Jim Bridenstine: This is Jim.

Cat Hofacker: Hi, administrator, this is Cat Hofacker from Aerospace America.

Jim Bridenstine: Well, hello.

Cat Hofacker: How are you doing today?

Jim Bridenstine: Excellent.

Cat Hofacker: Thank you, thanks so much for taking the time to speak with me this morning, really appreciate it.

Jim Bridenstine: Well, it's my honor, thanks for taking the time to cover what we're doing.

Cat Hofacker: Of course, well I believe you've done our Q&A section before, but just to give a reminder of how it works. We do feature some bio information at the top, so I will be checking in with your staff after this just to verify some of it, so we don't get all bogged down this morning with it.

Jim Bridenstine: OK.

Cat Hofacker: If you could just encourage them to help me get that information, that would be extremely helpful.

Jim Bridenstine: You bet.

Cat Hofacker: All right, awesome. Let's get right down to it. You just marked your first year in the job, so congratulations.

Jim Bridenstine: Well, thank you.

Cat Hofacker: So what are some accomplishments or milestones that you see as sticking out from your first year?

Jim Bridenstine: So, there were a lot of things that happened in the first year that I was here from a capabilities perspective, and then a lot of discoveries from a scientific perspective, and then some changes in direction and policy.

So, let's start with just some amazing accomplishments of the agency in the last year. So, in November we landed InSight on Mars, which was the eighth time in human history that we've landed on Mars. The United States of America is the only country that's ever done it. We've now done it eight times successfully.

InSight is going to give us great information and data about the formation of Mars and really how planets in general form. It's going to have the ability to understand Mars quakes and asteroid impacts on Mars. Help us understand,

basically get a 3D image of what the inside of Mars looks like. So that was a big accomplishment.

Another big accomplishment was entering orbit around Bennu with OSIRIS-Rex. OSIRIS-REx is a robot that is going to be bringing samples back to Earth from Bennu, which is an asteroid in deep space. So this was a first for humanity. The idea that we can actually orbit an object as small as Bennu, characterize it for a period of years and then bring a sample home from that asteroid in deep space, that will be a first for humanity.

Another big accomplishment was flying by Ultima Thule in the Kuiper belt, which is 4 billion miles from Earth. This was the first time we've ever had the ability to get good scientific data and characterize an object that is that far from Earth. Even more impressive is the fact that it was from the same New Horizons mission that gave us beautiful images of Pluto back in 2015. So, this is an amazing achievement for the return on investment from New Horizons. The idea that we cannot only get the first beautiful images of Pluto, but then a number of years later fly by Ultima Thule in the Kuiper belt, 4 billion miles from Earth, and bring home some brand new images of that, that's pretty amazing in itself.

Another big accomplishment was launching a Commercial Crew [spacecraft] to the International Space Station with the Crew Dragon. Even though it was uncrewed, it was a demonstration of what Commercial Crew will bring and we're getting very close now to launching American astronauts on American rockets from American soil to the International Space Station for the first time since the retirement of the space shuttles back in 2011.

Cat Hofacker: Yeah, it's a great time. You really seem like you're enjoying the job?

Jim Bridenstine: Really, there's a lot of amazing things happening. This agency never ceases to impress and so a lot of great things. So, on a scientific perspective in the last year, a number of scientific discoveries have been made that I think are noteworthy.

Number one, we now know that there are complex organic compounds on the surface of Mars, so the building blocks for life exist on Mars. That doesn't mean that there is life on Mars. We don't know, but those complex organic compounds do not exist on the moon. They only exist on Mars, they exist on Earth. So it might be an indicator of something, and I think it's important that NASA continue to investigate.

In the last year we also learned, because of the Mars Curiosity rover, which discovered the complex organic compounds, but we also learned that the methane cycles on Mars are commensurate with the seasons of Mars, so that's a big discovery. Doesn't guarantee that there's life, but the probability has gone up. And then not related to NASA specifically, but an orbiter of Mars from a

different country discovered that there's liquid water 12 kilometers below the surface of Mars. So I would say that when it comes to the scientific discoveries in the last year, those are some of the biggest scientific discoveries and they relate to Mars, which is very exciting.

