

THE ISS AFTER 2024: OPTIONS AND IMPACTS

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Chairman Babin, Ranking Member Bera, and Members of the Subcommittee, I am pleased to have the opportunity to present the Commercial Spaceflight Federation's views on "The ISS after 2024: Options and Impacts." I'm Eric Stallmer, President of the Commercial Spaceflight Federation, which represents 70-plus companies and tens of thousands of employees dedicated to America's future in space.

In my testimony, I will lay out a sustainable vision, not just for human space flight in low Earth orbit (LEO), but for America's broader and deeper space ambitions. This discussion is not just about the value of ISS in and of itself, or even to NASA's exploration agenda for the Moon, Mars, and beyond. The right yardstick is America's future economic development and settlement of space, starting with LEO but expanding outward. Clearly we want our first long-term international space station to be a firm steppingstone to that grander future.

By next year, for the first time in U.S. history, our space program will have multiple means of safely and affordably getting science experiments, other cargo, and crew to space. The ISS is currently expected to be utilized through at least 2024, but this Committee is posing the question of what should occur after. My testimony will focus on the following areas:

1. The ISS should be sustained beyond 2024 to the extent that the space station is technically capable and safe to remain in orbit. In addition, rather than abruptly ending such a major program without a functional successor, any ISS transition plan should

prepare an evolutionary path in order to avoid disrupting science and operations on orbit, and unnecessary economic upheaval to local economies.

2. To maximize return on investment for the Nation, commercial utilization of the ISS should be expanded, and NASA should take advantage of opportunities to offset some of the costs to maintain the space station.

3. NASA should use public-private partnerships to develop commercial space capabilities and services to support its cis-lunar activities, and should use commercial launch systems to support and augment these activities.

The ISS Today

The International Space Station (ISS) is one of the greatest achievements of our time. It is an engineering marvel, built and operated in concert with our partners around the world at a cost of over \$100 billion. It is a treasured national lab, which is being managed by CASIS, contributing to key scientific breakthroughs in science, and it represents the longest ever sustained human presence in space. It is the foundation of humanity's voyage to the stars, and the commercial spaceflight industry is proud to play a key role in its continued success.

CSF represents 70-plus companies and tens of thousands of employees dedicated to America's future in space.

Given this incredible investment, we need to ensure that we are maximizing our scientific and economic return from this unique asset. As the Space Shuttle program was winding down, NASA recognized that new partnerships with the private sector would best allow the agency to serve the needs of ISS while also significantly reducing costs. So, in 2006 during the Bush administration, NASA started the Commercial Orbital Transportation Services (COTS) program. This effort has been an undeniable success. By partnering with private industry under efficient fixed price Space Act Agreements (SAAs) that required co-investment for development, NASA now has two new launch systems and two new spacecraft for routine resupply to and from the ISS, with a third system from Sierra Nevada Corporation on the way

We are grateful for the Committee's and the Congress' recognition of the value of SAAs and for your support of this important tool in the recent NASA Authorization bill.

In addition to supporting NASA's logistical needs, one of the goals of the Commercial Cargo program was to stimulate what had been a declining U.S. spaceflight industry. It's

clear that was achieved. Following the introduction of the Falcon 9 launch vehicle and the certainty provided by ISS as an anchor customer, SpaceX, as well as a growing number of new American commercial launch companies, are recapturing a majority of the world's multi-billion dollar commercial launch market after years in which the U.S. was simply not competitive. That means thousands of high-tech jobs and billions of dollars flowing back into the U.S. economy that otherwise would have gone overseas.

Building on that success, NASA has pressed ahead, partnering with the U.S. commercial space industry, to restore America's human spaceflight capability in 2018, once again sending American astronauts to space from American soil aboard American rockets and spacecraft. Here, too, ISS remains a valuable component of the economics for ongoing commercial development of innovative space systems, new technologies, and scientific research.

We are learning how to make flying to and from space, and living in space, safe and routine. These developments are valuable for missions beyond Earth.

