



## Testimony

Before the Subcommittee on Space,  
Committee on Science, Space, and  
Technology, House of Representatives

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# INTERNATIONAL SPACE STATION

## Challenges to Increased Utilization May Affect Return on Investment

Statement of Shelby S. Oakley  
Acting Director, Acquisition and  
Sourcing Management

# GAO Highlights

Highlights of [GAO-15-722T](#), a testimony before the Subcommittee on Space, Committee on Science, Space, and Technology, House of Representatives

## Why GAO Did This Study

The United States has spent tens of billions of dollars to develop, assemble, and operate the ISS over the past two decades. NASA plans to spend about \$22 billion more from fiscal year 2016 through 2020—with over half of that planned for transportation—on the ISS. In January 2014, the Administration proposed extending the life of the ISS to at least 2024 to take further advantage of the investment in the ISS. Since 2005, Congress enacted several laws to increase utilization of the ISS by commercial and academic researchers. The NASA Authorization Act of 2010 required NASA to enter into a cooperative agreement with a not-for-profit entity to manage the ISS National Laboratory and in 2011 it did so with CASIS. CASIS is charged with maximizing use of the ISS for scientific research by executing several required activities.

This statement will provide an overview of (1) NASA's budget for ISS and the factors affecting budget levels through 2020, (2) several challenges that could impact effective utilization of ISS by both NASA and CASIS, and (3) steps that NASA and CASIS could take to better document and assess CASIS's progress in this regard.

This statement is based primarily on GAO's April 2015 report (GAO-15-397) as well as other prior reports and testimonies. GAO also conducted a limited amount of additional audit work in June 2015 to update certain information.

View [GAO-15-722T](#). For more information, contact Shelby S. Oakley at (202) 512-4841 or [oakleys@gao.gov](mailto:oakleys@gao.gov).

July 2015

## INTERNATIONAL SPACE STATION

### Challenges to Increased Utilization May Affect Return on Investment

## What GAO Found

Based on GAO analysis of the National Aeronautics and Space Administration's (NASA) fiscal year 2016 budget estimate, the agency anticipates that the costs to operate, sustain, perform research, and provide crew and cargo transportation to the International Space Station (ISS) are projected to increase by almost \$1 billion—or almost 53 percent—from fiscal year 2015 to fiscal year 2020 when the projected costs are expected to exceed \$4 billion. The majority of the total projected cost increase for ISS is attributable to commercial crew and cargo transportation. The budget for ISS cargo and crew transportation is currently planned to increase by over \$700 million from fiscal year 2016 to fiscal year 2020—or over 55 percent of the total ISS budget—which includes the purchase of six Russian Soyuz seats in 2018 and commercial crew missions beginning in fiscal year 2019. The costs to operate the ISS and perform research are expected to be stable with only slight increases through fiscal year 2020.

NASA and the Center for the Advancement of Science in Space (CASIS)—a non-profit entity selected to manage non-NASA research on the ISS National Laboratory—must overcome several challenges to increase utilization and achieve a better return on investment. NASA and CASIS officials told GAO that the ISS will be challenged to meet an expected increase in demand for crew time and certain research facilities. Securing cargo transportation has also presented challenges. CASIS-sponsored researchers have experienced cost increases of almost \$500,000 because of a cargo resupply launch failure in October 2014 and delays to other cargo resupply missions. GAO found that absorbing the increased cost has been a challenge for CASIS given its limited research budget and it could be faced with additional cost increases given the June 2015 launch failure of another cargo resupply mission.

In April 2015, GAO found that CASIS had taken steps to manage and promote research activities on the ISS National Laboratory, but that CASIS and NASA could do more to objectively define, assess, and report progress toward increased utilization. While CASIS had established annual metrics, it did not establish measurable targets for these metrics. GAO has previously reported that performance metrics should have quantifiable targets to help assess whether overall goals are achieved. Consequently, GAO recommended that the ISS program and CASIS develop measurable targets for CASIS's metrics for fiscal year 2016 and beyond. NASA concurred with this recommendation and indicated that these targets should be established by the end of 2015. GAO's April 2015 report also found that while NASA performs an annual assessment of CASIS's performance, the assessment is not documented. This type of documented information can support future assessments of return on investment. GAO recommended that NASA document the annual program assessment of CASIS performance. NASA concurred with this recommendation and plans to take action in response to CASIS's 2015 annual report. Because CASIS is allocated at least 50 percent of ISS research capacity, ensuring that CASIS continues to make progress promoting research activities and achieving its goal to increase utilization of ISS is essential to demonstrate a return on investment for the tens of billions of dollars already invested and that will continued to be invested in ISS.

