National Aeronautics and
Space Administration

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Committee on Science, Space, and Technology
Subcommittee on Space and Aeronautics

U.S. House of Representatives

Statement of:
Ms. Robyn Gatens
Director, International Space Station Division
Human Exploration and Operations Mission Directorate
National Aeronautics and Space Administration

117th Congress

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Chairman Beyer, Ranking Member Babin, and Members of the Subcommittee, I am honored to appear before you to discuss the International Space Station (ISS), the world's preeminent orbital microgravity platform for research and development. For more than 20 years, the ISS has supported cutting-edge research that benefits humanity, including in-space manufacturing of novel materials and life-saving medical products; helped to understand the Earth's climate; and provided an unparalleled platform for Science, Technology, Engineering, and Mathematics (STEM) engagement. The ISS has been and continues to be a positive example of international partnerships.

The research conducted on ISS has helped to advance science and improve life on Earth. Technology demonstrations and development on board have progressed the state-of-the-art for applications both on Earth and in deep space. Climate sensors deployed on ISS have validated climate models and contributed a host of new information about Earth's changing climate environment, while space science instruments on board have advanced our knowledge of everything from neutron stars to dark matter. The Station's crew itself has been a critical part of the experiment as well, using their own bodies as test subjects for research into human adaptation to living and working in microgravity. Without these long-duration demonstrations and experiments into the human and vehicle joint system, human exploration of the solar system will not be possible.

The ISS is now entering its third and most productive decade of utilization, including research advancement, commercial value, and global partnership. The first decade of ISS was dedicated to assembly, and the second was devoted to research and technology development, and learning how to most effectively conduct these activities in space. The third decade is one of results, where research capacity will be maximized due to the commercial crew and cargo programs, deep space exploration technologies will be verified to support human exploration of the solar system, medical and environmental benefits will continue to be returned to humanity, and the groundwork is laid for a commercial future in space.

Today, with commercial crew and cargo transportation systems online, the ISS is busier than ever. The ISS National Laboratory, responsible for utilizing 50 percent of NASA's resources on board the ISS, hosts hundreds of experiments from other Government agencies, academia, and commercial users to return benefits to people and industry on the ground. Meanwhile, NASA's research and development on board is advancing the technologies and procedures that will be necessary to send the first woman and first person of color to the Moon and the first humans to Mars.

The ISS is also now entering an era of robust commercial use, taking advantage of the utilities provided by the ISS to develop the capabilities industry needs to move from being dependent on NASA for access to space to providing the access NASA will need to continue its mission in low-Earth orbit (LEO) after the lifetime of the ISS. Commercial crew and cargo transportation are well known examples, and today provide the vital lifeline from the Earth to the ISS. Perhaps less known are over 20 commercial facilities operating on board ISS today, including a 3-D printer, a bioprinter, external Earth observation and materials platforms, and an airlock, that are available for use by both NASA and other paying customers.

The ISS provides the United States and our partners with unmatched capabilities in space. NASA operates ISS in partnership with four other space agencies, representing 15 countries, offering high-profile opportunities for U.S. leadership in civil and robotic spaceflight. At a time when other nations are seeking to expand their abilities to operate in space, the ISS remains the premier example of how an international team can productively and successfully cooperate in space over the course of decades. The United States will maintain and expand its international partnerships during and after the transition to commercial low-Earth orbit destinations (CLDs).

That said, the ISS is now more than 20 years old and is relatively expensive to operate. NASA is currently exploring, with its international partners, the extension of ISS operations to 2030, by which time we hope to have cost-effective commercial alternatives that will allow retirement of the Station. This approach would continue to return these benefits to the United States and to humanity as a whole, while preparing for a seamless transition of these missions to commercially-owned and -operated LEO destinations that will follow. The ISS is certified technically to continue to operate until at least 2028, and there are no engineering issues that NASA is aware of that would preclude safely and productively operating the ISS through 2030. Indeed, the ISS itself has been recently upgraded with a new commercial airlock, a new Russian research and docking module, and several power system upgrades that will operate for the life of the vehicle.

A number of research investigations and technology development activities that are necessary to extend human presence into the solar system require capabilities that at this time can only be provided by the ISS. NASA maintains roadmaps for these activities, including the ISS Technology Demonstration Fly-Off Plan and the Human Research Program Plan for Risk Reduction. These roadmaps show the plan for using the remaining life of ISS to accomplish what must be accomplished there, before moving any remaining and future work to CLDs. The ISS and future CLD platforms are more cost-effective locations than deep space to practice protocols to prepare humans for Mars missions. Long-duration crew stays in a microgravity environment followed by landing on Earth can to some degree replicate the conditions that astronauts will need to perform on a trip to Mars.

NASA envisions a bright future for the LEO economy. By the early 2030s, NASA plans to purchase crew time for at least two – and possibly more – NASA crewmembers per year aboard commercial CLDs to continue basic microgravity research, applied biomedical research, and ongoing exploration technology development and human research, informed by the first several Artemis lunar landings. These activities could be supplemented by crew time purchased by NASA from a commercial provider using the provider's own private astronauts. The CLDs would be visited on a rotating basis by other private astronauts unaffiliated with the CLD provider, seeking either research time for their own experiments, or tourists looking to visit and experience space.

After the end of the ISS, NASA plans to continue to provide support for research in LEO based on the successes and lessons learned of the ISS National Laboratory. We hope that our other U.S. Government partner agencies will join us in doing so. This will provide continuity for academia, research institutions,

U.S. Government Agencies (including NASA), and developing industries to continue their work using the unique environment of LEO.