Cat Hofacker: Yeah, absolutely, especially because I know you really view the 2024 directive to get back to the moon as going forward to the moon with the goal of being on Mars.

Jim Bridenstine: That's exactly right.

Cat Hofacker: So yeah, big question, 2024. How sure are we that we can make this happen? It's a pretty tight timeline.

Jim Bridenstine: So technologically it's achievable. We have to make sure that we hit our milestones and we don't make mistakes and we don't have setbacks. To make sure that we don't have setbacks we need to build redundancy into the architecture as much as possible.

So, instead of one lander, maybe we have two landers that can go from the gateway down to the surface of the moon. So those are the kind of things that we're looking at to ensure success for the 2024 moon landing. So those are important. In order to accelerate as fast as possible, we're actually ... one of my first initiatives even before the 2024 directive was given, was to create what we call the Commercial Lunar Payloads Services Program. CLPS is what we call it, and so we were turning to commercial industry and saying, "If NASA had a payload, who can deliver it, and for what cost?" In other words, the access to the moon for small payloads is not going to be by NASA purchasing, owning and operating its own hardware, but instead buying a service from commercial industry.

So one of the big initiatives, my first big initiative as a NASA administrator when I first got to NASA was can we access the moon commercially through different contracting mechanisms that don't include NASA purchasing, owning and operating all of the hardware? So far, we have had success getting CLPS rolled out. We have selected nine companies that we believe have a possibility of success. We do understand that through the Commercial Lunar Payloads Services program there will be failures. I want to make sure that gets known. There will be failures.

In other words, not everybody who attempts to land on the moon is going to be successful. I see CLPS as kind of a venture capital effort. It's high risk, but it's very high return and it's low cost. So, low cost, high risk, but a very high return for successful missions. So that was an initial program that we put together, to help inform us how we would get humans to the service of the moon eventually and when those humans are on the surface of the moon, what are they going to

be doing? What are the most interesting parts of the moon scientifically that we can investigate?

So, that's what Commercial Lunar Payloads Services is all about. So all of the ... remember, we had an effort to land on the moon in 2028, so in order to get to 2024 what we're doing is we're taking some of those investments that we were going to make in '25, '26, '27 and '28 and we're pushing them forward to today. That's how we're going to achieve the moon landing in 2024.

Cat Hofacker: Mm-hmm (affirmative). So you mentioned building redundancies into the system to account for delays. So certainly, a recent delay that might have manifested was, you know it's been almost two weeks since SpaceX's Crew Dragon anomaly, and I'm wondering if you can give me any updates on that because we really haven't heard much?

Jim Bridenstine: So the investigation is underway, NASA is of course in the investigation with SpaceX and when we get good data on what happened, we are certainly willing and able to share that. At this time there's just no new information to share, but as you mentioned, this is why we have redundancy in the system.

SpaceX is one Commercial Crew provider, we have another one which is Boeing, and we have to make sure that when we have setbacks that it doesn't shut down the program. If you go back to 1986 with the Challenger accident, we had no access to space at all, not on the military side, not on the commercial side. Certainly not within NASA, when the shuttle Challenger had its accident.

So we have to make sure that we don't put ourselves in that position again, which is why we have two different, dissimilar Commercial Crew providers in Boeing and SpaceX. Certainly, as soon as we get good information on what happened with the SpaceX incident, we will be happy to share that.

Cat Hofacker: Mm-hmm (affirmative). Some people are saying right now, they're really speculating that the capsule was totally lost. Are you able to confirm or deny that?

Jim Bridenstine: We're not at a point where we can say that.

Cat Hofacker: OK, it's good to ask, so thank you for the update. So you mentioned with the dissimilar Commercial Crew providers. So we're talking about, what does the SpaceX delay mean for Commercial Crew?

