

Senator Roger Wicker
Questions for the Record
Senate Committee on Commerce, Science, and Transportation
Nominations Hearing
November 1, 2017

Question 1. At Stennis Space Center in Mississippi, NASA and its industry partners are testing the next generation rocket engines for space exploration and national security space. They have already completed final test and assembly for the 4 RS-25s that will launch the first mission of SLS and Orion, known as Exploration Mission-1. And as of October 19th, they have already begun final assembly and testing for the RS-25s to be flown on the second launch of SLS and Orion.

Are you committed to continuing these efforts at Stennis to ensure we don't once again fall behind other nations when it comes to space launch and exploration?

A: Yes. Not only is Stennis Space Center NASA's primary rocket testing facility, but it is also in high demand for rocket testing by NASA's commercial partners. I am looking forward to the full-scale test of the SLS first stage, with the RS-25s integrated, at Stennis, expected late next year.

Question 2. What do you see as the long-term role of SLS and Orion within NASA's strategic vision for deep space human exploration?

A: SLS and Orion will serve as the backbone to our country's Deep Space exploration architecture. In order to go back into Deep Space, we need the ability to throw tens of metric tons of mass to trans-lunar injection as well as carry wide pieces of hardware, which the SLS will be uniquely suited to do.

Additionally, in order to travel to Deep Space, we need the Orion Multi-Purpose Crew Vehicle. Among other features, the Orion is designed with ECLSS to support astronauts for longer missions, is more hardened against radiation, and is designed to withstand the heat of re-entry from trajectories that accompany missions to Deep Space.

Question 3. Do you agree that long-term, consistent funding for these programs is essential to achieving our nation's deep space exploration goals?

A: Yes, I do. When it comes to NASA's biggest science and exploration missions we are discussing timelines of decades. Without long-term, consistent funding and support, progress and discovery could be prevented, taxpayer dollars wasted, and agency morale eroded. This is why it is crucial that NASA maintain its broad bipartisan support, and if confirmed I intend to work with Congress, the Administration, industry, scientists, academia and non-profits to develop a consensus agenda that is sustainable.

Question 4. Stennis Space Center was a vital element to our deep space exploration goals during the Mercury, Gemini, Apollo and Shuttle programs. It continues to provide critical rocket

propulsion testing for the SLS program. Do you agree that Stennis is the premiere Rocket Propulsion Test (RPT) center in the country? Do you also agree that keeping Stennis at that level of capability is vital to our national and long-term space exploration interests?

A: There is no question that Stennis the premier Rocket Propulsion Test center in the nation, and if I am confirmed as Administrator I will work to make sure that it stays the premier Rocket Propulsion Test center in the nation.

Question 5. I am concerned of reports that NASA is prioritizing funding to the maintenance and upgrades of other space centers while the rocket testing facilities at Stennis are in serious need of upgrades. What are your plans to fix this disparity and ensure Stennis remains at the forefront of our nation's propulsion testing capability?

A: For NASA to remain an agency on the cutting edge of technology and engineering development, it must be constantly reinventing itself and finding new efficiencies. To do this, NASA must do a careful accounting of its resources to determine what new acquisitions are needed, which old facilities can be mothballed or converted, and which aging facilities need upgrade investments. Should I be confirmed as Administrator, I will be my intention to make sure that every NASA center, including Stennis, has the resources it needs to accomplish the mission.

Question 6. With the presence of more than 20 private sector entities, the Stennis Space Center is an excellent example of a successful public-private venture. Space centers across the country are benefiting from co-location with commercial companies. However, NASA currently has limited authority to lease its property, and this authority will expire at the end of 2018.

Long-term leasing authority will allow NASA to enter into more cost-effective agreements. Expanding NASA's current leasing authority to include in-kind contributions will also allow space centers greater flexibility to pursue these public-private partnerships.

Do you see value in granting NASA's space centers this long-term, enhanced use leasing authority? Please explain.

