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U.S. Senate Reviews NASA's Science Priorities

Does life exist beyond Earth? Can we find it? What science should NASA prioritize in the near future? How will the agency reach its lofty exploration goals on time and within budget?

These were the central questions at a hearing in U.S. Senate offices on 1 August that focused on assessing the current priorities of NASA's Science Mission Directorate (SMD). During the hearing, senators heard testimony from scientists and administrators whose expertise covers the wide range of NASA's mission.

"As we look to draft a new NASA authorization act, hopefully this year, it is imperative that we continue to make progress answering [these questions]," said Sen. Ted Cruz (R-Texas), chairman of the Senate's Subcommittee on Space, Science, and Competitiveness, which convened the hearing.

During a previous hearing on 25 July, the subcommittee heard testimony about sending humans to Mars, a recent priority handed down from President Donald Trump. During the 1 August hearing, the subcommittee

sought to assess NASA's science priorities ahead of Congress's reauthorization of NASA by the end of 2018. Congressional authorization is a regular process that confirms a federal program's continued operation, defines the scope of its mission, and allows it to receive appropriated funding.

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Cruz stated that Congress must "also equip NASA with the capabilities that it needs to support science missions and priorities that will lead to discoveries across our solar system." He added, "This is a momentous time to be involved in space exploration."

What should NASA's science priorities be? Here are five key takeaways from the witnesses at the early August hearing.

1. Decadal Surveys Have Their Drawbacks

NASA currently sets its science priorities by following decadal surveys put together by the National Academies of Sciences, Engineering, and Medicine. These comprehensive overviews declare what the space science community believes to be the most important outstanding science questions and the missions needed to answer them.

The witnesses at the hearing, however, disagreed about how effective the decadal survey process is at deciding what's best for the space science community.

Sara Seager, a professor of astrophysics and planetary science at the Massachusetts Institute of Technology in Cambridge, explained that "the whole community feels that if they don't have one mission that the entire community buys into, that it will never get selected by the decadal survey." But getting that buy-in can lead to complex "all-in-one" missions, such as the delay-ridden James Webb Space Telescope, that may be too far beyond our technological capabilities to produce on time, she said.

There's also a generational issue, according to Seager. The scientists deciding what goes into a decadal survey are "the senior seed people who wouldn't necessarily vote the same way that the new generation would," she said.

Ellen Stofan, director of the Smithsonian's National Air and Space Museum in Washington, D. C., disagreed, arguing that the decadal process is effective as is. However, she believes that it could be more representative. "If we don't focus on increasing diversity in science, technology, engineering, and math," she said, "we are doing a disservice to our country because we are not tapping into the talent of all of our nation."

"It's really important that a diverse set of opinions are being listened to," added Thomas Zurbuchen, who is the associate administrator of



The gold primary mirror of the James Webb Space Telescope, NASA's next flagship telescope mission. This photo was taken in April 2017 when the telescope mirrors were still at NASA Goddard Space Flight Center in Greenbelt, Md. Credit: NASA/Desiree Stover

SMD, “because that’s where good decisions come from: people with different backgrounds and different priorities.”

2. James Webb Space Telescope Frustrates yet Excites

NASA’s next flagship telescope, the James Webb Space Telescope (JWST), is currently under development and has undergone a frustrating set of delays and cost growths, witnesses attested.

“These large projects are challenging and require perseverance,” said David Spergel, a professor of astronomy at Princeton University in Princeton, N.J. “JWST’s delays are frustrating to all of us.”

JWST, the successor to the aging Hubble Space Telescope, was originally estimated to cost \$500 million and be launched in 2007. Its current cost estimate is \$9.6 billion, and it is scheduled for launch in 2021.

“I think that if we went back in time,” Spergel acknowledged, “we would have preferred to be able to build a 4-meter James Webb Space Telescope that would have launched for less money a decade ago and do other things.”

But regardless of setbacks, the behemoth telescope will be worth the wait, the witnesses agreed.

“The exoplanet community remains tremendously enthusiastic,” said Seager, “because the JWST will provide our first capability to study exoplanets in the search for life.” Seager is an exoplanet researcher and has taken a lead role in many current and past exoplanet missions.

And the telescope will be a boon to more than just the science community, according to Spergel. “The eventual success of this complex engineering project will be a source of national pride and a symbol of U.S. technical prowess,” he said.

3. Earth Science Should Not Be Left Behind

“One of the portfolios within NASA’s Science Mission Directorate that is often overlooked, but is absolutely vital, is Earth science,” Sen. Edward Markey (D-Mass.), the subcommittee’s ranking member, said at the hearing. He cited such recent natural disasters as wildfires, 2017’s devastating Atlantic hurricanes, and ongoing droughts around the world.

These disasters, Markey said, demonstrate that our Earth science investment “must be both abundant and unwavering.”

Zurbuchen agreed. “There is no program in NASA science that has more direct impact to everyday life than our Earth science program,” he said in his testimony. “Whether it is developing the tools to predict severe weather or



The four expert witnesses who testified before the Senate Subcommittee on Space, Science, and Competitiveness on 1 August. From left to right are Thomas Zurbuchen, Ellen Stofan, David Spergel, and Sara Seager. Credit: C-SPAN

drought, or whether it is to understand the complex interactions of the Earth system, what we learn here affects our lives.”

Zurbuchen added that NASA will remain committed to maintaining its current level of Earth science observation and research.

4. Private Sector Partnerships Will Lead to Rapid Progress

The witnesses agreed that the rise of commercial spaceflight companies in the past decade provides NASA with new avenues for streamlining its mission development and launch procedures.

“It’s not our intent, ever, to compete with the private sector,” Zurbuchen said at the hearing. “Our intent is to grow that sector and benefit from positive partnerships, to really offload things that are possible there so we can focus on the bleeding edge [of science].”

Stofan put the situation simply. “It’s really important for NASA to stay focused on what only NASA can do,” she said.

“The ecosystem of potential partners has gotten much bigger,” Spergel testified. “I think there’s opportunity for NASA to partner not only with the Boeings and the SpaceXes but with the many small companies that are coming up in robotics, electronics, and machine learning.”

Partnering with the private sector might even lead to quicker advancements. “The seat of innovation is the private commercial industry,” Seager explained to the listening senators, “because they can afford to take risks that NASA cannot.”

5. The Big Question of Our Time Is Whether Life Exists Beyond Earth

In its 2017 NASA reauthorization, Congress charged the agency with dedicating resources to searching for life in our solar system and beyond. Is there life elsewhere? asked Cruz at the hearing. If so, why should we prioritize finding it?

“We know that life is tenacious, diverse, and highly adaptable,” Stofan replied. “Given the commonality of conditions here and elsewhere in the solar system, it is highly unlikely that life is unique to our planet.”

The answer to whether life exists elsewhere will likely be a game changer. “I believe it’s one of the big questions of all of humanity,” Zurbuchen said at the hearing. “This will be one of those questions that, if answered, will be remembered forever. It will be a leap, not only in understanding more about nature but in learning about ourselves at a level that we’ve never had in the past.”

And the hunt itself may have effects as wide reaching as the Apollo program’s. “Most senior engineers today...were inspired by the Moon landings,” said Seager. “And today the equivalent to that is the search for life. When we do discover it, it will inspire that next generation.”

“Although we don’t have evidence for life beyond Earth,” she said, “we are the first generation with the capability to find it.”

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