Jim Bridenstine: So that's something we need to work through, and we're going through that process right now. What we do know is that Boeing is going to launch uncrewed to the International Space Station in August. So we're very much excited about that and anticipating success.

As far as how it's going to affect SpaceX, SpaceX isn't just doing a test flight here, they have an operational program after the test flight that we have funded as well. So we are looking to potentially move forward some of the Crew Dragons that would have been operational, but again we haven't made any decisions here, we're just looking at all of the options.

Cat Hofacker: Mm-hmm [affirmative]. I understand. So you mentioned NASA is funding the SpaceX Crew Dragon, we're trying to get this happening for Commercial Crew. So if SpaceX is conducting its investigations and it's acting as a private company that certainly seems understandable that we maybe wouldn't hear anything, but this is a federally funded space program. Shouldn't the public be able to know what's going on with that?

Jim Bridenstine: Absolutely, which is why we're doing the investigation and its why NASA is a part of the investigation, and as soon as we know what happened we'll be happy to share it.

Cat Hofacker: OK, and then as far as the power failure on the International Space Station on Wednesday, are there any updates on that?

Jim Bridenstine: We have ... I don't know if I should say it at this point because we haven't said anything publicly, but it's ... we are making great strides toward fixing the situation, I'll just say that.

Cat Hofacker: OK, thank you. Another big issue, kind of overhanging the 2024 moon landings of course with these things it's always about money. No one ever said space exploration was cheap, and I know that you are still working on submitting the amended budget request to Congress. So what kind of is the feeling about that the Hill? How do you feel about getting that money that NASA will need to achieve the 2024 landing?

Jim Bridenstine: I feel pretty confident, I think most people understand the history. The history is that since 1972, which was the last time we landed on the moon, there have been many attempts to get back to the moon and all of the attempts have failed. Not because of technological challenges, but they have failed because of political challenges.

So, the goal here is to make sure that we are not doing the things that make this politically problematic, which have been tried in the past. So we need strong bipartisan support in order to achieve the end state, it's how President Kennedy was able to achieve the moon landing back in the 1960s. He had strong bipartisan support. Lyndon Johnson, Richard Nixon continued that bipartisan support that ultimately resulted in a moon landing on July 20, 1969. So we just have to make sure that we're doing what we, we're doing all the right things to make this as apolitical and bipartisan as possible.

Cat Hofacker: Mm-hmm (affirmative). And when do you expect to have that figure, the budget number for Congress?

Jim Bridenstine: I think it could be just in a matter of a week, or a couple of weeks.

Cat Hofacker: OK, so with the big 2024 deadline looming, once we actually achieve that, like you said this isn't just about going to the moon, this is about going forward. So once we do achieve the moon landing, how do we keep that momentum going forward to reach Mars?

Jim Bridenstine: So the reason to go to the moon is to go to Mars. When we think about Mars, Mars and the Earth are only on the same side of the sun once every 26 months. So when we go to Mars, we have to be willing to stay there for a couple of years and the only way to learn how to live and work on another world is to use the moon as a proving ground.

So the reason we go to the moon is so we can go to Mars, and one of the things that this president has done that's so impressive, is he put in Space Policy Directive 1 that we are going to utilize the resources of the moon. So the hundreds of millions of tons of water ice on the south pole of the moon, we intend to use for life support. It's water to drink, it's air to breathe, and then take all of what we learn about how to live and work on another world and expand that to Mars.

So, as we are headed toward the moon, we want to build technology and capability that is replicable at Mars, and that's what we're doing. So, there are people who say that you can get to Mars without using the moon. I think that's crazy; I think it's unsafe; I think it would be inappropriate.

What we learned during the Apollo program is that the moon is the path to Mars. We saw what happened on Apollo 13, our astronauts made it home safely. Why? Because they were going to the moon, if they were headed to Mars it would have been the end of the story for them.

So the moon is the proving ground, it's the place where we can learn. It's the place where we can ultimately understand how to utilize the resources of another world to live and work, and ultimately apply all of what we learn at the moon, where it's only three days away as opposed to Mars, which is a seven-month journey, plus a two-year stay.

