

NASA Town Hall on Moon 2024 Budget Amendment
with Administrator Jim Bridenstine

NASA Panel Speakers:

JIM BRIDENSTINE, Administrator

WILLIAM H. GERSTENMAIER, Associate Administrator,
Human Exploration and Operations Mission Directorate

JAMES L. REUTER, Acting Associate Administrator,
Space Technology Mission Directorate

THOMAS ZURBUCHEN, Associate Administrator, Science Mission Directorate

Moderated by

BETTINA INCLÁN, Office of Communications, NASA

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James E. Webb Auditorium
NASA Headquarters

BETTINA INCLÁN: Good afternoon. I am Betinna Inclán with the Office of Communications here at NASA. Welcome to this special Town Hall with Administrator Jim Bridenstine. This is an exhilarating day for people across NASA, and we look forward to getting the first woman and next man to the Moon by 2024.

As you are about to hear from the Administrator, we have the plan. We know the plan is achievable, and the President and the Vice President have given us the push we need to get started.

We encourage everyone across the agency to be part of this important Town Hall, and you can do so either by your mobile device or your desktop computer. Just type nasa.gov/townhall at the top of your browser. Once you get to our secure Town Hall website, you will be asked to add the center which you are participating. Then you will have the option to either write your question, or you can vote one of the questions that is already on the list. We will also be taking questions from those of you who have joined us here inside the Webb Auditorium at Headquarters.

We look forward to the discussion with the Administrator and our senior leaders, and we look forward to your participation. Please join me as we welcome our Administrator, Jim Bridenstine.

[Applause and cheering.]

ADMINISTRATOR JIM BRIDENSTINE: Thank you, Bettina, for the introduction.

It is a big day. Two months from now, we will be 50 years since we landed Neil Armstrong and Buzz Aldrin on the Moon. Fifty years ago, when this program went forward, all of our astronauts were born from either naval aviation or Air Force aviation, and when you think about it, they all came from fighter pilot backgrounds, test pilot backgrounds, and then they became astronauts. In those days, there were no opportunities for women to have the path to go to the Moon.

What we have now is a new opportunity. In today's era, we have a very diverse astronaut corps and a highly qualified astronaut corps, and I can tell you based on my conversations with many of them, they are all excited about returning to the Moon.

A couple of weeks ago, we had a Town Hall, and we talked about what a great opportunity it is for the President and the Vice President to stand up and say we are going to accelerate the path and we are going to get there by 2024. Then they came to us and they said, "What is it that you need to accomplish that goal? What do you need as an agency?" Well, it is pretty simple. We need an SLS rocket with the Orion Crew Capsule and the European Service Module. We also need a Gateway, and finally, we need the landing capability to get us to the surface of the Moon. We put it all together, and it turns out that we need about \$1.6 billion.

And the administration said, "If you get that, is that going to get you enough for the year 2020 to get humans to the surface of the Moon in 2024?" The answer is yes. It is absolutely enough for the year 2020.

We will need more, additional resources in future years for sure, but they gave us what we need in order to achieve the end state. They gave us what we need for the year 2020, and I want to also tell you, because a lot of us in this room did a lot of work to make sure that the money wasn't cannibalizing other parts of the agency.

So I think in a very strong vote of confidence for this agency, the administration decided to give us \$1.6 billion of new spending that is not coming from the Science Mission Directorate. It is not coming from the International Space Station. It is not coming from any part of NASA. That is I think a very strong indicator that this administration is committed to achieving the end state in a bipartisan way, which is something that we worked very hard to achieve.

I have a daughter. She is 11 years old, and I want her to see herself in the same position that our current, very diverse astronaut corps currently sees itself, having the opportunity to go to the Moon. In the 1960s, young ladies didn't have the opportunity to see themselves in that role. Today they do, and I think this is a very exciting opportunity.

I also want to be clear. Why are we accelerating? We had a plan for 2028. Why are we accelerating to 2024? And this is an important message for everybody at NASA to understand. There's two risks that we're dealing with. One risk is simply technical, and given the folks in this

room and people throughout the entire agency that are watching, I know that this agency can retire the technical risk. I have no doubt that we can achieve this by 2024 if it is up to the technical capabilities of this agency.

There is another risk. The other risk is political. It is why we are not at the Moon right now, and it is in fact why are at not at Mars right now. Of course, I am not suggesting we are not at Mars. We are. Go InSight. Go Curiosity. I see the Science Mission Directorate folks being like, "We're at Mars." Okay, got it.

[Laughter.]

ADMINISTRATOR JIM BRIDENSTINE: So just know this. That the political risk historically, whether it was a Space Exploration Initiative, or the Vision for Space Exploration, it is always become priorities change, budgets change, administrations change, Congresses change. So how do we retire as much political risk as possible? We accelerate the program. Basically, the shorter the program is, the less time it takes, the less political risk we endure. In other words, we can accomplish the end state.

The other thing that is important to note is that when we achieve this within 5 years as the Vice President said, when we achieve this within 5 years, we are going to have a program. We are going to have an operation where we're going to be sending humans to the Moon every year in a sustainable architecture that all of American can be very proud of.

And I also want to say this. You in this room, when we achieve that—and of course, throughout the entire agency, at the centers across the United States of America, when we achieve that end state, you are going to have something magnificent to share with your children and your grandchildren. This is a great opportunity for our lifetime, and I think we—I don't think—I know we can achieve it.