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

Thank you for the opportunity to discuss our work on the National Aeronautics and Space Administration's (NASA) management of the International Space Station (ISS). The United States has spent tens of billions of dollars over the past two decades to develop, assemble, and operate the ISS, which has been used as a manned research outpost continuously for over 14 years. NASA plans to spend about \$22 billion more from fiscal year 2016 through 2020—with over half of that planned for transportation—to enable further scientific research the agency views as critical to future human space activities. In January 2014, the Administration proposed extending the life of the ISS by a minimum of 4 years to at least 2024 to take further advantage of the investment in the ISS. Congress enacted several laws to increase utilization of the ISS by commercial and academic researchers.<sup>1</sup> In response to direction in the NASA Authorization Act of 2010, in 2011 NASA selected the Center for the Advancement of Science in Space (CASIS), a non-profit entity, to manage non-NASA commercial and academic research aboard the ISS National Laboratory. Because CASIS is allocated at least 50 percent of ISS research capacity and was created to maximize the value of the ISS investment, future success of the ISS as a research platform is partially dependent on CASIS's success.

My statement today will provide an overview of NASA's budget for ISS and the factors affecting budget levels through 2020. In addition, my statement will also focus on several challenges that could impact effective utilization of the ISS by both NASA and CASIS as they continue their efforts to demonstrate that the research and technology development performed aboard the ISS National Laboratory benefits life on Earth and develop commercial markets that can be sustained in low-Earth orbit. Finally, I will discuss steps that NASA and CASIS could take to better document and assess CASIS's progress in this regard.

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<sup>1</sup>Commercial Space Act of 1998, Pub. L. No.105-303, § 101; National Aeronautics and Space Administration Authorization Act of 2005, Pub. L. No.109-155, § 507; and National Aeronautics and Space Administration Authorization Act of 2010, Pub. L. No. 111-267, § 504.

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In preparing this statement, we primarily relied on work conducted to support our April 2015 report.<sup>2</sup> Additionally, we relied on our prior reports and testimonies, including those related to CASIS's management of the ISS National Laboratory, the agency's acquisition approach for commercial crew transportation, and ISS sustainment and utilization.<sup>3</sup> Information on our scope and methodology is available in the reports cited in this statement. We also conducted a limited amount of additional audit work in June 2015 to update information on CASIS's efforts to increase utilization of the ISS and planned commercial crew and cargo partner missions. The work upon which this statement is based was performed in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient and appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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## Background

The ISS supports research projects with state of the art facilities for Earth and space science, biology, human physiology, physical science, and materials research, and provides a platform to demonstrate new space-related technologies. The ISS currently has three crew members in the U.S. operating segment who, according to NASA officials, devote a total of approximately 35 hours per week to conduct research. The remaining crew time is used for operations and maintenance of the ISS, training, exercise, and sleep.

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<sup>2</sup>GAO, *International Space Station: Measurable Performance Targets and Documentation Needed to Better Assess Management of National Laboratory*, [GAO-15-397](#) (Washington, D.C.: April 27, 2015).

<sup>3</sup>GAO, *NASA: Significant Challenges Remain for Access, Use, and Sustainment of the International Space Station*, [GAO-12-587T](#) (Washington, D.C.; March 28, 2012); *International Space Station: Approach for Ensuring Utilization through 2020 Are Reasonable but Should be Revisited as NASA Gains More Knowledge of On-Orbit Performance*, [GAO-12-162](#) (Washington, D.C.; December 15, 2011); and *National Aeronautics and Space Administration: Acquisition Approach for Commercial Crew Transportation includes Good Practices, but Faces Significant Challenges*, [GAO-12-282](#) (Washington, D.C.: December 15, 2011).