Maximizing the Use of ISS

The goal of our space program has always been to achieve both significant scientific progress and a sustainable human presence in space. The ISS has been successful in each of these by any measure. With operational cargo flights and, soon, crew flights achieving a steady flight cadence, the value of the ISS as a national asset has grown. There are more opportunities than ever to perform the key science and engineering experiments for which the station was designed.

In addition, the private sector has jumped at the opportunity to support important research on ISS. Companies like Bigelow Aerospace, Planet, and NanoRacks are testing exciting new technologies like inflatable habitats to help us go to deep space, developing new generations of advanced satellites, and opening up opportunities to a broader utilization community to fly thousands of experiments. This is precisely the kind of response that this Committee had envisioned when it challenged NASA in the Commercial Space Act of 1998 to open ISS' airlocks to commercial industry. We are grateful to both Congress and NASA for having that vision and for the resultant opportunities today.

The Commercial Spaceflight Federation is concerned that a premature termination of the ISS would harm the scientific community, American industry, and, most importantly, the Nation's ambitions to be the world's leader in deep space exploration. Only now are we finally reaching the full operational level for which ISS had been designed. An early

retirement of the station prior to 2028 would not allow sufficient time to leverage the asset appropriately. It would be folly to deorbit ISS in 2024 on the promise of future space capabilities; the ISS should fly throughout a transition period until such time as we have a sustainable orbital economy, more likely to be in place by 2028.

Understandably, in this era of fiscal constraint, it is prudent to review opportunities that exist to introduce additional efficiency. But, to be very clear, the ISS and NASA's deep space exploration programs are not in competition, but, rather, are complementary.

Certainly, there exist numerous opportunities to streamline ISS operations and reduce costs, all the while increasing utilization. These should be explored and pursued. Specifically, it is our perspective that continued and increased partnerships with industry offer this opportunity. NASA should continue to encourage competition and contract on a firm fixed price basis for crew and cargo transportation services. This keeps costs low and incentivizes continuous innovation. NASA should continue to partner with industry under SAAs for development activities and under firm fixed price contracts to acquire services. This model has been repeatedly proven to be successful.

One potential opportunity for partnership might be to privatize portions of the station or to even expand the station with the addition of new habitats. Last year, SpaceX delivered Bigelow Aerospace's Expandable Activity Module, or BEAM, to ISS, in a partnership with NASA's Advanced Exploration Systems division.

This partnership depicts a successful venture between NASA and the private sector, providing important technologies that increase the value of ISS and provide a critical proving ground for technologies that will be needed once the ISS is retired. Commercial habitats, such as BEAM, present NASA with increased capabilities and cost savings for future missions to the Moon and to Mars. This is merely one example of multiple opportunities. To that end, we would advocate strongly for a node to be placed on the ISS as soon as possible to support the addition of multiple private sector modules.

Other opportunities could include adding a NanoRacks docking port or even the commercial lease of entire modules. Together with commercial cargo and commercial crew transportation systems, the next step is commercial space destinations. A Commercial Space Destinations Program, modeled after COTS and CCP, is technologically achievable, has a high likelihood for attracting non-government customers, and could be implemented for a moderate government investment.

Continued ISS operation beyond 2024 provides certainty to industry and the scientific community, opening the door for even greater investments by the private sector.

An “ecosystem of space commerce” could be created – one that is sustainable, cost effective, and safe. It would cement the transition of LEO space activity from a primarily government-directed activity to more of a commercially-directed activity. In addition, it would provide essentially the same capability to NASA for microgravity research for significantly less money, as well as expand the United States commercial industrial capacity to help meet national security space needs.

It is also critical that NASA require private industry to invest its own capital in order to secure any NASA partnerships. Under the COTS program, SpaceX and Orbital ATK, and now Sierra Nevada Corporation, invested hundreds of millions of dollars of their own money to develop their systems. Bigelow also invested millions of dollars developing the BEAM. Traditionally, NASA would have had to bear those costs.

