

**U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON SPACE AND AERONAUTICS**

HEARING CHARTER

*NASA's International Space Station Program:
Status and Issues*

Thursday, April 24, 2008
10:30 a.m. – 12:30 p.m.
2318 Rayburn House Office Building

Purpose

On Thursday, April 24, 2008 at 10:30 a.m., the House Committee on Science and Technology's Subcommittee on Space and Aeronautics will hold a hearing to examine the status of the International Space Station (ISS) and issues related to its operation and utilization, including the planned and potential uses of the ISS to meet both NASA and non-NASA research needs.

Witnesses

Witnesses scheduled to testify at the hearing include the following:

William Gerstenmaier

Associate Administrator
Space Operations Mission Directorate
National Aeronautics and Space Administration

Ms. Cristina Chaplain

Director
Acquisition and Sourcing Management
Government Accountability Office

Dr. Jeffrey Sutton

Director
National Space Biomedical Research Institute

Dr. Edward Knipling
Administrator
Agricultural Research Service
U.S. Department of Agriculture

Thomas B. Pickens III
CEO
SPACEHAB, Inc

Dr. Louis Stodieck
Director
BioServe Space Technologies
Aerospace Engineering Sciences
University of Colorado

Dr. Cheryl Nickerson
Associate Professor
Center for Infectious Diseases and Vaccinology
The Biodesign Institute
Arizona State University

Potential Issues

The following are some of the potential issues that might be raised at the hearing:

Status and Risks of ISS Assembly and Logistics Flights

- *What is the status of ISS construction and logistics flights and what issues could impact the planned construction schedule and sequence?*
- *What are the main risks and challenges to successfully assembling the ISS by the time the Shuttle is retired?*
- *What is the impact on programmatic risk of the low level of reserves (\$32 million) requested for FY 09?*
- *What are NASA's options if scheduled and proposed ISS assembly and logistics flights are not completed by the end of 2010 and how will this impact future ISS utilization and operations?*
 - *What challenges, risks and assumptions does each option pose?*

- *Do any of the options require prior action by the Congress?*
- *What has been the progress in securing a commercial cargo transportation capability?*
- *What planned actions have the international partners indicated they will take to maintain access to the ISS during the “gap”?*
- *Will operational, wear, or failure data now available have an impact on NASA’s current ISS logistics strategy?*

Utilization of the ISS and the ISS National Laboratory

- *How does ISS research contribute to reducing risk in human space exploration? How much of that risk will be retired by the Administration’s proposed 2016 ISS end date?*
- *How much of NASA’s on-orbit research facilities and racks are currently being used to support research?*
- *Does NASA have a plan with priorities for ISS research to be conducted in the post-2010 period, and if so, what is NASA doing now to prepare that research for flight?*
- *How many experiment facilities/ hardware to support research investigations have been completed but are not planned for flight, and what if any plans does NASA have to fly that hardware on the ISS, free-flyers or other microgravity platforms?*
- *What advantages does the ISS National Laboratory provide to Laboratory partners, public and private?*
- *How will agency or commercial participants in the ISS National Lab get access to the ISS and who will pay for transportation?*
- *When will NASA know how much upmass and downmass is available to support research through commercial cargo vehicles?*
- *Will NASA’s decision to support investigations on ISS be determined by commercial logistics availability or will NASA seek to supplement, if necessary, logistics requirements for research needs through non-U.S. launch capabilities?*
- *What lead time is required for potential ISS users, including other governmental agencies, to prepare experiments to fly on the ISS?*
- *What impact does the uncertain status of the ISS past 2016 have on potential users being able to plan long term research using the station?*
- *What will NASA do with the unused capacity and capabilities of the ISS if other agencies decide not to make significant use of it?*

- *What is the status of NASA's (1) development of educational projects to be conducted on the ISS, and (2) plan for research that supports national competitiveness in science, technology, and engineering, as directed in the America COMPETES Act (P.L. 110-69)?*

BACKGROUND

Overview

The ISS is the most complex international scientific and technological endeavor ever undertaken, involving the United States, Russia, Japan, Canada, and 10 nations of the European Space Agency. One of the fundamental objectives of the ISS is to enable astronauts to learn how to live and work in space for long duration missions. When President Bush announced his Vision for Space Exploration in 2004, he made completion of the ISS an important part of the overall exploration initiative. The ISS has been continuously crewed for over 6 years; a 6 person crew capability is planned to start in 2009. At assembly complete, the ISS will have a pressurized volume of over 33,000 cubic feet and a mass of over 925,000 pounds.