A: If confirmed as Administrator, I will seek to utilize public-private partnerships that are in the best interests of NASA. Tools such as enhanced use leasing have been a valuable for NASA, and I look forward to working with Congress to determine how these tools might be improved or enhanced.

Senator Dean Heller
Questions for the Record
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Question 1. Ensuring continued U.S. access to critical materials used to support both NASA and the DOD is important for our national security. Among those materials is ammonium perchlorate, which is used as a propellant for rockets, missiles, and manned spaceflight.

What is your view on ensuring ammonium perchlorate is domestically sourced so that the U.S. continues to have a steady supply of this chemical?

Our contractor for the rocket boosters is Orbital ATK. Although the agency does not have a requirement to purchase ammonium perchlorate, NASA does have a requirement that our prime contractor ask for consent to subcontract in amounts greater than \$750,000. NASA only consents to the request and does not approve or consent to which company the subcontract is issued.

A: Ammonium perchlorate is a crucial material for NASA's human exploration plans. Each SLS launch will feature two solid rocket boosters which use ammonium perchlorate as their oxidizer. Each SLS launch will use close to two million pounds of ammonium perchlorate. That said, it would be inappropriate for NASA to directly intervene between a contractor and a subcontractor. However, I am committed to ensuring our nation has a robust domestic industrial base, and should I be confirmed I look forward to working with Congress to achieve this objective.

Senator Mike Lee
Questions for the Record
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Question 1. Mr. Bridenstine, in the documents you presented to the Committee, you stated that you believe that one of NASA's top challenges is "Bringing together traditional space companies and new space entrepreneurs into a comprehensive NASA vision to maximize resources and efficiencies."

What role do you envision the private sector playing in helping NASA fulfill its mission? How will continued private sector involvement make NASA more efficient and allow it to fully maximize resources?

A: We must recognize that NASA currently has more mission than it has budget. The days when NASA's budget represented 3 to 4 percent of the federal budget are not likely to return. Nor would we want to necessarily replicate that model, as it proved to ultimately be unsustainable. Fortunately, times have changed and great advancements have been made. The American space industry is more capable than ever before. A lot of this is due to advancements in research and technology development made by NASA decades ago that entrepreneurial Americans have taken and advanced further.

Should I be confirmed, NASA will develop exploration and science architectures that leverage everything the United States has to offer. This includes the private sector. This way, we will maximize resources and ensure NASA can carry out its mission.

Question 2. As you know, our current strategy for deep space exploration includes the development of the Space Launch System (SLS) and Orion space capsule. I'm proud to say that many Utahns have worked on several of the components for these projects.

- A. What is your view on the SLS and Orion Programs?
- B. How do you anticipate using the SLS and Orion in the National Space Council's call for a plan to refocus our human spaceflight efforts on a return to the Moon?
- C. What are your thoughts on the establishment of a Deep Space Gateway as part of the exploration architecture?

A:

- A. SLS and Orion will serve as the backbone of our country's Deep Space exploration architecture.

- B. SLS and Orion have the ability to deliver large payloads and humans further out into space than any other operating rocket and spacecraft. As such, they will be the backbone of any plan to return humans back to the Moon.
- C. The idea of a platform beyond LEO and in cislunar space provides a lot of opportunities for the United States. These opportunities include: partnerships with both the international community and commercial industry, staging area for lunar surface and Martian missions, testing life support systems outside of the Van Allen Belt, and more. Should I be confirmed, I look forward to working with Congress to determine if the Deep Space Gateway or other Deep Space architectures enable sustainable deep space exploration.

Question 3. What criteria would you recommend using in determining whether to extend United States support of the ISS beyond 2024 and when should that determination be made?

A: I believe continued presence in low Earth orbit (LEO) is in our national interest, and should I be confirmed, the decisions NASA makes will be influenced by this objective. The International Space Station has been a crowning achievement of diplomacy in space, and has facilitated great advancements in science and research as well as the development of the LEO economy.

