COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

Securing the Promise of the International Space Station: Challenges and Opportunities

Wednesday, March 28, 2012
9:30 a.m. – 11:30 a.m.
2318 Rayburn House Office Building

Introduction

Assembly of the International Space Station (ISS) is complete, and NASA's focus is shifting from assembly and activation, to utilization and maintenance. The decision to extend the life of the ISS thru at least 2020 provides an unprecedented opportunity to perform promising scientific research. But will NASA be able to take full advantage of the research possibilities of the ISS? Currently, the U.S. laboratory section is about 50 percent utilized, and there are funding and access constraints that could affect the quantity and effectiveness of future research. Is NASA's funding for ISS research sufficient to allow a robust program? Has NASA adequately planned to enable effective research on the ISS? How much access will NASA have now that the Space Shuttle is no longer in service? What is the role of our international partners?

This hearing will review NASA's plans for conducting ISS research, and ensuring that essential spares, facilities, transportation and other resources are adequate to meet the research needs on the ISS thru 2020. This hearing is not intended to focus on NASA's commercial crew program or the Russian Soyuz system which all members of the international partnership are using for crew access for the next several years.

Witnesses

Mr. William H. Gerstenmaier, Associate Administrator, Human Exploration and Operations Mission Directorate, National Aeronautics and Space Administration

Ms. Cristina Chaplain, Director, Acquisition & Sourcing Management, U.S. Government Accountability Office

Lt. Gen. Thomas P. Stafford, Chairman, NASA Advisory Council ISS Operational Readiness Task Force

Background

The International Space Station partnership consists of Canada, Europe, Japan, Russia and United States. These entities have cooperated for two decades on design, development, operation and utilization of the ISS. The first element was launched in 1998, and the ISS has been permanently occupied since November 2000.

Now that the assembly of the ISS is complete, the focus has shifted from assembly and activation of the systems, to the maintenance and utilization of the facility. The majority of supplies and spare parts were traditionally delivered by the Space Shuttle. But since the Space Shuttle was discontinued in July of last year, NASA and the international partners must now rely on a combination of existing foreign and emerging domestic commercial launch systems to supply spares and other supplies to the ISS through at least 2020. NASA took advantage of the last two Shuttle missions to fully stock the ISS and deliver large spare parts and other components that could not be delivered on smaller vehicles. As a result, NASA believes that the sparing needs of the ISS are met for the remainder of this year. But NASA could face delivery shortfalls in the future.

Meeting ISS Requirements

Section 503 of the NASA Authorization Act of 2010 [P.L. 111-267] directed NASA to assess its plan to ensure that essential spare parts, equipment and systems were available to support ISS through 2020. The same Act directed the Government Accountability Office (GAO) to evaluate and report on the accuracy and level of confidence in NASA's assessments.

The reviews were to include "*the essential modules, operational systems and components, structural elements, and permanent scientific equipment on board or planned for delivery…required to ensure complete, effective and safe functioning and full scientific utilization of the ISS through September 30, 2020."*[1] In January 2011 NASA reported to Congress that the ISS could be effectively maintained through 2020 with a combination of existing international, and planned domestic commercial re-supply vehicles.

Table 1 below shows NASA's assumptions as reported by GAO in December 2011.[2] Table 1 assumes two European ATV flights beyond 2014 (in 2016 and 2019) that are not currently agreed to by ESA. Table 1 also assumes three Japanese HTV flights beyond 2016 that are not currently agreed to by JAXA.

[1] Section 503, P.L. 111-267

[2] U.S. Government Accountability Office, GAO-12-162, International Space Station: Approaches for Ensuring Utilization through 2020 Are Reasonable but Should Be Revisited as NASA Gains More Knowledge of On-Orbit Performance, December 2011

Table 1: NASA's Planned Vehicle Launches for 2012 to 2020 to Resupply the ISS

Vehicles	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
ATV	1	1	1		1			1		5
HTV	1	1	1	1	1	1	1		1	8
SpaceX	3	3	3	2						11
Orbital	2	2	2	2						8
SpaceX Follow On Vehicle A					3	3	2	3	3	14
Orbital Follow On Vehicle B					1	2	3	2	2	10
Total	**7**	**7**	**7**	**5**	**6**	**6**	**6**	**6**	**6**	**56**

Source: GAO analysis based on NASA documents.

Note: This table does not include flights by the Russian Soyuz or Progress vehicles.