The first step is to get the right amount of money for the next year, and we have that in the budget request. We've got to make sure that we're keeping this together in a bipartisan way and going forward to the Hill and letting them know why this is so important for our country.

I want to share with you a video that we recently made. It's an important video. This is the first time that we have released it publicly, but you guys have seen the "We Are NASA" video. I think everybody in America has seen it who has an interest in this kind of activity. Well, this is a video that puts a little more meat on the bones. It talks about how we're going to go achieve that end state of the next man and the first woman on the surface of the Moon in 2024. "We Are Going."

[Video presentation begins.]

Male Speaker: Fifty years ago, we pioneered a path to the Moon. The trail we blazed cut through the fictions of science and showed us all what was possible.

Today are calling to explore is even greater. To go farther, we must be able to sustain missions of greater distance and duration. We must use the resources we find at our destinations. We must overcome radiation, isolation, gravity, and extreme environments like never before. These are the challenges we face to push the bounds of humanity. We are going to the Moon to stay by 2024, and this is how.

Female Speaker: This all starts with the ability to get larger, heavier payloads off planet and beyond Earth's gravity.

Male Speaker: For this, we assign an entirely new rocket.

Male Speaker: The Space Launch System. SLS will be the most powerful rocket ever developed.

Female Speaker: And with components in production—

Male Speaker: —and more in testing—

Female Speaker: —this system is capable of being the catalyst for deep space missions.

Female Speaker: We need a capsule—

Female Speaker: —that can support humans from launch—

Female Speaker: —through deep space and return safely back to Earth.

Female Speaker: For this, we have built Orion.

Male Speaker: This is NASA's next-generation human space capsule.

Male Speaker: Using data from lunar orbiters that continue to reveal the Moon's hazards and resources—

Male Speaker: —we are currently developing an entirely new approach to landing and operating on the Moon.

Male Speaker: Using our commercial partners to deliver science instruments and robotics to the surface, we are paving the way for human missions in 2024.

Male Speaker: Our charge is to go quickly and stay, to press our collective efforts forward with a fervor that will see us return to the Moon in a manner that is wholly different than 50 years ago.

Female Speaker: We want lunar landers that are reusable that can land anywhere on the lunar surface.

Female Speaker: The simplest way to do so is to give them a platform in orbit around the Moon from which to transition.

Male Speaker: An orbiting platform to host deep space experiments and be a waypoint for human capsules. We call this lunar outpost "Gateway."

Female Speaker: The beauty of the Gateway is that it can be moved between orbits.

Male Speaker: It will balance between the Earth and Moon's gravity—

Female Speaker: —in a position that is ideal for launching even deeper space missions.

Female Speaker: In 2009, we learned that the Moon contains millions of tons of water ice.

Male Speaker: This ice could be extracted and purified for water and separated oxygen for breathing or hydrogen for rocket fuel.

Female Speaker: The Moon is quite uniquely suited—

Female Speaker: —to prepare us and propel us to Mars and beyond.

Male Speaker: This is what we are building.

Female Speaker: This is what we're training for.

Male Speaker: This, we can replicate throughout the solar system.

Male Speaker: This is the next chapter of human space exploration.

Male Speaker: Humans are the most fragile element of this entire endeavor, and yet we go for humanity. We go to the Moon and on to Mars to seek knowledge and understanding and to share it with all. We go knowing our efforts will create opportunities that cannot be foreseen. We go because we are destined to explore and see it with our own eyes. We turn towards the Moon now not as a conclusion but as preparation, as a checkpoint toward all the lies beyond. Our greatest adventures remain ahead of us. We are going.

Female Speaker: We're going.

Male Speaker: We are going.

Male Speaker: We are going.

Male Speaker: We're going.

[Video presentation ends.]

[Applause.]

ADMINISTRATOR JIM BRIDENSTINE: So we are going, and in order to go, it requires an all-of-NASA approach.

Historically, there have been divisions. Maybe it is we are going to cannibalize this part of the agency in order to get more money for that part of the agency. Well, what we're doing now is entirely different. You heard about the sustainable return to the Moon, but this time when we go, we're going to stay. But we're also not just going to go as the Human Exploration and Operations Mission Directorate. In this budget, we're talking about the 1.6 billion of new dollars. There is also money in there for the Science Mission Directorate to do science on the surface of the Moon. There's also money in there for the Space Technology Mission Directorate. So I have all of the Mission Directorate heads here, the Associate Administrators, to, no kidding, share with you what each one of the Mission Directorates is going to be doing in order to accomplish this end state of the next man and the first woman on the surface of the Moon within 5 years.

So, with that, I am going to turn it over to the Associate Administrator of Human Exploration and Operations, Bill Gerstenmaier.

WILLIAM H. GERSTENMAIER: Thanks, Jim.

ADMINISTRATOR JIM BRIDENSTINE: Bill?

[Applause.]

WILLIAM H. GERSTENMAIER: Again, thank you. I think you saw in the video exactly what we're doing, and you got to see faces and hardware and people that are working on this. To make this happen, we're going to need the entire workforce, like Jim said, and we are going to need all of this pulling together and figure out ways we can break down barriers between us, figure out ways to move and work more efficiently than we ever have before. We need to move with fast decisions and make decisions and recognize that it may not be a perfect decision, but we need to make that decision, get behind that decision, and move forward and continue to move forward.