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## Congress Directs Changes in Management of the ISS

Since 2005, Congress has directed several changes regarding the management and utilization of the ISS. For example, the NASA Authorization Act of 2005 designated the U.S. Operating Segment of the ISS as a national laboratory and the NASA Authorization Act of 2010 directed the NASA Administrator to provide initial financial assistance and enter into a cooperative agreement with a not-for-profit organization to manage the activities of the ISS National Laboratory for non-NASA utilization of the ISS research capabilities and available facilities.<sup>4</sup> The 2010 act also requires the ISS National Laboratory-managed experiments to be guaranteed access to and use of at least 50 percent of the U.S. research capacity allocation including power, facilities to keep experiments cold, and requisite crew time onboard the ISS through September 30, 2020. Our April 2015 report provides a synopsis of these legislative actions.<sup>5</sup>

In August 2011, after a competitive process, NASA signed a cooperative agreement with CASIS, a not-for-profit entity, to manage the activities of the ISS National Laboratory through September 30, 2020.<sup>6</sup> CASIS is bound by the responsibilities outlined in the cooperative agreement, which tasks it with maximizing the value of the ISS National Laboratory by stimulating interest and use of the ISS for scientific research by directly soliciting potential users and fostering a market to attract others. CASIS is also charged with maximizing the use of the ISS for advancing science, technology, engineering, and mathematics education. Pursuant to the cooperative agreement, NASA will provide CASIS \$15 million annually through 2020, of which it will seek to award at least \$3 million in research grants. CASIS officials have stated that the remainder of NASA funding is used for infrastructure and direct costs such as labor and travel-related expenses. Further, CASIS is also responsible for soliciting non-NASA funding for research by targeting various sources.

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<sup>4</sup>Pub. L. No. 109-155, § 507 and Pub. L. No. 111-267, § 504.

<sup>5</sup>[GAO-15-397](#).

<sup>6</sup>The Administration recently proposed extending the operational life of the ISS from 2020 to at least 2024. Our prior work has shown that it is technically feasible to extend the ISS operational life to at least 2028.

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## NASA Is Taking Steps to Establish Commercial Transportation Capability

In 2005, NASA established the Commercial Crew and Cargo Program to facilitate the private demonstration of safe, reliable, and cost-effective transportation services to low-Earth orbit and encourage innovation in the private sector. The goal of this program is to enable the government to buy both cargo and crew commercial transportation services at a reasonable price. NASA is procuring cargo transportation to the ISS through a commercial resupply services contract that was signed with Orbital Sciences Corporation (Orbital) and Space Exploration Technologies Corporation (SpaceX) in 2008. As of April 2015, SpaceX has launched six successful resupply missions and Orbital has launched two successful resupply missions. Orbital and SpaceX are scheduled to provide 8 and 15 resupply flights, respectively, through December 2017, although the number of Orbital flights may be modified. Orbital resupply flights to the ISS were deferred pending a review of a launch failure that occurred during a resupply launch in October 2014, which resulted in the loss of that mission. According to NASA officials, both Orbital and NASA are still reviewing the mishap and have not provided final reports as of June 2015. The ISS program anticipates that Orbital will resume missions by the end of 2015; however, the flight will use an Atlas rocket to launch a Cygnus spacecraft instead of Orbital's Antares launch vehicle. In late June 2015, SpaceX experienced a launch failure during a cargo resupply launch that resulted in the loss of that mission. NASA is currently evaluating the impact this recent launch failure will have on the ISS program. In September 2014, NASA released a request for proposals for its Commercial Resupply Services 2 (CRS2) requirements, which would result in a follow on contract to the Commercial Resupply Services contracts that were awarded to SpaceX and Orbital in December 2008. NASA expects to award CRS2 contracts in September 2015 for cargo transportation services beginning in 2018, about 4 months later than anticipated.

NASA has relied upon Russia to provide crew transportation to and from the ISS since the retirement of the Space Shuttle in 2011. NASA has purchased crew launches from Russia through 2017 and crew rescue and return through mid-2018. NASA purchases seats—at a cost of over \$65 million each in 2015—aboard Russian Soyuz space capsules. To support its goal of obtaining low cost domestic crew transport, in September 2014, NASA awarded contracts to The Boeing Company (Boeing) and SpaceX to develop a capability to transport astronauts to and from the ISS. Those awards include a minimum of two to a maximum of six crewed service missions per provider. The Commercial Crew Program, which is outside of the ISS program, is currently responsible for the cost to develop this capability and will also fund one crewed service flight per provider. ISS

