on the project.

Emily Martin: (Laughs).

Dr. Louise Prockter: But I just couldn't believe how exciting everything was and it's, you know, still exciting to this day. It's an incredible opportunity to do this kind of work. It's (laughs) certainly a lot harder being the P.I. because before, I've had to make decisions, but they have been, you know, usually at the lower level. But here, unfortunately the buck stops here. So, a friend of mine, who is actually working on a different mission right now, put it really well when he said the problem with being the P.I. is that you, you have to make decisions without enough data. And as scientists, we're all about data.

Emily Martin: Hmm!

Dr. Louise Prockter: So, there's always this sort of…

Emily Martin: (Laughs).

Dr. Louise Prockter: …level of discomfort about is that the right thing to do, you know? Am I gonna to regret this three years from now? So, you know…

Emily Martin: (Laughs).

Dr. Louise Prockter: …we'll find out if we get selected whether I've made the right decisions or not. (Laughs).

Emily Martin: (Laughs). No, but that is such a brilliant way of talking about it. I feel like for those of us who study the outer solar system especially, everybody is always asking these really detailed questions and you're like, "I don't know!"

Dr. Louise Prockter: (Laughs). Right!

Emily Martin: I mean, I can make an educated guess, but until you get me more data, I don't know. And they're like, "Yes, but I need an answer."

Dr. Louise Prockter: (Laughs). Right!

Emily Martin: And so, this is like, this is like that, but a lot more.

Dr. Louise Prockter: Yeah, it's not a low-pressure environment let's say. And you know…

Emily Martin: (Laughs).

Dr. Louise Prockter: …a lot of hours, and the evenings and the weekends, and you know, luckily, I have this fantastic team, both the project technical team at JPL, Jet Propulsion Lab, but also you guys on the science team are fantastic. You know, just some brilliant, brilliant scientists and everyone has something really valuable to contribute to the concept, you know, to the study. So, yeah. I really hope we can take this all the way.

Nick Partridge: Timing becomes important here in many respects. Sometimes, there's a planetary alignment reason that the timing is really critical. To use another mission as an example, like Voyager, the Voyager mission could really only of happened once every 200 years because of the way the planets aligned. Sometimes there's literal celestial urgency to this process. Where are we in the process now for these active missions?

Emily Martin: As part of competing against other missions, you've gotta make a really solid case for why now. And as you eluded to Nick, sometimes that has to do with the alignment of certain celestial bodies.

Dr. Louise Prockter: The reason we can fit in Discovery is because of two things. The one is we have this very serendipitous trajectory we can use to fit in, Jupiter's, on the way to Neptune at the time we want to, or will be by the time we encounter it. It's just in the right place at the right time, but the other thing is that we can use nuclear power for our space craft, so this has been made available in the Discovery Program for the first time and these are power supplies that are long-lived, but they don't take up nearly as much space as a solar panel would.

Emily Martin: One of the big reasons we need to go kind of ASAP is that when Voyager flew by Triton, it was in southern summer, which essentially means that the southern hemisphere's experiencing summer because it's getting the most sunlight. And we think that was related to why we saw all the plume activity that Voyager saw. They need to go now because one of the reasons is, they want to be able to see the southern hemisphere in summer again to actually be able to test that hypothesis further because, think about it. I mean, if these plumes are tapping into a global liquid ocean, like we want to know that before we can't know that. We need to get to Triton before 2040, while it's still in southern summer. If we don't do it by 2040, we'll have to wait another 80 years.

[MUSIC]

Nick Partridge: Four very exciting missions and man, don't we wish they could all win? But sometime in Spring 2021, we're gonna find out which corner of the solar system we'll be visiting next.

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Emily Martin: AirSpace is from the Smithsonian's National Air and Space Museum. You can follow us on Twitter or Instagram at @AirSpacePod.

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Nick Partridge: AirSpace is produced by Katie Moyer and Jennifer Weingart. Mix by Tarek Fouda. Special thanks to Andrew Fletcher. Distributed by PRX.

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Dr. Louise Prockter: These moments, they may be few and far between, but they’re history, right? We make history with what we do. It’s incredible that being able to explore.