So I think this Town Hall today is really about that. This is our chance to talk to you, the workforce, about what we're doing and how we're going to put this together and how we're going to use this \$1.6 billion to advance what we're already doing. I think it's a tremendous testimony to what we've put in place that we don't have to reinvent everything. We don't have to start all over again. We're able to take the Gateway, shrink it a little bit. We can use it as this orbiting outpost that allows us to go anywhere on the surface of the Moon and allows us to have a reusable architecture. It can grow easily to add international partners and build this base to go beyond the Earth-Moon system with humans.

So it all fits. SLS and Orion are moving forward. The activities we have been doing with science, the things we have been doing with the Space Technology Mission Directorate. All those fit together.

So, hopefully, today when you ask your questions, we'll give you some answers. We'll give you some information how we can move forward, but we look to you to help us then figure out how we get behind this huge challenge we have in front of us and how we take this dream, how we take this commitment that the administration has given us for this \$1.6 billion in 2020, above where we are, how you can help us work with Congress to get that approved. So, on October 1st, we can start laying in place the contracts that actually start building hardware that give us a lander that takes from the Gateway down to the surface and back.

So it's an exciting time. I look forward to answering questions and talking to you and moving forward.

ADMINISTRATOR JIM BRIDENSTINE: You gave us just a little preview there, so \$1.6 billion. A billion of that is going to be focused on the lunar landing activity. Would you talk for a second about what that looks like, what it may or may not look like, based on what industry provides us, and ultimately how the procurement of that is intended to go?

WILLIAM H. GERSTENMAIER: Sure. The way we envision it is we would start out with a reusable system at Gateway, and we first envision there would be a transfer vehicle that takes the ascent vehicle and the descent vehicle down to a low-lunar orbit, and then from there, the descent module takes us down to the surface of the Moon. We can then do activities for a couple days on the surface of the Moon, get back in the vehicle, then take the ascent vehicle directly back to Gateway.

That was kind of our concept, but then we got thinking about it, and we said, "Well, maybe that is not exactly the right staging. Maybe it doesn't need to be three pieces. Maybe it should be two pieces. Maybe there's two and a half. Maybe there's a different architecture." So we've actually put out a synopsis. We've actually got some studies we're about ready to award here in a couple of weeks, where we're going to ask industry's comments of how they want to put this together and what is the right architecture. But the key thing is using Gateway, you get a reusable, sustainable architecture, which is a very different way of doing the Moon than we've ever done before.

ADMINISTRATOR JIM BRIDENSTINE: And we would, in essence, be buying a service—

WILLIAM H. GERSTENMAIER: Right.

ADMINISTRATOR JIM BRIDENSTINE: —to take our astronauts from the Gateway down to the Moon and back to Gateway. In essence, we're simply buying a service, and we're looking to those service providers to create the absolute best ideas that they have because they might

want to provide services that may or may not deal with NASA in the future for a commercial lunar landing capability.

WILLIAM H. GERSTENMAIER: Initially, we thought we'd keep them as three pieces and then NASA would integrate, but then we thought, nope, for speed, it's better that we let the commercial sector do that to figure out how that occurs, and we participate with them. But we'll describe later what the roles are we see for NASA engineers and the NASA workforce, and this first study phase, we're going to actually build some prototype hardware. We're going to build some pumps, some cooling systems and other pieces or ideas. Maybe we're going to embed NASA engineers with these companies that are actually building those prototypes.

So then our NASA workforce gets a chance to see firsthand on development, see new hardware being built, and then the NASA employees are there, can reach back into the agency, and pull in computational fluid dynamics. They can pull in more resources, et cetera, to help these small companies move forward.

So we're working a way that we can figure out a way to truly partner, where we take partnering up to that next level, where we actually embed NASA folks with those that are building hardware for us.

We are building off of what we've done with commercial cargo, what we've done with commercial crew, what Thomas is going to be doing with the Commercial Land Services Program. We're taking all of those things. We learn from those, and then we embed them in the next thing we do moving forward. So we're not just trying something totally new. We're building off of what we've done before.

ADMINISTRATOR JIM BRIDENSTINE: And we have done amazing things. Commercial resupply. Now we're on the brink of commercial crew. So we've learned lessons of the past. We're going to apply them to the future, and, Bill, I appreciate your great leadership on all these activities.

Okay. So the next thing, we'll talk to Jim Reuter here, who is with the Space Technology Mission Directorate, the Associate Administrator of Space Technology Mission Directorate, about ultimately what is space technology. What are we going to use the Space Technology Mission Directorate for to achieve this end state of humans living and working on the Moon?

JAMES L. REUTER: Thank you, Jim. I think what we've seen throughout history is that technology always drives exploration, and so we in the Space Technology Mission Directorate are really excited to be a strong part of this activity, and also with a \$130 million increase in the budget to work on additional and enhance our activities for precursors, for support for the 2024 landing, and for surface operations.

So there's several technologies that we have already been working on, such as precision landing, solar electric propulsion, cryogenic fluid management, that are still integral to this whole activity.

What we are doing now is ensuring that what we do—that our schedules align with the push towards 2024.

Beyond that, then, we're looking very strongly at the surface itself for activities that we'll do there. One activity that we share strong common interest with science is in looking and capturing lunar ice and converting to water and then processing that and using it for propellants. So that is an activity that we'll have a strong push for.

