

NASA

National Aeronautics and Space Administration

Office of Inspector General

**Testimony before the House of Representatives
Subcommittee on Space, Committee on Science,
Space, and Technology**

THE INTERNATIONAL SPACE STATION: ADDRESSING OPERATIONAL CHALLENGES

**Statement of Paul K. Martin
Inspector General
National Aeronautics and Space Administration**

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Chairman Babin, Ranking Member Edwards, and Members of the Subcommittee:

The Office of Inspector General (OIG) is committed to providing independent, aggressive, and objective oversight of NASA programs and personnel. Thank you for this opportunity to appear before the Subcommittee today to discuss the challenges NASA faces in operating the International Space Station (ISS or Station), particularly in light of the loss of three cargo resupply flights during the past 8 months. The OIG has issued four reports related to this topic over the past 2 years, including reviews on NASA's plans to extend Station operations until 2024 and its contracts with private companies to fly cargo and eventually crew to the Station.¹ We plan to issue five additional reports related to this topic later this year, including an audit examining the effects of the October 2014 loss of a commercial cargo resupply mission on Station operations.²

The culmination of decades-long international efforts to plan, build, and operate a permanently crewed research platform in space, the ISS is a unique technological achievement that plays a key role in NASA's goal of sending humans to Mars. In November 2013, the ISS completed 15 years of continuous operation in low Earth orbit. With the United States' plan to extend Station operations until 2024, a spacecraft originally designed and tested for a 15-year life span may now operate for 26 years.

While NASA has identified no major obstacles to continued operation of the Station through 2024, in a September 2014 report we found several technical challenges the Agency must address in order to extend ISS operations, including ensuring adequate power generation in light of degradation of the Station's solar arrays.³ As noted in this report, the number one operational risk for the ISS Program is ensuring the ability to deliver supplies and transport astronauts to and from the Station. The failure of three cargo resupply missions in 8 months – an Orbital Sciences Corporation (Orbital) mission in October 2014, a Russian Progress vehicle in April 2015, and a Space Exploration Technology (Space-X) in June 2015 – underscores the importance of managing this risk. While NASA contracted with two commercial cargo providers to ensure redundancy, both companies' resupply flights are now on hold pending the outcome of accident investigations and approval from the Federal Aviation Administration and NASA to resume cargo missions.

Fortunately, the successful docking of a Russian Progress cargo flight on July 5, 2015, will provide the ISS with much-needed supplies in the short-term until the launch of a Japanese cargo flight in August and NASA's commercial partners return to flight. In the event that Orbital and SpaceX do not return to flight before 2016, NASA may need to make additional operational adjustments, including potentially reducing the number of crew on board the ISS, which in turn would significantly reduce the Station's research capability.

¹ NASA OIG, "Extending the Operational Life of the International Space Station Until 2024," (IG-14-031, September 18, 2014); "NASA's Management of the Commercial Crew Program," (IG-14-001, November 13, 2013); "NASA's Efforts to Maximize Research on the International Space Station (ISS)," (IG-13-019, July 8, 2013); and "Commercial Cargo: NASA's Management of Commercial Orbital Transportation Services and ISS Commercial Resupply Contracts," (IG-13-016, June 13, 2013).

² In addition to a report on the October 2014 mission failure, we are examining NASA's management of ISS contracts, NASA's efforts to manage health and human performance risks for space exploration, challenges to international cooperation in space programs, and NASA's Commercial Crew Program. We also plan to open a review examining the impact of the loss of the June 2015 commercial resupply mission.

³ NASA OIG, Extending the Operational Life of the ISS.

While it appears the ISS has sufficient food and water to sustain the crew for the next several months, NASA lost important supplies in both the October 2014 and June 2015 failed cargo missions. For example, both flights were carrying supplies for the Station's Environmental Control and Life Support System, including replacement parts for the ISS's water purification system. The flights also carried hardware for the first International Docking Adapter that is necessary to support docking operations for the commercial crew vehicles NASA hopes will begin arriving at the Station in 2017. In addition, the Center for the Advancement of Science in Space (CASIS), which manages non-NASA research aboard the ISS, lost more than \$675,000 of research on both flights, including 5 stem cell research projects, a microgravity investigation to help fine tune delivery and dosage of drugs, 8 miniature satellites known as Cubesats, and 10 sets of high school and middle school experiments.

Because NASA utilizes the ISS as a research platform to study and mitigate a variety of risks associated with human travel and long-term habitation in space, the Station is an important part of NASA's plans to send humans beyond low Earth orbit. In our judgment, the recent Orbital and SpaceX launch failures have affected research in three ways: (1) a reduction in available crew time due to a temporary delay in returning the Station's crew complement to six, (2) the cost to regenerate some of the research lost, and (3) a delay in the return of experiments due to the suspension of SpaceX flights, which is the only company capable of returning experiments and other cargo to Earth. Moreover, in our September 2014 report on NASA's plans to extend operation of the ISS, we reported that even if Station operations continue through 2024, NASA will not have sufficient time to address all the health and human performance risks for which the Station is an appropriate research platform.⁴ Accordingly, NASA needs to prioritize Station research to address the most important risks in the time remaining. Later this year we plan to issue an audit examining in detail NASA's efforts to address the health and human performance risks associated with long-duration space exploration.