The decision of whether to extend United States support of the ISS beyond 2024 is a complicated challenge. We must weigh several key factors. For one, we must consider what the LEO research needs are of NASA and its partners like CASIS. Second, we must weigh NASA's needs for astronaut activities and training in LEO. Third, we must weigh whether the market exists for a profitable commercial LEO platform. Fourth, we must weigh how we can best maintain the international partnerships which are so crucial to our current ISS program. Fifth, we must weigh how much money we can afford to continue spending on a human platform in LEO, and how we can make sure that we have a sustainable budget wedge for Deep Space Exploration.

If I am confirmed as NASA Administrator, I intend to work with Congress to weigh the options and to determine the best path forward for the ISS.

Senator Todd Young
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Question 1. Representative Bridenstine, though it doesn't receive as much public attention as NASA's exploration missions, the agency's Earth Science mission provides data critical for both scientific research and practical application. In fact, Indiana companies contribute to these missions by building sophisticated instruments to measure certain properties and conditions in the atmosphere. In turn, this data in part feeds into weather forecasting models to help create longer term and seasonal forecasts utilized by a variety of industries, such as agriculture and energy. I'm focused on making sure we retain the capability to perform these science missions that have a significant real-world application. Would you explain your view of NASA's Earth Science mission and whether you intend to prioritize it in future NASA budget submissions?

A: I support NASA's Earth Science mission. As a Representative from and resident of the state of Oklahoma, I have a keen appreciation for the role space plays in helping us save lives, protect property, and produce energy and food. NASA's Earth Science mission is critical to facilitating these activities, both through the programs that NASA operates itself as well as acting as the procurement agent for NOAA's weather satellites.

If confirmed, NASA will continue to follow the guidance of the Earth Science decadal surveys and I will advocate within the Administration and with Congress to see that the agency is able to carry out the recommendations of those decadal surveys.

Senator Jim Inhofe
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Question 1. Some have expressed opposition to your nomination because Members of Congress are too political. It would be an asset to have an Administrator of NASA who can articulate a vision to Members of Congress responsible for authorizing and funding that agency. James Webb, was political – he was also a military pilot and worked in Oklahoma – and he successfully lead NASA during the Gemini and Apollo Missions from 1961-1968. How do you believe your service as a Member of Congress will help you as the next Administrator of NASA?

A: While in Congress, my committee assignments have allowed me to be involved in a wide array of space policy on a bipartisan basis. On the House Science, Space and Technology Committee, I served on the Space Subcommittee which oversees NASA as well as commercial space policy. I also served as the Chairman of the Environment Subcommittee during the 114th Congress, where we oversaw NOAA and did a lot of work on NOAA's satellite programs. Additionally, I was a member of the House Armed Services Committee, subcommittee on Strategic Forces, where we focus on the country's national security space enterprise. My time on these committees allowed me to develop an expertise and understanding of the United States' space program.

My time as a member has given me firsthand knowledge of the legislative and budget processes. The next Administrator will be required to work with Congress, the National Space Council, the Office of Management and Budget, the White House, and international partners. An understanding of these entities, and relationships with those leading them, will be critical to maintaining America's preeminence in space.

Question 2. As the Senator for Oklahoma, I serve on the Senate Armed Services Committee. I know that we face threats today that we have never faced before, something you know as a Member of House Armed Services Committee. What do you see as NASA's role in national security and how will you work with the Department of Defense as NASA Administrator?

A: NASA is an agency dedicated to the peaceful exploration of space, technology development, and utilization of science. It is also a wonderful tool of foreign policy and diplomacy for the United States. When relationships with certain countries become strained, NASA is able to maintain partnerships between civil space programs. It is important we continue and strengthen those partnerships, and this would be a priority of mine should I be confirmed. NASA is uniquely suited to enable partnerships in space that can decrease misperceptions and prevent catastrophic kinetic warfare in space.

It is also true that the Department of Defense can benefit from technology development that NASA has undertaken for civilian purposes. For instance, NASA is currently pursuing the development of hypersonic technology. This will be a paradigm shifting proposition for our national security. Additionally, a partnership between NASA, the Air Force, and industry delivered the Automatic Ground-Collision Avoidance System to reduce the incidence of distracted or incapacitated pilots colliding with nearby terrain. This technology also has the potential to reduce collision threats to vehicles on land, at sea, or in space.