In addition to that, looking at ways of recovering oxygen from the soil, that is a very promising technology as well.

And then beyond that, when we envision a scene where there could be a lot of mini robots or rovers traversing the surface of the Moon and extending our reach and our knowledge base.

All of that requires a power architecture when you think about it on the Moon, a power and thermal management architecture, and there will be some technologies there that we'll be looking at like regenerative fuel cells and then ultimately towards fission, nuclear power that we dip into demonstrating.

Then beyond that, going off the surface, we envision that there's several opportunities for using small spacecraft, CubeSat-size activities to do things like lunar comm relays with payloads on the surface, with better understanding of autonomous navigation activities, and also help characterizing the surface even better from space.

So, with that, the best thing that we think about this is that the Moon is absolutely a perfect place for a testbed, and it's a great proving ground for us to extend to Mars. Thank you.

ADMINISTRATOR JIM BRIDENSTINE: Great. Thank you, Jim.

So Space Technology is going to be a big piece of it. I heard that we're going to figure out how we're going to get oxygen from the regolith. You called it "soil." I think maybe some biologists would argue that that's not soil, but at the end of the day, we're going to get oxygen. We need to get water. We also potentially could be ultimately creating fuel out of the water ice as well, and we need fission power in order to achieve these goals that, of course, I know you're working on. So there's no shortage of opportunity here, and we're thrilled that Space Technology got a plus-up as well.

JAMES L. REUTER: Yeah. And I'll also reiterate what you also said about this is a strong partnership with our NASA workforce, with industry, and with academia. And what we find is when we have those partnerships together, we really strengthen the activities that we do, and we enjoy very strong support from each of our centers, and we expect to continue to do so.

ADMINISTRATOR JIM BRIDENSTINE: That is wonderful. When we talk about academia, we're talking about, no kidding, very low TRL kind of capabilities, technology readiness levels, and that is where universities play very strong roles.

JAMES L. REUTER: Absolutely.

ADMINISTRATOR JIM BRIDENSTINE: And we leverage them highly, which means we need to engage our universities through the centers, all across the United States. So thank you for your leadership on all that activity.

JAMES L. REUTER: Thank you, Jim.

ADMINISTRATOR JIM BRIDENSTINE: Another benefit to the new budget is that the Science Mission Directorate also has additional funding. Since I've been the NASA Administrator, now it's been well over a year, it's hard to believe. It seems like I started yesterday.

But since I've been here, I've heard over and over again about all the science that we ought to be getting from the Moon that maybe we've been missing out on, and of course, I've heard it from activists across the country. I've also heard it from inside the agency, and I know Dr. Thomas Zurbuchen, our Associate Administrator for the Science Mission Directorate, has a keen heart for the activities that happen on the Moon from a science perspective. So if you would share with us how you intend to use the resources that we are getting from this new budget request in order to use science on our Moon objectives.

THOMAS ZURBUCHEN: I really want to answer that. Before I do, I want to just quickly point out what happened last week. What happened last week, of course, OCO-3 instrument that arrived at the Space Station as part of a resupply mission, commercial resupply mission, was installed and was powered down in record time. That is one of those examples that we want to model for.

What we want to do, of course, like we always do in science, is we want to go beyond the realm of where we are today, both where our experiences are, but also where our thinking is. And we want to go break through those boundaries in partnerships with these mission directorates.

ADMINISTRATOR JIM BRIDENSTINE: OCO-3, Orbiting Carbon Observatory, and we are collecting more information than ever before in the history of the world on the carbon in our atmosphere. So I just wanted to make sure we are—

THOMAS ZURBUCHEN: Absolutely.

So, as we go forward here to the Moon in '24 with humans at the surface, what we want to know is really about those polar regions where we want to land. The \$90 million extra that is here over and above the commercial program that was already discussed by you, Bill, just earlier, the \$90 million for that is there to analyze those resources and those polar regions.

Yes, we have seen them remotely. We look at them with our LRO spacecraft. We have images. We want to go there and analyze them, and eventually, frankly, we'd like to bring them back to Earth, but also learn exactly in partnership with these other directorates how to take those resources out, use them for our human exploration and perhaps for making fuel as we want to go deeper into the solar system. That's only one element, though, because there's other objectives that we're trying to address.

Already talked about the fact earlier, and Jim Green gives amazing talks about this. There's many questions that we can answer at the Moon that frankly there's no better place to answer, such as what is the age of the solar system and its bombardment history. The Moon is a history book of that in a way the Earth is not and other planets are not. So we want to go to the Moon and answer those.

The other part is, of course, the micro processes that intersect, interact with the Moon act all over the solar system and in other planetary systems. We want to learn and understand and take that knowledge and transfer them over to planetary sciences, to astrophysics, to heliophysics, to earth science and learn about that. And as already mentioned, a third objective is really about kind of taking that knowledge and turn it into how do we deal with those resources. All those will be addressed by these instruments that we're going to drive with our commercial partners to the surface of the Moon. We're the fastest element in that campaign. We're deeply aware of that. We're watching every day, and I just want to thank all these valuable civil servants and contractors that have been part of that, together with our commercial partners, to actually keep us on speed and keep us targeted towards the objectives at hand.