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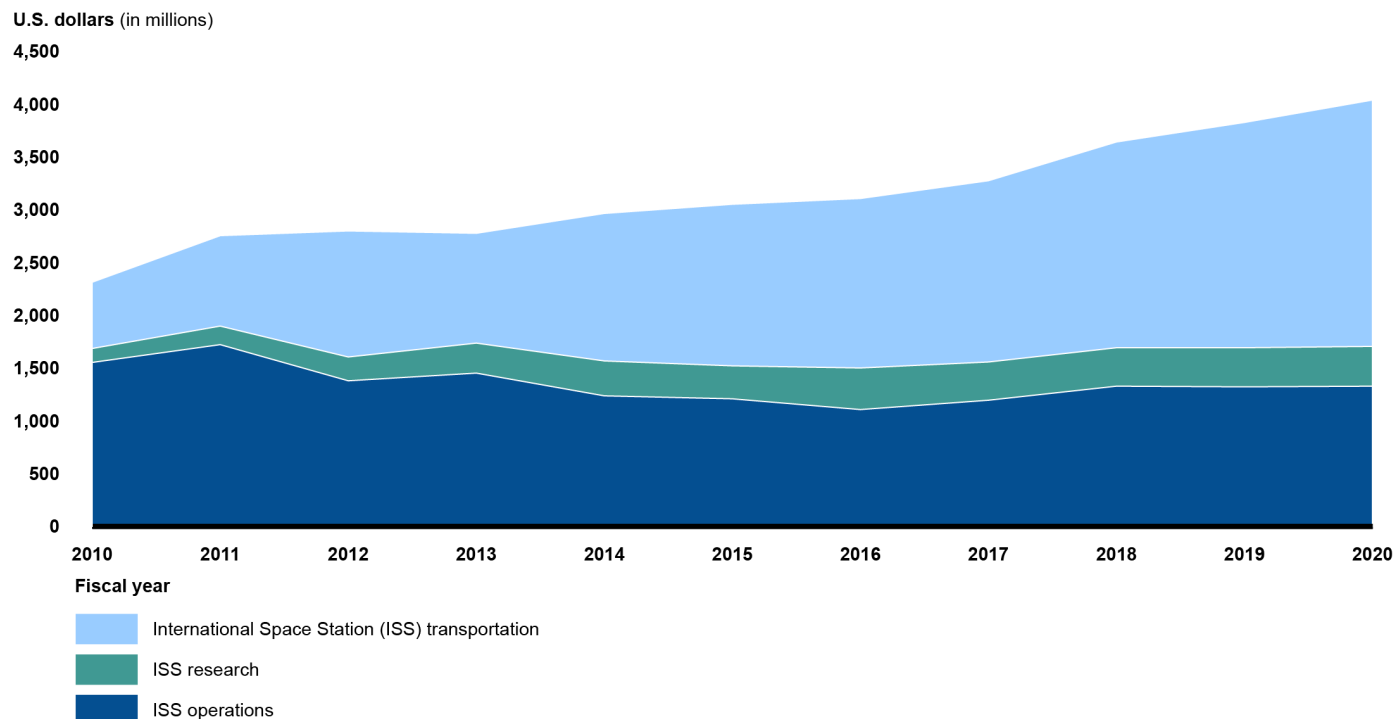
program officials have stated that they expect the first service flights to take place in fiscal year 2018. The ISS program will fund the remaining service flights. NASA expects this capability to be available in fiscal year 2018; however, it is unclear whether those vehicles currently in development under the commercial crew program will be ready in time. Once this capability has been established, NASA plans to increase the number of astronauts in the U.S. operating segment of the ISS from three to four.

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## ISS Budget Projected to Rise to Account for Increasing Transportation Costs while Operations and Research Costs Remain Stable

NASA makes a significant investment in the ISS program each year. Based on our analysis of NASA's fiscal year 2016 budget estimate, the agency anticipates that the costs to operate, sustain, perform research, and provide crew and cargo transportation to the ISS are projected to increase by almost \$1 billion—or almost 53 percent—from fiscal year 2015 to fiscal year 2020 when the projected costs are expected to exceed \$4 billion. See figure 1 for ISS funding from fiscal year 2010 through fiscal year 2020.