Question 3. In March, the President signed into law the NASA Transition Act. This legislation passed Congress without a single no vote. It outlined a roadmap for NASA's core missions: space science, space technology, aeronautics, human space flight and exploration, and education. Would you agree that these are NASA's core missions? How will you work to advance these core missions as Administrator?

A: Yes, I agree. I was involved, with many members of the Senate Commerce Committee as well as the House Science Committee, in the crafting of the NASA Transition Authorization Act of 2017. I fully support the core missions of NASA that it identified.

In order to advance these core missions, we cannot look at NASA's various mission directorates and divisions as siloed or mutually exclusive. NASA's programs often serve multiple purposes. Take the International Space Station as an example. It is operated under the Human Exploration and Operations directorate, and important research on long term spaceflight is being done to inform explorations deeper into space. Synergistically, the ISS also has science payloads that observe both the Earth and the cosmos. And of course, ISS astronauts often do downlinks with school children, a unique educational experience that excites like no other.

There are many synergies within NASA's mission directorates. We can make resources go farther if we do not view missions and programs as a zero sum game. Should I be confirmed, I will seek to maximize those synergies in order to advance NASA's core missions.

Question 4. President Trump reestablished the National Space Council, to ensure all aspects of our nation's space power—national security, commerce, foreign relations, exploration, science—are coordinated and aligned at the highest levels of government. What role do you see for National Space Council in the development of America space policy?

A: Multiple agencies are involved in space either as policymakers, regulators, or operators. If the United States is to remain the preeminent spacefaring nation, we must take a whole of government approach to the space enterprise with a formal method of interaction. This warrants an entity that can facilitate a discussion at the principals' level, which is the most important role the National Space Council (NSpC) can play. I am encouraged by what we saw at the first meeting of the NSpC in October of 2017. Should I be confirmed, I look forward to actively participating as a member of the NSpC.

Question 5. Our nation's investment in NASA has spurred innovation across our industrial base and the wider economy. In fact the "Aeronautics" part of NASA has helped drive research leading to more fuel efficient and streamlined airframe and wing designs. Today, NASA is working to develop the X-57 Maxwell, an all-electric powered airplane. I know you are familiar with the X-57 Maxwell program, do you believe it represents how Congressional investment in NASA can pay dividends in the private sector and throughout the economy?

A: Yes I do. NASA has a long history of advancing aeronautics. These advancements have allowed the United States to become the world leader in aircraft and aerospace manufacturing. As technology continues to progress, NASA's research in this area will play a key role in maintaining our industry's lead. This will be a priority of mine should I be confirmed.

Question 6. December 14, 1972 was the last time someone walked on the surface of the Moon, almost 45 years ago. Since then, we have seen major investments by NASA to build launch the Hubble Telescope and the International Space Station. More recently, the private sector has made major investments in research and development in support of low-earth orbit launches. As NASA Administrator, will you work as to promote a "unity of effort" across all space stakeholders to leverage public and private sector resources to support NASA's core missions?

A: In order to promote a unity of effort, NASA must start with guidance from Congress, the Administration, and science decadal surveys, then design the architectures to meet our national interests. Should I be confirmed NASA will determine how to fill out those architectures through a combination of government backbone, commercial partnerships, and international partnerships. Flexibility in the architectures that allows for the greatest use of resources will be my goal, should I be confirmed.

Senator Deb Fischer
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Question 1. Representative Bridenstine, you have been strong proponent of the Commercial Space Launch Competitiveness Act and other measures to support commercial space exploration. Commercial space exploration will likely be what takes us back to the Moon and ultimately to Mars. I am encouraged by measures the House and Senate have taken to spur these innovations. Going back to the moon in a meaningful way and manned travel to Mars will require the realization of innovations currently in their early stages, such as asteroid mining to produce fuel in space, with support from both the private sector and NASA.