ADMINISTRATOR JIM BRIDENSTINE: That's wonderful, Thomas. I do think a lot of people miss the fact. That people think, well, the Earth and the Moon, we fly through the same piece of space at the same time. Therefore, whatever impacts the Moon has impacted the Earth, and therefore, we can get just as much science from the Earth. But the Earth has this very active hydrosphere, and it has a very active geology and a very active atmosphere. So we have not preserved the history of the solar system the way the Moon has preserved the history of the solar system.

So we are all very excited about getting to the Moon and learning what that history really is and then also using the Moon, in essence, to do deep space science, no kidding, astrophysics, maybe even from the far side of the Moon where it's very quiet from an electromagnetic spectrum perspective. So there's a lot of opportunity to use the Moon to gather information about our solar system, to use the Moon to gather information about deep space, not just our solar system, but other galaxies and in fact the universe at large, so there's just a lot of opportunity.

THOMAS ZURBUCHEN: I really appreciate that you said that. There are science questions that are in the minds of our community that frankly the best place to answer them are away from Earth.

In fact, we have already, in some of our calls for proposal, put the Gateway in as a platform for some of these experiments. We don't know what they are. The OCO-3 instrument that we just talked about on Space Station was invented by a really creative principal investigator. We want to put the ball in the hands of the most critical, most innovative and really excited people that can critically look at all these ideas and take the best one and give them to us, and then we can fund them, whether it's at the Gateway or the surface of the Moon. We want to do just that.

ADMINISTRATOR JIM BRIDENSTINE: That's awesome.

Okay. So what I'd like to do now is just open it up for the question-and-answer session, and of course, we're all here to answer questions. So, Bettina, I guess you've got incoming.

BETTINA INCLÁN: Yes. Thank you, gentlemen, for a great conversation. We're going to take a question from the website that people submitted, and then we'll take a question from the audience. So start thinking, and we'll call on you quickly.

The first question is, Will the Moon objectives take precedence over research in areas like earth science and unmanned aircraft systems in the national airspace?

ADMINISTRATOR JIM BRIDENSTINE: Absolutely not. In fact, we worked very hard as a team, as an agency to make sure that the budget amendment would preserve all of the important parts of NASA's budget, and we achieved that goal. So the \$1.6 billion is new money focused on the lunar objectives, and none of it is coming from other parts of the agency. So we're all very, very proud of that.

Thomas, did you want to address it?

THOMAS ZURBUCHEN: I just wanted to say, I think the one thing I wanted to say from my work that happens during times where cameras are not on, that message from Jim, that message from Bill, from Jim here, is consistent. Each and every hour, we have that discussion. So it's not the case that somehow there's a big question about this intent, you know, by 1 percent, we go this way. That message that you just talked about is consistent in each and every one of our meetings. So I just want to say that to the science community out there listening in. You have kind of a front on your side here and the Administrator and his team, and I am sure the aeronautics community would say exactly the same sitting up here. Those are the two communities that were addressed by your question, Bettina.

ADMINISTRATOR JIM BRIDENSTINE: I think this mission going to the Moon unifies us across all mission directorates in a way that is very positive.

BETTINA INCLÁN: Great. We're going to take a question from the audience.

JAMES L. REUTER: Quiz this guy.

ATTENDEE: You've got to answer it.

ADMINISTRATOR JIM BRIDENSTINE: This is going to be a tough one.

[Laughter.]

ATTENDEE: You know, the way to achieve our objectives, as we've seen in the past, is to focus, and I call that "burning a hole in steel." As managers and the activities that we do, what are the things that you think we should be doing to create that focus, such that we can meet that objective?

ADMINISTRATOR JIM BRIDENSTINE: So I think there's a couple of things. A couple of things that the Vice President actually said 6 weeks ago when he announced that we were going to accelerate the Moon program, I think one of the things he said that was important is that we cannot have paralysis by analysis.

For every person in this room, there's a different idea on how to accomplish the objective. Why? Because this is an agency that has the smartest people in the country, and everybody here has a strong opinion. And I'll tell you, I love that about this agency. So keep those strong opinions. But know that there's going to come a day, and in fact, that day is very near, when we have to stop the debate and actually move forward on the program. And that day is very close.

I would also say beyond the paralysis by analysis, something else the Vice President said, is that anything that is not necessary is a distraction, and that applies across all mission directorates, across all missions. That if you're bogged down in bureaucracy, help us understand how to help you get the bureaucracy out of the way so that we're not wasting time, and in fact, we are doing what is necessary to achieve the end states. And that's true whether you're working on earth science missions or working on astrophysics or whatever the case is. So anything that is not necessary is a distraction, and I would like to reinforce that.

THOMAS ZURBUCHEN: Do you mind if I add, just give you an example? So I'm a strong believer in getting the right people on the task and using the right processes, which is what you just talked about. I just want to give you an example.

I just met with the CLPS team upstairs. They are working through a major milestone. We're getting ready to talk about that in 2 or 3 weeks and so forth. It's just really exciting what's happening. How did they get there? First of all, people focused entirely on that. They took the most aggressive schedule. So far, every single milestone that they put up, they beat, every single milestone, and that only works if people are basically prioritizing this over other things. So, in other words, not every task is equally important. So this one, because of the fact that it's where our thrust is, it has to have priority over others. So the processes need to be focused towards that, and so for me, that's really the example that we want to use in science.