NASA is already laying the foundation of this future. Extending the operation of ISS could give U.S. private industry time to develop the capabilities and experience to operate in LEO, and to deploy the platforms that will meet the needs of NASA and other users there. In January 2020, NASA competitively awarded a contract to Axiom Space for the use of the forward Node 2 port on ISS, on which they will deploy a commercial module in the 2024 timeframe. This module will support private activities in LEO that could otherwise not be accomplished on the Government-owned ISS, proving out a business plan for commercial platform operations. Axiom plans to add more modules to this complex with the eventual aim of departing ISS and becoming a free-flying destination in LEO.

In order to maintain competition for safe, reliable, and cost-effective CLDs, NASA recently released a solicitation to stimulate U.S. private industry development of free-flying orbital destination capabilities and create a market environment in which those services are available to both Government and private-sector customers. NASA's hope is to make two to four awards for commercial free-flyers, provided that sufficient funding is available to do so. These awards, combined with the Axiom port segment, will ensure that private industry is ready to provide CLD services prior to ISS retirement so that there is no gap in U.S. presence in LEO.

After Axiom and the other CLD partners have matured their designs over the next three to four years, NASA intends have a second phase of activity whereby NASA first contracts with industry to certify their designs as safe for NASA personnel and then goes on to purchase services from the CLD providers. This second phase is similar to the Commercial Crew transportation Capabilities (CCtCap) contracts that NASA awarded to SpaceX and Boeing for the Commercial Crew Program. Thus, NASA is building on the successful legacy of our commercial crew and cargo programs that are currently delivering important research, supplies, and NASA astronauts to the ISS.

These activities will enable the development of commercially-owned and -operated LEO destinations that are safe, reliable, and cost-effective, and will allow NASA to be one of many customers in LEO. With the introduction of CLDs, NASA expects to realize efficiencies from the use of innovative, efficient, and cost-effective platforms using a more commercial approach to meeting the Agency's needs in LEO. As commercial LEO destinations become available, NASA intends to implement an orderly transition from current ISS operations to these new commercial LEO destinations. Transition of LEO operations to the private sector will yield efficiencies in the long term, enabling NASA to shift significant financial and personnel resources towards exploration objectives. NASA envisions a transition period, during which both ISS and CLDs are operational, of roughly two years. This would allow a gradual transfer of NASA activities from ISS to commercial platforms, while allowing NASA and its commercial partners to incorporate lessons learned from the first round of activities on CLDs into subsequent activities.

To give future commercial providers a business model to work towards, NASA is refining its "Forecasting Future NASA Demand in Low-Earth Orbit: Quantifying Demand"[1] white paper, and will define NASA's anticipated service requirements for future CLD providers. These forecasts will include not only the anticipated NASA demand for crew accommodation, technology testing, human research, and science, but also capture the expected future needs of other U.S. Government, private, and international users. The intent of this activity is to allow future CLD and launch providers to scale their

[1] https://www.nasa.gov/sites/default/files/atoms/files/forecasting_future_nasa_demand_in_low-earth_orbit_revision_two_-_quantifying_demand.pdf

activities to meet the future needs of the U.S. Government, while also allowing them to design private use of the capabilities. Given the unique barriers of access to space, NASA and the ISS National Laboratory are partnering to support and incubate promising commercial in-space manufacturing applications such as advanced materials, regenerative medicine, and tissue engineering through the ISS National Lab, with the goal of creating sustained, self-sufficient demand for future CLD services. Other demand-enabling initiatives include allocating a portion of ISS resources for commercial use activities and private astronaut missions on a reimbursable basis.

It is in the interests of the United States that a seamless transition be effected from ISS to a future CLD such that no gap in U.S. human spaceflight capability is experienced. A gap could jeopardize the strong network of U.S. Government, international, and commercial research and technology partnerships that have developed over the last two decades. Operating ISS beyond 2025 gives NASA and U.S. commercial industry the time necessary to bring one or more CLDs online, concurrent in the late 2020s with ISS operations, to ensure that these new capabilities can meet the needs of NASA, its partners, and the Nation.

Thank you for the opportunity to discuss the International Space Station; I would be pleased to respond to any questions you might have.

Robyn Gatens
Director, International Space Station
NASA HQ

Ms. Robyn Gatens is the director of the International Space Station (ISS) in the Human Exploration and Operations mission directorate at NASA Headquarters. She is also an agency senior expert for environmental control and life support (ECLSS) and crew health and performance systems.

As ISS director, Gatens leads strategy, policy, integration, and stakeholder engagement for the space station program at the agency level, including use of the station for research and technology demonstrations including to support NASA's Artemis missions, and activities to secure an ongoing U.S. presence in low-Earth orbit (LEO) by enabling a successful, long-term private sector commercial LEO space economy.

In her 35 years at NASA, Gatens has led the development and management of life support and habitation systems for human spaceflight missions. She has also led agency strategic and budget planning to mature these habitation system technologies needed for future deep space exploration missions, using the ISS as a demonstration testbed.

She began her NASA career in 1985 at the Marshall Space Flight Center in Huntsville, Alabama. She held various leadership positions at Marshall, including manager for the Orion spacecraft crew support and thermal systems before transferring to NASA Headquarters in 2012.

Gatens is the recipient of NASA's Outstanding Leadership and Exceptional Achievement Medals and holds a Bachelor of Chemical Engineering degree from the Georgia Institute of Technology.