As such, the use of water and fuel in space, harvested from asteroids, has the potential to greatly reduce the cost and complexity of lunar and Mars missions. Will the use of commercially provided asteroid resources be part of NASA's exploration plans?

A: In order to move sustainably into Deep Space, in-situ resource utilization will be required. We must exploit the vast resources that are available throughout the Solar System. For instance, water ice on the Moon, could be split into oxygen and hydrogen for spacecraft fuel and life support. Water ice is available in large quantities throughout the Solar System. Should I be confirmed, NASA will look to study and characterize the amount and nature of the water ice on the Moon, as well as other celestial bodies. The capabilities needed to extract and utilize this resource would be a focus of the space technology program I plan to lead, if confirmed.

We must also recognize the private sector entities with stated objectives to harvest resources from asteroids and other celestial bodies. In the future, they could play a role in NASA's exploration plans. If confirmed, NASA will examine and consider opportunities for partnership with these commercial entities.

Question 2. Earlier this year, the President signed into law the NASA Transition Authorization Act. This law seeks continuity in NASA's core programs, such as the Space Launch System and Orion spacecraft. Do you intend to continue NASA's work on SLS and Orion?

A: Yes, I am absolutely committed to continuing NASA's valuable work developing SLS and Orion, which will serve as the backbone of our architecture to return humans to the Moon, on to Mars, and further into Deep Space.

Senator Shelley Moore Capito
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Question 1. Our nation's civil, military, and commercial satellites are more vulnerable than ever before to interference from potential adversaries around the world. The ability to engage with and refuel our satellites adds years to their lives, which means our orbital assets are more robust. I am proud that the West Virginia Robotic Technology Center (WVRTC) at West Virginia University is leading the effort in developing this capability as part of NASA's Restore-L mission. I am deeply concerned by efforts to re-scope the mission to a ground demonstration, which will likely end the program and deprive us of a critical capability. Unfortunately, the Administration wanted to eliminate this mission and I am glad that we were able to continue funding the mission in CJS FY' 18 appropriations bill. NASA and the WVRTC can utilize robotics for on-orbit assembly, orbital debris removal, planetary resource utilization, and habitat construction for Moon or Mars exploration.

Do you see robotics and astronaut-robot collaboration as critical capabilities for NASA's exploration objectives?

A: Yes. Robotics, both for satellite servicing and in-space robotic assembly, will be critical to sustain and advance satellite architectures, decrease costs, and mitigate space debris. Satellite servicing missions have the ability to upgrade existing satellite infrastructure and extend crucial science missions for years. If confirmed, working with Congress, I plan to continue NASA technology development for satellite grappling, rendezvous and proximity operations, transferring propellant, and robotic modification and replacement of satellite payloads.

Deep Space exploration also requires robotic technology to conduct sample return operations from distant planets. West Virginia University recently won NASA's Sample Return Robot Centennial Challenge. This was a five-year competition among citizen inventors that will inform NASA as it develops a new generation of autonomous rovers.

Question 2. NASA's Independent Verification and Validation (IV&V) Program is a world leader in systems and software engineering. IV&V provides the NASA's highest achievable levels of safety and cost-effectiveness for mission critical software. Other government agencies are seeking and purchasing their services because of their quality and the value they add.

Do you support an appropriate and stable budget for NASA's IV&V Program and will you work with me to help save government resources by maximizing IV&V's capabilities across other government agencies?

A: Yes. As a former Navy pilot and current Air Force pilot, I am keenly aware that software is essential to safety and mission assurance. Software is also often on the critical path for systems development, so delays result in disproportional cost increases. NASA's IV&V facility has

proven itself capable of improving safety, keeping projects on track, enhancing system development, and even providing valuable research opportunities and training for young STEM students. It serves a critical role within the Office of Safety & Mission Assurance, providing independent safety oversight for NASA Headquarters. If confirmed as Administrator, I will work with Congress to make sure that the IV&V program retains an adequate and stable budget, and to exploit its capabilities wherever possible.