And I know from talking to my colleagues, that's what they are doing too, to really make sure that we do the right things, but we do the right things at the best possible speed with handling all these and really prioritizing them over the things that could distract us.

ADMINISTRATOR JIM BRIDENSTINE: If it's okay, I'll just—you like to use acronyms. I know there's a lot of people across the agency that maybe not everybody knows CLPS, Commercial Lunar Payload Services. It is the Science Mission Directorate's goal to get small payloads to the surface of the Moon as expeditiously as possible.

So how do we do that? We buy that. We buy that as a service. We buy access to the surface of the Moon as a service. NASA isn't purchasing, owning, and operating the hardware that gets us there. We just create the science that we want, and we say, "Who can deliver this to the Moon, and at what cost?" And that's the program that Thomas has correctly identified, a program that has gone very, very fast because of the focus.

WILLIAM H. GERSTENMAIER: I was just going to say that what's exciting about that is we can watch and see how that program goes and use it as a gage to see how ready industry really is to step up to more commercial activities for human-class landers in the future, so we don't just sit idly back and watch what the Science Mission Directorate is doing. We're actively involved with them, learning everything we can, so that when we get to that next, more demanding step, have we learned from that activity? Not just technology, just not the techniques, just not the science piece, but also the acquisition piece and how we structure ourselves and how we team and how we work together, so we can continue to keep learning off of each other and in advance and then keep this focus or keep this drive towards this goal of 2024.

JAMES L. REUTER: And the thing I'll add too is that one more method of ensuring focus is continue on open communication when in context for what's going on, and with that, we give the responsibility and authority to our folks, and we support them as they need. But we get out of their way when they don't need it. So that's another key part that can really drive things.

ADMINISTRATOR JIM BRIDENSTINE: Awesome.

BETTINA INCLÁN: Great. We're going to go for another question from online. Is the \$1.6 billion increase in funding request actually enough to accelerate going to the Moon in the next 5 years?

ADMINISTRATOR JIM BRIDENSTINE: So that's a great question. It is enough for the year 2020. It enables us to get out of the gate with a good start and to do it in a way where we're not creating divisions inside the agency, where we actually get to be unified as an agency moving forward. That's what's so valuable about the \$1.6 billion.

It is absolutely true if you think about any development project that NASA has ever done in history, it follows a traditional bell curve. It starts off small, and then it gets bigger and bigger.

And then after the development is over and you start going into sustained operations, the bell curve starts coming back down. So that normal bell curve exists here.

What we have done is we have come out of the gate strong, and remember we just opened the conversation. That is what we did. I have heard criticism that somehow, well, NASA didn't work with Congress to do this or the administration didn't work with Congress, so it's dead on arrival. That is not the case.

The way the process works—and I know a little bit about it. The way the process works is that the administration makes a proposal to Congress, but that's what it is. It is a proposal. Then it's over to Congress to say what they want to accept, what they don't want to accept, what they want to plus-up. And so we have given them what we believe is necessary to achieve the goal, but what we gave them was an amendment for the year 2020.

The next step is we've got to come up with the budget proposal for 2021, and so that process, we are underway with right now, but know this. This is a good, out-of-the-gate, first start, a very honest proposal from the administration that keeps us all together and moving forward, and I think a bipartisan way. And that at the end of the day, we're going to be working with Congress to make sure that they're getting what they need to make this a successful program.

BETTINA INCLÁN: Wonderful. We're going to go for a question from the audience. Right here.

ATTENDEE: Curtis from the Office of Procurement, and my question is based on the industrial base, what I'll call the service provider base. Since we're on a very aggressive timeline, my question is, Are we incorporating the concept of making sure we have enough service providers, and not a single source where if something were to happen to them, we're stuck in space, so to speak? Can you talk about how we're going to be expanding our service provider base?

ADMINISTRATOR JIM BRIDENSTINE: You are making I think an excellent point which is NASA wants to be one customer of many customers in a robust commercial marketplace in low-Earth orbit. We eventually want to apply that to the Moon as well, but we also want to be one—we want to have numerous providers, numerous providers that are competing on cost and innovation and safety. Again, we're not going to do anything that jeopardizes safety. So it is high on our mind. I'll let Gerst answer the question more in depth.

WILLIAM H. GERSTENMAIER: I think another thing that we're doing that's important is we're creating interoperability standards. So we're not saying that the hardware has to be uniquely designed for one particular application. If you can meet this interface like the international docking standards, no matter how you build the docking interface, the two vehicles can come together and dock. We're going to set one for rendezvous and proximity operations, one for atmosphere, and one for power. So what that does is that really opens up the market.

So then even if somebody is not in the initial procurement and they're not actually moving forward with it, as the first time, those standards are out there. They can be building. They can be developing. They can be getting ready to go, and then their hard work and plug and play and move right into this architecture and move forward.

So I think we're trying to build an architecture that's open that allows folks to come at what speed they're ready to come in, and we can make interchanges back and forth with different providers as we move forward, and we're not dependent upon a single provider.

So, again, this is kind of an experiment in sustainability, but it's based on things we've done with Space Station. It's based on things we've done internationally. So it's proven in that sense, but now can we take it to this next level and do human landing kind of capability on the Moon? And then that's the goal of what we're trying to do.

ADMINISTRATOR JIM BRIDENSTINE: And I would add that the open architecture allows us to not just have multiple contractors or suppliers, providers of services in the United States of America, but in fact all around the world.