Even though NASA's calculation of total launch capacity assumes the extra ATV and HTV flights shown above, a slight capacity shortfall remained. In December 2011 GAO noted, "*Although NASA expects domestic commercial launch vehicles to deliver the bulk of cargo required by the ISS through 2020, NASA strategic planning manifests indicate that NASA may not have sufficient capability to carry all the cargo that could be needed on the ISS. The manifests show that, when anticipated growth in national laboratory demands and margin for unforeseen maintenance needs are accounted for, the current number of flights NASA is planning for may not cover all of NASA's anticipated needs beginning in 2014.*" See Figure 1 below.

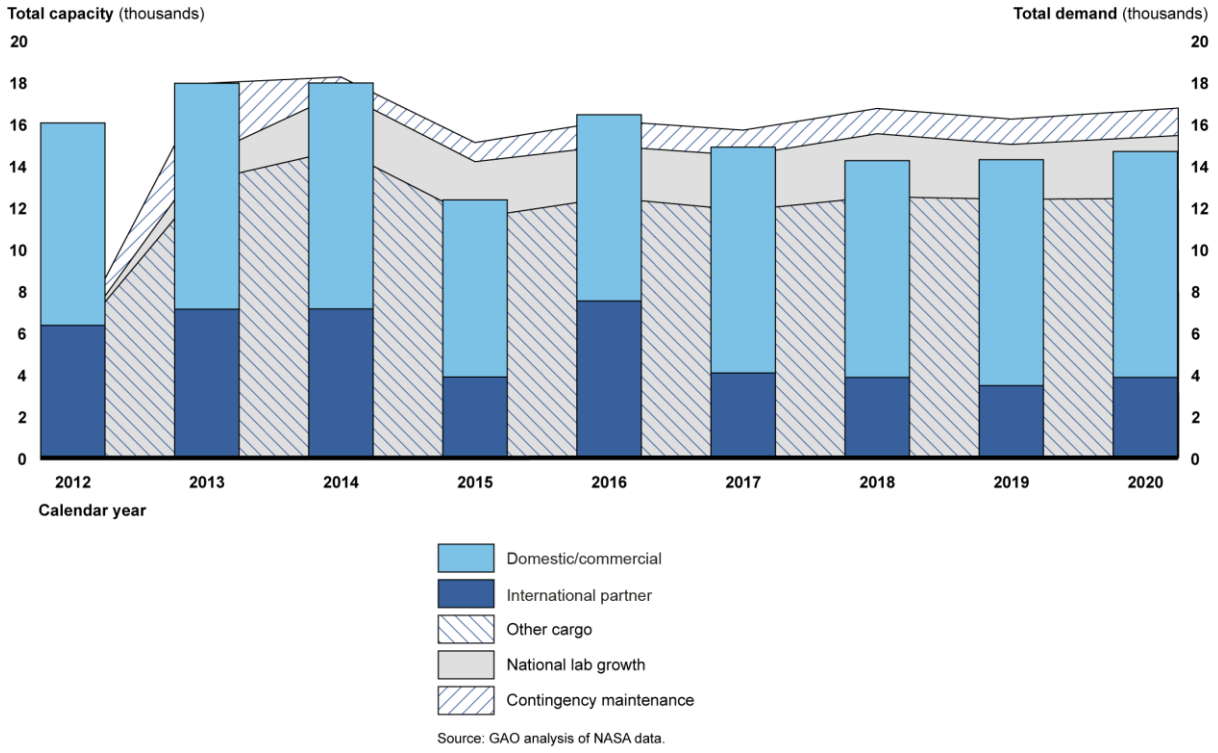

Figure 1: Cargo Capability of U.S. Commercial and International Partner Vehicles vs. NASA's ISS Sparing Needs from 2012 to 2020[3]

[3] U.S. Government Accountability Office, GAO-12-162, International Space Station: Approaches for Ensuring Utilization through 2020 Are Reasonable but Should Be Revisited as NASA Gains More Knowledge of On-Orbit Performance, December 2011

Based on NASA data provided to GAO, Figure 1 illustrates the shortfall in capacity needed to adequately service and utilize the ISS through 2020. As noted earlier, this chart contains assumptions about ATV flights in 2016 and 2019, and HTV flights beyond 2016, that artificially inflate the available launch capacity illustrated by the vertical bars. In the near term, the amount of launch capacity assumed in 2012 will likely be reduced due to schedule delays by the current domestic commercial providers. However, NASA believes the 2012 sparing needs have been met by the extra deliveries from the last two Space Shuttle missions. In the invitation to this hearing the Committee requested NASA to provide current estimates of the sparing requirements through 2020, and launch capacity based on current international commitments and realistic appraisals of the domestic/commercial providers.