**Figure 1: International Space Station Funding by Budget Element for Fiscal Years 2010 through 2020**



Source: GAO presentation of NASA data. | GAO-15-722T

The majority of the total projected cost increase for ISS is due to the ISS program's need to pay for commercial crew and cargo transportation. The budget for ISS cargo and crew transportation is currently planned to increase by over \$700 million from fiscal year 2016 to fiscal year 2020, at which point it will comprise over 55 percent of the total ISS budget. ISS program officials told us that in fiscal year 2017, the program will begin to fund commercial crew missions that are expected to take place in fiscal year 2019.<sup>7</sup> NASA has also initiated steps to purchase six Soyuz seats from Russia for flights to the ISS in 2018, the cost of which ISS program officials said was accounted for in the projected transportation costs. If NASA determines that domestic commercial entities are able to fulfill crew transportation requirements in 2018, those vehicles will become NASA's

<sup>7</sup>According to ISS officials, the Commercial Spaceflight Program will fund the first flight for Boeing and SpaceX and the ISS program will then fund the second and any subsequent crewed flights.

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primary transportation source to the ISS and the Soyuz seats purchased may then be utilized as backup transportation or to augment future ISS needs.

Based on our analysis of NASA's fiscal year 2016 budget estimate, the cost to operate the ISS is expected to be relatively stable with only slight increases through fiscal year 2020. The ISS operations costs decreased \$500 million—or 30 percent—from a peak in fiscal year 2011 through fiscal year 2015. Operations costs are expected, however, to increase by approximately \$130 million from fiscal year 2017 through fiscal year 2020, which NASA officials attribute in part to inflation and the addition of the fourth crew member. Our past work on Department of Defense (DOD) aircraft systems similarly found that operations costs can increase over time.<sup>8</sup> There may be other factors that could increase operations costs for the ISS over time such as the need for additional spare parts and mitigations needed for structural issues. The ISS program has implemented a number of initiatives that have yielded cost savings or containment. For example, NASA reduced operations costs by scaling back ISS program and contractor workforce levels and by combining several contracts. The NASA Inspector General currently has ongoing work assessing NASA's efforts to combine and consolidate ISS contracts for operations and maintenance.

NASA also projects that the cost for the ISS Research account will remain stable through fiscal year 2020, when research costs are expected to be about 9 percent of total ISS projected costs. Within this account, NASA provides limited funding to CASIS—\$15 million per year—of which a minimum of \$3 million is to be used to sponsor non-NASA research aboard the ISS by commercial, academic, and other government agency users. Although NASA research costs are projected to remain stable, CASIS sponsored research is not limited to this \$3 million minimum. For example, our analysis of CASIS information shows that CASIS has averaged more than \$4.3 million in grants paid out to researchers each fiscal year since 2012 and has paid over \$15 million to its grantees through March 2015.

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<sup>8</sup>GAO, *Defense Management: DOD Needs Better Information and Guidance to More Effectively Manage and Reduce Operating and Support Costs of Major Weapons Systems*, [GAO-10-717](#) (Washington, D.C.: July 20, 2010).

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## NASA and CASIS Face Challenges to Increase Utilization and Sustain the ISS Which Could Affect Return on Investment

As we reported in April 2015, NASA and CASIS must overcome several challenges to increase utilization and sustain the ISS until 2024 and achieve a better return on the investment. According to NASA and CASIS officials, as CASIS increases the number of experiments for the ISS National Laboratory, the demand for crew time and certain research facilities aboard the ISS is expected to increase and officials project the ISS National Laboratory will be challenged to meet that demand. NASA officials told us that while the demand for crew time is currently manageable, it remains allocated at or near 100 percent, as the three crew members on the U.S. segment of the ISS utilize most of the 35 hours scheduled per week to conduct research. Crew time for research is expected to double on the ISS National Laboratory once the crew increases from three to four astronauts in fiscal year 2018 because, according to NASA officials, the additional crew member will devote most of his or her time to research. NASA's ability to support increased utilization through an additional crew member, however, is reliant on commercial crew providers providing the promised capability and NASA's ability to fund the effort. Both Boeing and SpaceX plan to hold demonstration flights to the ISS in 2017, but risks remain for both contractors.