So the open architecture, the way we do data, the way we do communications, the way we do docking, the way we do life support, the way we do avionics, all of that data is going to be made available to the public, on the internet. Anybody can download it, and if there is a small country out there, for example, that wants to plug into the system, we'd love to have their capability join us. So this is a great opportunity to not just get more providers domestically, but all around the world and have the United States of America lead a coalition of nations for a sustainable return to the Moon to prove the technology, retire the risk, and go on to Mars.

BETTINA INCLÁN: Great. We'll take another question that was submitted. How do you envision each center's contribution to the Moon initiatives? For example, what is Goddard's role and current plan?

ADMINISTRATOR JIM BRIDENSTINE: So we go through a process for all of the technologies and all of the capabilities that we are developing, and that process ultimately will determine what centers are going to be responsible for which activities.

Bill, if you'd like to address that?

WILLIAM H. GERSTENMAIER: For example, Goddard is really critical now in our communications area. They do a lot of our activities for communications. They'll continue to do that.

We're looking at things like laser communication, which we're working with the Space Technology Mission Directorate on, and that activity will be part of Orion. It will be part of Gateway moving forward. Those things are there, some orbital mechanics and flight dynamics. Goddard will play a role there. SLS. Those have been assigned. Orion has been assigned. The

lunar elements, we're going to figure out where all of those go and then have discussions across the agency to go figure that out.

But I think the important thing is we need to figure out a way we can use the whole of the agency. This is something that is going to need every center contributing. We'll find pieces. You'll also see us build inter-center teams, where now we can have folks working from multiple centers all teamed together to go forward. I think even the Commercial Landing Services Program that Thomas is doing is also pretty much a multi-center activity, sponsored by a bunch of different civil servants that all come together and work on that project.

So we'll get those details as we come together. We'll work with the center directors. I think this Town Hall is kind of the first beginning of us starting to have this dialogue with the workforce to see where folks contribute. There may be work that is going on down in the centers that we are not aware of that maybe center directors are. They need to bring those forward. How can they be part of this effort? And we'll figure out a way to pull that together to build this strong, cohesive team to go do this activity.

ADMINISTRATOR JIM BRIDENSTINE: I would add, if it's okay, it's not—when he says an all-of-NASA approach, he means all of the mission directorates, all of the centers, and that's absolutely true. But it goes beyond that. This is an all-of-America approach. So when we think about how we're going to get our astronauts to the Moon, they're going to launch on SLS with an Orion Crew Capsule and a European Service Module. That right there makes the program internationally, and all of that is absolutely critical to achieving the end state of the next woman—or the next man and the first woman on the Moon in 2024.

It is also true that in order to get those landers aggregated at the Gateway, we're going to need a lot of launches with rockets that we don't purchase, own, or operate, but we're talking about buying services. People would call it commercial. Those landers ultimately need to be launched commercially, and we're looking at procuring those landers commercially as well. So this is an all-of-America approach. When we place the next humans on the Moon in 2024, it will be an all-of-the-above, very uniting effort that brings everybody together for this one moment in time that will be I think just monumental and something we can all tell our children and grandchildren about.

BETTINA INCLÁN: Fantastic. A question from the audience?

ATTENDEE: Hi. My name is Taylor. I'm from Kennedy Space Center.

So with the expedited schedule and an increase in budget, what actionable strategies is the agency taking to hiring a next-generation workforce who will ultimately be implementing and leading these programs in the decades to come?

ADMINISTRATOR JIM BRIDENSTINE: So that's an important question, and you are hitting something that I think we think about quite frequently, which is if you look at the average age

of our workforce, we're near 50. Is that right, Bob? Or are we at 50? We're at 50, which means we have this bow wave of retirements coming. So that is a challenge, but it's also an opportunity because we need that next generation to get inspired and enthused.

Well, imagine how many people are going to want to join NASA or join one of our service providers, maybe join one of our contractors, when they see this monumental achievement. If you walk around NASA today—and everybody who is of age will tell you. They remember exactly where they were when Neil Armstrong and Buzz Aldrin landed on the Moon. We are trying to create that moment for the next generation. That is what we are trying to do with this stunning achievement, and there's a lot of work to do. But I think we're getting there, but we do have to be thinking very acutely on this very specific challenge, which is the workforce, which largely in the next 10 years is going to start retiring.

Did you have something?

WILLIAM H. GERSTENMAIER: Yes. I was going to say this is a pretty exciting time because in my career, the development in human space flight is maybe every 10, 20 years. So maybe in your career, you get one chance to see a major development activity. We have got tons of development going on right now across the agency. So this is a great time to bring in new folks, and actually get them involved.

The work at the Kennedy Space Center, getting the mobile launch platform ready to go operate and doing the test out at the pad later this summer, I mean, those are really once-in-a-lifetime experiences for folks to get involved hands on, first of all, to see how hardware is developed, how systems are put together, and then how later they'll be taken to flight.

Same thing at the Marshall Space Flight Center, where the SLS 135-foot hydrogen tank sits there in the structural test article ready to be fully tested in new ways that it's never been tested. We completed the engine section. The inter-tank section is also going through structural testing. These are great times for new employees to get hands-on experience with real hardware that really augments the learning you get in school. It augments the academic learning, but it really gives you that hands-on experience. So we need to make sure we take advantage of that. We need to bring in co-ops, summer interns. This is a chance for new folks to get a chance to see and interact with hardware that will really set, I believe, their career in a very positive direction moving forward.