Next Space Technology Exploration Partnerships (NextSTEP), a NASA initiative to develop better technologies for application beyond LEO, has chosen several commercial companies as awardees for the program’s phase II. Currently, two CSF member firms, NanoRacks and Space Systems Loral, are working together to convert the used upper stages of United Launch Alliance rockets into habitats. These habitats will then be attached to the ISS, allowing a new incubator for commercial launch innovation. NASA chose this Ixion Team, as well as Bigelow and several others, to participate in NextSTEP.

Private companies are now developing the technologies required for a fully private low Earth orbit economy, complete with space stations and routine transportation. But, this is far more likely to be ready by 2028, rather than 2024. In the intervening period, a reliable commercial crew marketplace to fully grow and demonstrate the sustainability of the marketplace for private passengers is necessary. Opening the ISS to private businesses now, and continuing this agenda past 2024, will deliver an assured transition to a sustained private American presence in LEO that can untether NASA from the fixed costs of future space stations while continuing to make capabilities available whenever needed.

Commercial industry is already gearing up to train the next generation of private astronauts. For example, companies like ETC/NASTAR, ZeroG, and David Clark provide equipment, training services, life support, suits/gear, and various support for NASA and commercial human spaceflight missions to ISS and beyond.

A Sustainable Deep Space Exploration Program

The same technologies being developed for use traveling to and operating on ISS today, as well as other commercial capabilities, will enable us to sustainably go deeper in space than ever before.

This Committee and NASA have discussed the goals of sustained human presence in lunar orbit, on the lunar surface, and on Mars. In order for that goal to be achieved, we must leverage the commercial capabilities, both those being proven out with ISS, as well as others under development.

Again, these capabilities would act in concert with NASA's other deep space exploration efforts. The SLS and Orion system is planned to launch once or twice a year at most, with a range of competing missions not just to the Moon, but to Europa and Mars. In order to ensure a sustained human presence, and assured access, we need a far more frequent and regular flight cadence, and we should leverage US commercial launch systems to support and augment NASA cis-Lunar activities.

Blue Origin has also announced it is now developing its own deep space exploration architecture, and it has proposed to conduct what it is calling Blue Moon by 2020. Blue Moon, which would be done in partnership with NASA, is a lunar spacecraft with a lander that would touch down near a resource-rich crater at the Moon's south pole. This program would augment and enable NASA's lunar activities. The Blue Moon spacecraft could carry as much as 10,000 pounds of cargo to the lunar surface, leveraging their liquid hydrogen expertise and experience with precision vertical landing to offer one of the fastest paths to a lunar lander mission.

Already, we are seeing efforts to go to deep space as a direct result of the ISS program. SpaceX has announced a privately funded mission to Mars in 2020 on the Red Dragon spacecraft, a derivative of the Crew Dragon spacecraft they will be using to fly NASA astronauts. NASA has said publicly this effort is saving the agency millions of dollars.

Made In Space, which is already manufacturing on ISS, is developing advanced commercial on-orbit manufacturing services producing products for use in space and on Earth. The company is scheduled to send a new manufacturing product to the ISS in the first quarter of 2017. If initial tests are successful, the company will begin producing ultra-high-quality optical fiber for applications here on Earth, like fiber-based internet, medical devices and sensors for the aerospace and defense industry. We are confident

that in-space manufacturing of goods valuable to people on Earth will soon drive significant commercial activity in space, perhaps one day creating a space-based economic boom.

Moon Express has announced that it has all the resources it needs to ensure the company can attempt to launch a small robotic lander to the Moon as soon as the end of this year. Last year, Moon Express became the first commercial company to win U.S. government approval to fly a commercial deep space mission.

Conclusion

How should Congress enable a sustainable, robust American space enterprise, one that will continue to foster the burgeoning commercial activity in low-Earth orbit (LEO), but also enable the United States to make meaningful progress in deep space?

The answer, in short, is to expand the use of public-private partnerships with American commercial space companies. Through private-sector competition, investment, and innovation, the commercial space industry has proven it can deliver reliable and affordable goods and services that support U.S. government civil space missions and initiatives, as well as recapture global market share.