According to CASIS officials, they have been challenged to raise additional funding from external sources to supplement the amount of funding provided by NASA. CASIS officials attributed this challenge to the fact that CASIS is a new non-profit entity and the value of performing research aboard the ISS has not been fully demonstrated. Although CASIS's business development team is actively identifying partnerships and funding opportunities with commercial and non-profit granting organizations, CASIS officials said that it takes time to identify, develop, and mature these partnerships to result in funding support. Through December 2014, CASIS reported that it had received funding commitments from external sources of approximately \$12 million to support its research mission. However, according to CASIS's fiscal year 2014 annual report, published in December 2014, CASIS received contributions totaling only \$9,193 in 2014. NASA officials stated that doing research aboard the ISS National Laboratory can take upwards of 2 to 3 years to plan and execute, timelines that are generally not acceptable to commercial companies that desire a more rapid return on their investments. CASIS and NASA officials also told us that the value of doing research aboard the ISS National Laboratory has to be further demonstrated so commercial industries can be convinced it is worth the high investment.

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We also reported in April 2015 that the ability to secure cargo transportation for selected research investigations to the ISS is outside of CASIS's control and has presented challenges. NASA provides launch services to the ISS National Laboratory through its commercial resupply services contracts and CASIS receives cargo allocations for its sponsored research. Budget shortfalls due in part to the effects of sequestration and the Orbital launch failure have resulted NASA cancelling 4 of 46 planned cargo flights through 2020. In January 2015, NASA's Aerospace Safety Advisory Panel noted that both commercial cargo launch providers had struggled to meet desired launch dates and that the schedule performance must significantly improve to enable consistent scientific research on the ISS.<sup>9</sup> The panel added that there will be additional pressure on cargo logistics while Orbital works through its plan to resume cargo missions. This pressure will likely be increased because of the June 2015 launch failure of a SpaceX cargo resupply mission. We found that such launch failures and delays have resulted in cost increases for CASIS-sponsored researchers. For example, the rocket launch failure to the ISS in October 2014 resulted in the loss of several CASIS-sponsored research investigations at a total cost of almost \$175,000 which includes hardware and materials, labor consulting, and grants. In addition, launch delays for another cargo resupply mission resulted in over \$300,000 in cost increases for several researchers. This included costs for additional materials and samples such as biological payloads that have a limited viability or very specific requirements associated with the timing of the payload flight and often require consumables such as gas and water that must be replenished when a launch is delayed. Absorbing the increased cost has been a challenge for CASIS given its limited research budget, but it is addressing the cost increases due to delays by asking researchers that have biological payloads to identify the impact and associated costs for launch delays in their budgets so it can plan for budget reserves, as necessary.

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<sup>9</sup>National Aeronautics and Space Administration, *NASA Aerospace Safety Advisory Panel Annual Report for 2014* (Washington, D.C., Jan. 28, 2015). The Aerospace Safety Advisory Panel was established by Congress in 1968 to provide advice and make recommendations to the NASA Administrator on safety matters. The panel reviews safety studies and operations plans and advises the NASA Administrator and Congress on hazards related to proposed or existing facilities and operations, safety standards and reporting, safety and mission assurance aspects regarding ongoing or proposed programs, and NASA management and culture issues related to safety.

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To extend the ISS service life to 2024 or beyond, NASA must ensure that spare parts are sufficient and available when needed and that the structures are sound. In December 2011, we found that NASA had a reasonable approach to determine, obtain, and deliver necessary spare parts to the ISS through 2020.<sup>10</sup> At that time, we found that NASA had given equal weight to manufacturers' predictions and actual performance. However, because NASA has generally found failure rates for replacement units to be lower than manufacturers' predictions, over time the resulting estimates could prove to be overly conservative. More recently, the ISS program reported that one part was failing at rates greater than projected and that spares were not available as a result. In December 2011, we recommended that NASA should reassess the relative weight given to original reliability estimates of spares' life expectancies as performance data accumulates. NASA concurred with this recommendation and the ISS program has taken action to revisit to the methods it uses to calculate the need for spare parts for the ISS. NASA performs an annual assessment of the spare parts, which has resulted in the procurement of spare parts based in part on actual hardware performance. In our December 2011 report, we also found that NASA is using reasonable analytical tools to assess structural health and determine whether ISS hardware can operate safely through 2020. On the basis of prior analysis of structural life usage through 2015 and the robust design of the ISS structures, NASA anticipated that—with some mitigation—the ISS will remain structurally sound for continued operations through 2020. At the time of our 2011 review, NASA had assessed only 40 percent, by weight, of the assembled ISS because most of the ISS structures have not been on orbit long enough to accumulate the data needed for analysis. NASA expected to complete ISS structural assessments in early 2016. These are positive steps; however, continued efforts such as this will be important to ensure that processes NASA uses to evaluate the need for spare parts are adequate to operate and sustain the ISS for at least an additional 4 years.