In addition to serving as a platform for NASA research, the Station also provides a laboratory for other government agencies and private entities to advance new technologies in health and medicine, robotics, manufacturing, and propulsion. In August 2011, NASA signed a cooperative agreement with CASIS to manage non-NASA research aboard the ISS. Pursuant to the agreement, NASA provides CASIS \$15 million annually and the organization is expected to raise additional funds from private entities and encourage companies to self-fund research. When we interviewed CASIS officials as part of our ISS extension audit, they told us that provisions in the agreement with NASA requiring researchers to assign patent licenses and data rights to the Government were deterring commercial stakeholders from conducting research on the ISS. To address this issue, NASA submitted proposed legislation to Congress in June 2013 that would allow researchers to retain "all rights in inventions made... during the conduct of [Station] activities." To date, the legislation has not moved forward.

While utilization of the ISS for research has increased, several factors continue to pose limits to fully utilizing the Station. First, until a seventh crew member is brought onboard, NASA will not be in a position to maximize the amount of crew time dedicated to research on the Station.⁵ Moreover, during 2016 substantial crew time will be devoted to reconfiguring the ISS to accommodate the commercial vehicles NASA hopes will be ready to transport astronauts in 2017.

⁴ NASA OIG, Extending the Operational Life of the ISS.

⁵ Although the ISS can support a crew of seven, currently only six individuals can be on Station at one time to accommodate evacuation in case of an emergency. The Russian capsule, which is currently the only vehicle transporting astronauts to the Station, has a three-person capacity and only two Soyuz capsules can be attached to the Station simultaneously.

To that point, securing safe and reliable crew transportation remains a major operational challenge to ensuring the continued effectiveness of the ISS. The fourth and final phase of NASA's Commercial Crew Program began in September 2014 with the award of \$6.8 billion in firm-fixed-price contracts to The Boeing Company (\$4.2 billion) and SpaceX (\$2.6 billion) to complete development and certification of their respective spaceflight systems. Under these contracts, NASA will provide specific requirements for launch systems, spacecraft, and related ground support. The contracts include at least one crewed flight test with a NASA astronaut to verify that the fully integrated rocket and spacecraft system can launch, maneuver in orbit, and dock to the ISS, as well as to validate that all systems are performing as expected. Upon certification, each company will conduct at least two, but as many as six, crewed missions to the Station.

In a November 2013 audit report, we identified four challenges to NASA's Commercial Crew Program: (1) unstable funding, (2) integration of cost estimates with the Program schedule, (3) providing timely requirement and certification guidance to contractors, and (4) spaceflight coordination issues with other Federal agencies.⁶ Since that time, NASA has made progress in these areas and expects to address our report recommendations by the end of this month. In May 2015, we began a follow-on audit examining whether the Commercial Crew Program is meeting its planned cost and schedule goals and how it is managing risks and certification requirements.

NASA's annual cost to operate the ISS in fiscal year 2014 was almost \$3 billion. Those costs included on-orbit vehicle operations, research, crew transportation, and cargo resupply by U.S. commercial and international partner vehicles. During fiscal year 2016, the ISS Program plans to spend \$1.1 billion (almost 36 percent of its budget) on operation and maintenance of the Station and another \$1.1 billion on cargo transportation.

Going forward, NASA officials have indicated they intend to maintain the ISS budget between \$3 and \$4 billion per year through 2024; however, we suspect the cost to NASA will likely be higher. First, much of the projected cost increase can be attributable to higher transportation costs, but we found NASA's estimates for cargo and crew transportation to be optimistic. Second, the Agency's international partners have yet to commit to participating in Station operations beyond 2020. A decision from one or more not to participate could drive up costs for NASA. Given the importance of international cooperation to the ISS and other NASA missions, the OIG is conducting an audit examining NASA's efforts to partner with the space agencies of other countries on science and exploration-related projects.

In addition, as a follow-on to our work on extending the Station to 2024, we are examining NASA's ISS contracts to assess whether the Agency is doing everything possible to avoid incurring unnecessary costs. In the course of this audit, we learned that NASA has taken actions to reduce the operations and maintenance costs of the ISS Program, including competing contracts and taking initial steps to convert portions of the largest ISS contract to a fixed-price vehicle. However, at this point it is unclear to what extent these strategies will result in future cost savings.

In conclusion, the OIG looks forward to continuing our cooperative relationship with NASA, this Subcommittee, and other congressional committees as we examine NASA's effort to address challenges in effectively operating the ISS.

⁶ NASA OIG, Commercial Crew Program.