Funding and Management of ISS Research

Amounts shown in millions of dollars		FY2012	FY2013	FY2014	FY2015	FY2016	FY2017
ISS Research		**225.5**	**229.3**	**227.4**	**231.3**	**238.3**	**241.7**
Biological & Physical Research		58.3	60.3	56.8	58.1	60.7	60.4
Non-Profit Organization		15.0	15.0	15.0	15.0	15.0	15.0
Multi-User System Support*		152.1	154.0	155.6	158.2	162.6	166.3
* MUSS is the infrastructure to support research							

Figure 2: ISS Research Funding, NASA's FY2013 Budget Proposal[4]

Figure 2 shows NASA FY2013 budget request for ISS Research. Funding for NASA's Human Research Program is not shown because it is managed in the Exploration Research and Development account. The NASA FY2013 ISS Research budget is $229.3 million which includes $60.3 million for NASA-sponsored Biological and Physical Research, $154 million for the infrastructure to support the research, and $15 million to administer the new non-profit entity, the Center for the Advancement of Science in Space (CASIS). Given that the US section of the ISS is only about 50 percent utilized, is the FY2013 budget enough to support quality research? This topic will be discussed in more detail below.

The FY2008 Omnibus Appropriations Act (P.L. 110-161) directed NASA to engage the National Research Council (NRC) "*to conduct a "decadal survey" of life and physical sciences research in microgravity and partial gravity to establish priorities for research for the 2010-2020 decade.*" In April 2011 the NRC completed their report entitled, *Recapturing a Future for Space Exploration: Life and Physical Sciences Research for a New Era*.

The National Academies report raised a number of concerns about the administrative and organizational oversight of life and physical sciences research, about the overall priority and declines in NASA funding for research, and about the need to rejuvenate the pipeline of graduate students,

[4] Does not include the Human Research Program funded by NASA's Exploration Research and Development

scientists, and engineers to improve the translation of fundamental and applied research to space exploration needs.

In the words of the report, "…*a vibrant and ultimately successful life and physical sciences space research program is a partnership between NASA and the scientific community at large. The present program, however, has contracted to below critical mass and is perceived from outside NASA as lacking the stature within the agency and the commitment of resources to attract researchers or to accomplish real advances*."

The report noted that the scientific community has dwindled in the last decade due to declines in NASA's life and physical sciences research from approximately $500 million in FY2002 to less than $200 million in FY2010, with much of the latter going to the Human Research Program.

ISS National Laboratory

The NASA Authorization Act of 2005 designated the U.S. portion of the ISS as a National Laboratory. The Act also directed NASA to develop a plan to "*increase the utilization of the ISS by other Federal entities and the private sector*…," The National Laboratory designation was intended to stimulate ISS research and strengthen relationships among NASA, other Federal entities, academic and private institutions to pursue national advancement of science, technology, engineering, and mathematics.

In 2011 NASA formed a new division within the Human Exploration and Operations Directorate to coordinate and manage ISS research. NASA's Space Life and Physical Sciences Research and Applications Division (SLPSRA), "*oversees basic and mission driven scientific research in support of human space flight and crew health and safety, overseeing basic and applied scientific research in life and physical sciences and serves as agency liaison with the ISS National Laboratory management organization.*"

In 2011 SLPSRA sought proposals from qualified entities to manage the ISS National Lab and on July 13, 2011 selected the Center for Advancement of Science in Space (CASIS). Until this time, NASA had managed the ISS National Lab, and sought to facilitate utilization of the ISS to conduct basic and applied research, technology development and industrial processing by U.S. federal, state and local government entities, and U.S. commercial, academic and non-profit entities.

It is unclear when this new organization will be able to accomplish these objectives, while striking a balance between basic and applied research, technology development and industrial processing. Already there have been management changes at CASIS. On March 5th the Executive Director of CASIS resigned after less than six months on the job.

Over the coming months, NASA and CASIS will need to coordinate their efforts to ensure there is no disruption of current research activities. CASIS will need to engage with other non-NASA agencies, academic institutions and private industry to expand opportunities for research. This work is an important step in fulfilling the promise of the ISS, and the Committee will be monitoring this activity.

Overarching Questions and Concerns

- Has NASA organized properly to enable effective research on the ISS?
- Is NASA's research funding sufficient to allow a robust research program?
- Given the funding, programmatic, and international limitations, does NASA have a viable plan to effectively maintain and utilize the ISS thru 2020?
- What are the assumptions about international participation that are in the plan, and how could they change?
- What are the resource and access constraints that limit the scientific utilization of the ISS?
- Does NASA have credible backup plans for alternative crew and cargo access to ISS, including the requirement for a government backup capability as directed by the Authorization Act?