Cat Hofacker: Mm-hmm (affirmative). So without a very firm deadline for a Mars landing, like we have for the 2024 moon landings, are you at all worried that once we do achieve 2024, there will be a lack of urgency, the kind of stuff that's plagued NASA programs in the past?

Jim Bridenstine: Yes, I'm concerned about that. So we've got to make sure that doesn't happen. So, the answer is we need leadership, but remember the goal here is to put that

first human on the moon since 1972, in 2024 to have a sustainable lunar program by 2028, and then to do all of the things we need to do to live, to learn how to live and work on another world, and then go to Mars.

So, there's a lot of things that have to be invented in order to go to Mars, the moon is the proving ground, but if 10 years from now, if we don't have active leadership attempting to make that next great leap, you're right, it will be a problem, but I can tell you right now this administration is very motivated and highly focused on achieving the moon landing and making sure that the technologies we develop are applicable for an eventual Mars landing.

Cat Hofacker: Mm-hmm (affirmative). Now in the past you've really stressed the role our international partners have to play in both this venture and future explorations. The Trump administration does though seem very adamant about, you know, "we have American boots on the moon, launching American rockets, from American soil." So how do you reconcile that, the collaboration we have with international partners with this mandate almost that we need to be the ones leading this?

Jim Bridenstine: Well, I mean we lead because we bring the preponderance of the assets, and a preponderance of the capabilities, and without our leadership quite frankly it just won't happen. So we are very open, and we want international partnerships, 100%. This is about American leadership and we want them to be with us when we go to the moon, but the reality is America is going to lead, that's who we are, that's what we do, it's what we've done in the past, and it's what we're doing now.

Absolutely, this is an effort internationally that we want to lead on. So if you just look at the International Space Station, for example, the United States of America provides 77% of the resources for the International Space Station, and there are 15 different nations that participate in the International Space Station from an operational perspective.

So while we are one of 15, we bring the preponderance of the capability and the preponderance of the assets. So it's up to us to lead; we can either choose to lead or we're just not going to go, but we have to lead and certainly we want to lead with a coalition of international partners to achieve even more spectacular outcomes.

Cat Hofacker: Mm-hmm (affirmative)-

So yeah, switching gears here, let's bring it back down to Earth a little bit, so to speak. So, in terms of measurements, what do you think are some of the most important Earth measurements that we need to be making?

Jim Bridenstine: That's a good question.

I think the number one thing that we do at NASA is follow the guidance of the decadal surveys [from the National Academies of Sciences] and the decadal surveys have been very clear about what our objectives should be. Understanding the coupling of the water and energy cycle is a high priority. So we have to be able to, when we talk about the energy and the water cycle, energy cycle of course comes from, we're talking about energy from the sun and how it warms the Earth and then what happens with the water from that happening.

So understanding the water cycle is a critical piece of what we do. Water, of course, is the most potent greenhouse gas in the atmosphere, and so by measuring it we can get a good understanding of the climate as a matter of fact. So we have a number of missions. ICESat is a mission that helps us understand and characterize the ice at the poles of the Earth, and how that ice is changing. It helps us measure the thickness of the ice and then you combine that with imagery that helps us understand the mass of the ice in the horizontal, I guess the mass, like the land, how much of the Earth is it covering at the poles.

So ICESat is a critical mission to help us understand the water cycle. GRACE Follow-On is helping us understand how water moves around the Earth just by measuring gravity, so what we find is that the gravity of the Earth is not uniform, not stable. It's constantly changing, and that gravity change is based on where water is accumulating. So, as glaciers and ice caps melt and then re-accumulate and then melt, where does the water go? And ultimately helping us understand where it goes helps us then understand the next step, which is the vapor and where does the vapor go and how does that affect the warming climate.