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<sup>10</sup>[GAO-12-162](#).

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## Objective Assessment of Progress Needed to Demonstrate Return on Investment

Despite these challenges, in April 2015, we reported that CASIS had taken steps to carry out its responsibilities to manage and promote research activities on the ISS National Laboratory as outlined in its cooperative agreement.<sup>11</sup> For example, CASIS had identified key research areas and released seven requests for proposals to solicit interest for research projects. While we noted this progress, we found that CASIS and NASA could do more to objectively define, assess, and report progress toward increased utilization. Specifically, we found that while CASIS had established annual metrics that met most of the key attributes of successful performance measures, it did not establish measurable targets or goals for either fiscal year 2014 or 2015 metrics. We have previously reported that performance metrics should have quantifiable, numerical targets or other measurable values, which help assess whether overall goals and objectives were achieved.<sup>12</sup> We concluded that without these targets, NASA and CASIS cannot conduct assessments of CASIS's efforts to increase ISS utilization that are objective, measurable, or conclusive. To enable such assessments, in April 2015 we recommended that the ISS program manager work with CASIS to collectively develop and approve measurable targets for CASIS's metrics for fiscal year 2016 and beyond. NASA concurred with this recommendation and indicated that these targets should be established by December 31, 2015.

Also in our April 2015 report, we found that while NASA performs an annual assessment of CASIS's performance, the assessment is not documented. Federal standards for internal control call for information to be recorded and communicated to management and others who need it to carry out their responsibilities. This type of documented information is important to support decision making and to support future assessments of return on investment. However, without definitive and documented assessment factors, NASA will also be challenged to take action in response to CASIS performance. According to the cooperative agreement between NASA and CASIS, continued funding of CASIS is contingent on the scientific progress of the project and that NASA will assess such progress in fiscal year 2020 to make a determination about whether to extend or terminate the cooperative agreement.<sup>13</sup> We concluded that

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<sup>11</sup>[GAO-15-397](#).

<sup>12</sup>GAO, *Tax Administration: IRS Needs to Further Refine Its Tax Filing Season Performance Measures*, [GAO-03-143](#) (Washington, D.C.: Nov. 22, 2002).

<sup>13</sup>The current cooperative agreement includes a provision for extension beyond 2020.

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without documentation based on objective measures of performance, NASA lacks support to make such a decision. We therefore recommended that the ISS program manager document the annual program assessment of CASIS performance in order to provide CASIS management actionable information to better fulfill its responsibilities. NASA concurred with the recommendation and stated that officials would begin documenting the agency's annual program assessment in response to CASIS's 2015 annual report. It will be important that NASA and CASIS follow through on their commitments to have objective measures that will enable NASA to measure CASIS's progress to increase utilization and demonstrate the return on the investment of the ISS.

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In conclusion, the ISS offers the potential for scientific breakthroughs, a unique test bed for new technologies and applications, and a platform for increased commercial and academic research and NASA has made an important commitment to the future of research aboard ISS by proposing to extend operations to 2024. Key to supporting this commitment is effectively managing the challenges that could affect efforts to maximize the return on investment for the tens of billions of dollars that have been spent on the ISS. Achieving greater utilization of the ISS and its unique capabilities, showing the benefit of commercial and academic research, and demonstrating success to generate increased interest from potential users could help NASA demonstrate such a return. Because CASIS is allocated at least 50 percent of ISS research capacity, ensuring that CASIS continues to make progress promoting research activities and achieving its goal to increase utilization of the ISS is essential. Even with an extension of operations to 2024, CASIS has limited time to demonstrate that the research and technology development performed aboard the ISS National Laboratory benefits Earth and commercial markets can be sustained in low-Earth orbit. By NASA and CASIS working together in the coming years to address challenges that could negatively affect increased utilization of this unique research facility and to identify and document objective measures of success to demonstrate a return on investment, such a return might be realized.

Chairman Babin, Ranking Member Edwards, and Members of the Subcommittee, this completes my prepared statement. I would be pleased to respond to any questions that you may have at this time.

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# GAO Contacts and Staff Acknowledgments

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## GAO Contacts

For questions about this statement, please contact me at (202) 512-4841 or [oakleys@gao.gov](mailto:oakleys@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this testimony.

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## Staff Acknowledgments

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