JAMES L. REUTER: And I'll add in Space Technology, we really view the development of our early career folks as being an essential part of what we do. We think we're the perfect platform to give people a chance to try and lead, and if it fails, then you learn. And so we are expanding our early career initiative activities and other activities for our early career and then applying them to activities that will support us for the Moon.

ADMINISTRATOR JIM BRIDENSTINE: Real quick, just by show of hands. If you're here right now and you were an intern at NASA, will you raise your hand?

[Show of hands.]

ADMINISTRATOR JIM BRIDENSTINE: We've got a good number. So our intern program is growing. I know Mike Kincaid has been working very hard on it. I encourage you at the centers all across this agency, when you have interns, give them meaningful work. Embrace them. Encourage them. Entice them to come back one day. That's what that program is all about, and we've had great success with it, but we're going to need more great success in the coming years, as you've correctly identified.

BETTINA INCLÁN: Great. We're going to take one or two more questions before we wrap up. Here's one. What is the status of the Mission to Mars Directorate? When will NASA reorganize so it has a mission directorate focused on the Moon and Mars instead of the current organization that gives priority to the ISS and SLS?

ADMINISTRATOR JIM BRIDENSTINE: That's a wonderful question, something that we're thinking about. Certainly, one of the challenges that we face is that NASA doesn't get to reorganize alone and unafraid. I wish we did. We have to talk to the folks over on the Hill. The appropriators that ultimately write our checks have a keen interest in how we're organized, and we have had some people express skepticism about the direction that we are going.

Now, that being said, know this. We are trying to focus on what works to achieve that ultimate goal in 2024. That's what we're trying to do, and I don't know at the end of the day how we're going to be organized. Know that where we are right now is where we are. Work within the current system as it exists, and when there is new news, which there isn't right now, but when there is new news, we will make sure everybody is informed at the right time. But right now, there's nothing new to report. We're just working through a process.

The other thing that's important to note is we had those plans on the agenda before the administration said we're going to accelerate by 4 years, and then the administration said anything that's not necessary is a distraction. So we're trying to figure out what are the things we need to do, what are the things we don't need to do, how do we not create extra burdens given that there is some skepticism on the Hill, those kind of activities.

BETTINA INCLÁN: Any questions from the audience?

[No response.]

BETTINA INCLÁN: With that, we're going to wrap up and giving some closing remarks.

ADMINISTRATOR JIM BRIDENSTINE: Sure. So I just want to say thank you, everybody, for the time today all across the agency and, of course, those of you in this room here at Headquarters. We've been given this monumental opportunity, and it wasn't just backed up with rhetoric. It was backed up with a budget request.

The next step is to communicate why this is so important for our country. We have had the conversation about my 11-year-old daughter. I'm sure there's people in this room that have their own daughters and want them to see themselves in this role in the future, not that everybody is going to be an astronaut. But people need to understand that opportunities like this are available to everybody in America, and that's really what this is all about.

But when we think about how important space is to our country, we need to be able to communicate not just inside the agency, but outside the agency. We need to be able to communicate how the Apollo program has led to absolutely stunning developments that have elevated the human condition, the way we communicate. A lot of you have heard me talk about this before. I have to keep talking about this.

By the way, this is on NASA TV. What does that mean? That means people who aren't affiliated with NASA will be watching it. The way we communicate has been changed, transformed, because of what NASA has done. Over-the-Horizon Communications, DIRECTV, DISH Network, XM radio, Internet Broadband from Space. The guy who comes from Oklahoma, I can tell you, without Internet Broadband from Space, there would be a lot of us that didn't have Internet Broadband at all, and now that's transforming the entire world.

But it goes beyond that, the way we produce food, the way we produce energy, the way we do disaster relief, national security, weather prediction, understand climate. All of these things have been transformed because of this little agency that gets really—it gets less of one-half of 1 percent of the federal budget, and by the way, there's polling out there that indicates that most of America believes we get over 6 percent of the federal budget.

[Laughter.]

ADMINISTRATOR JIM BRIDENSTINE: We're at less than one-half of 1 percent. The return on investment from this little agency has elevated the human condition in ways that nobody imagined in the 1960s or the 1970s, and what we're about to do is going to transform the world again. When we go to the Moon, it's going to require new technologies. It's going to require us to learn more about science than we've ever learned before. We're going to have to invent things and do things, and it will once again transform the human condition, so that 50 years from now when people are celebrating the Artemis program, 50 years from now when people are celebrating the new agenda to go to the Moon with the next man and the first woman, people are going to say, "Look at how this has transformed and elevated the human condition.

So this is a great opportunity for us. It's not just rhetoric. It's been matched by budgets. We need to communicate to all of America how this is good for our country and in fact good for the world, and of course, we here in Washington are going to be on the Hill talking about how this is a strong bipartisan effort to get to that end state, which we think is so important, which is an accelerated lunar program that at the end of the day is sustainable. In other words, this time when we're at the Moon, we're going to stay. We're going to prove technology. We're going to retire risk, and we're going to take all of it for the first mission to Mars.

So thank you for joining us for the town hall and look forward to getting to work to achieve this goal. Thank you, guys.

[Applause and cheering.]