So all of these things, I think, are important for us to understand, so we're also actively sensing water vapor in different parts of the electromagnetic spectrum, and, of course, we do that because, number one, we want to understand the changing climate, but number two, we want to be able to predict weather. So understanding weather prediction is a key component as well, which was also in the decadal survey that we follow, which talks about extending and improving weather and air-quality forecasts.

So those are all I think important capabilities and missions for understanding the Earth. Understanding carbon dioxide is a big mission for us. We have the Orbital Carbon Observatory Two on orbit right now helping us gather information on carbon dioxide. We have Orbital Carbon Observatory 3, which will be launching this year to the International Space Station to help us gather even more information from a carbon dioxide perspective.

We also have GeoCarb that will be a geostationary hosted payload on a communication satellite in geostationary orbit. GeoCarb is going to give us great information on not just carbon dioxide but methane, and other greenhouse gases that are over the Western Hemisphere. So NASA is focused on Earth science. Our Earth science budget is strong; I should say our Earth science

budget request is very strong, and we continue to study the Earth in ways that only NASA can do.

Cat Hofacker: So with the role NASA plays in climate science and then with climate change becoming an increasingly large issue, I'm wondering, do you ever talk to President Trump about climate change and its implications?

Jim Bridenstine: I haven't. Mostly the president has designated the vice president as the chairman of the National Space Council, so I mostly work with the vice president on these activities, and what you'll find is that our budget requests for Earth science is higher than five of the enacted budgets under President Obama. So we have a strong Earth science budget that I think keeps NASA right where it needs to be and, of course again, if you look at how we compare to the rest of the world.

If you add up all of the nations of the European Space Agency, Canada, Japan, Russia, all of our partners on the International Space Station, you add up all of their climate science budgets and ours alone is still higher than all of theirs. So I would say that the United States is very strong when it comes to studying the climate.

Cat Hofacker: Mm-hmm (affirmative)

So, since you've been administrator and have seen these studies and taken part in a lot of these discussions, I'm wondering have your personal views on climate change evolved?

Jim Bridenstine: So this has been a narrative that has been presented, when I was in the House of Representatives, I was on the Armed Services Committee and there was an amendment to have the Department of Defense understand climate and how it affects our national security posture.

There are a lot of Republicans against it and a lot of Democrats for that amendment. I broke with my party and supported that amendment. Why? Because here's what we know: The Arctic ice is melting. As a Navy pilot I can tell you that the Navy is having to defend territory it never used to have to defend, and the ocean is open in ways that the ocean didn't used to be open, especially when we talk about the Arctic.

So climate change is very real, it has a national security kind of posture, my position on that, that was my position on it in the House of Representatives. It's my position on it today. So, I have a history of being in favor of trying to understand the changing climate.

Cat Hofacker: Mm-hmm (affirmative).

NASA public affairs: So, Cat we're at 30 minutes, so if you have a last question you can go ahead.

Cat Hofacker: Yeah, absolutely.

So, circling back to Commercial Crew. So with NASA bringing on more commercial partners through programs like that to tackle certain tasks, what kinds of big-picture things does this free the agency to tackle in the future?

Jim Bridenstine: So the reason we want to commercialize low Earth orbit in general is so that we can have more resources to go where there isn't yet a commercial industry. So, in low Earth orbit we have an interest in being one customer of many customers, which drives down our costs. We also have an interest in having numerous providers that are competing on cost and innovation, and we are rapidly approaching that in low Earth orbit, and what does that mean for us? That means that we can use the resources that are remaining to do things for which there isn't yet a commercial market. Namely go to the moon and on to Mars.

Again, we want to at the same time work to commercialize activities in cislunar space and then of course at Mars as well. So the reason we do commercialize is so that we can use the taxpayer resources to do the things that only NASA can do. We don't want to do things that commercial industry can already do.

Cat Hofacker: All right, administrator, thank you very much for your time today and, as I said, I will be following up so we can confirm your bio information.

Jim Bridenstine: OK, thank you so much.

Cat Hofacker: Thank you, have a good day.

Jim Bridenstine: All right, bye-bye.

Cat Hofacker: Bye.