Development and construction of the ISS has been a difficult journey. In addition to schedule delays of its own, the ISS was severely impacted by the loss of the Shuttle *Columbia* and its crew. The ISS was in the midst of assembly when the accident took place. Today, construction is over 65% complete. Development is mostly done and components only await their turn on the Shuttle manifest for on-orbit assembly. The most recent additions to the ISS happened in March with the attachment of the Canadian-built Special Purpose Dexterous Manipulator and the Kibo Japanese Experiment Logistics Module - Pressurized Section. Later next month, STS-124 will take up the Japanese Experiment Module's Pressurized Module and the Japanese Remote Manipulator System.

The retirement of the Shuttle currently scheduled for 2010, will cause the U.S. to rely on partners such as Russia to provide routine transportation and emergency crew return from the station or acquire commercial services. That period of time during which the U.S. will have no crew transportation capability is referred to as "the gap". While NASA is encouraging the development of a commercial crew and cargo capability, the availability of

such a capability is uncertain at this time. The Commercial Crew and Cargo Program is NASA's effort to foster the development of a cost-effective commercial space transportation capability for the post-Shuttle Era. Initially, this capability will be used to carry cargo to the ISS; future options could involve developing a crew transportation capability. The development of the commercial cargo/crew transportation capability is being funded in the Constellation budget managed by the Exploration Systems Mission Directorate (ESMD). While the services will be demonstrated through the Commercial Orbital Transportation Systems (COTS) project, the operational responsibility for the program will move to the ISS program within the Space Operations Missions Directorate (SOMD).

NASA is seeking partnerships with other government agencies and the commercial sector to utilize the ISS as a National Laboratory, as designated by the NASA Authorization Act of 2005. NASA's plan for the ISS National Laboratory, the National Lab Report, was submitted to Congress in May 2007. Interest in ISS use has been demonstrated in the areas of education, human health-related research and defense sciences research. A Memorandum of Understanding for "Cooperation in Space-Related Health Research" between the National Institutes of Health (NIH) and NASA was signed on September 12, 2007. This could be the first in a series of Memorandum of Understandings with U.S. government agencies that have expressed interest in access to the ISS for research and development purposes. In addition, NASA issued an announcement of "Opportunity for Use of the ISS by Non-Government Entities for R&D and Industrial Processing Purposes" on August 14, 2007, and is planning to enter into several Space Act Agreements as a result.

Fiscal Year 2009 Budget Request

NASA's FY 09 budget provides \$2.06 billion for the International Space Station Program under the direction of SOMD. It should be noted that NASA's FY 2009 budget has been restructured pursuant to the Consolidated Appropriation Act, 2008, and is now presented in seven accounts. In addition, the budget estimates presented in the FY 2009 request are in direct program dollars rather than in the full cost dollars used in previous Presidential budget requests. From a direct cost perspective¹, the proposed

¹ As part of the congressionally directed budget restructuring, NASA shifted from a full-cost budget, in which each project budget included

FY 09 budget for the ISS is an increase of \$247 million from that appropriated in FY 08.

The ISS Program budget funds:

- ISS operations. The FY 09 request for ISS operations is \$1,755.4 million, a slight increase from the \$1,713.1 million enacted in FY 08. The ISS Operations budget funds several key activities: Program Integration, Multi-User System Support, Avionics and flight software, and Launch and Mission Operations.
- ISS Crew and Cargo Services. The FY 09 request for ISS Crew and Cargo Services is \$304.8 million, an increase from the \$100.1 million enacted in FY 08. The purchase of ISS Cargo Crew Services was transferred from ESMD to SOMD in the FY 2008 budget. The total available funding for the purchase of cargo transportation services is \$2.6 billion over five years.

Funding for research conducted on the ISS is included in the budget managed by the Exploration Systems Mission Directorate (ESMD). The FY 09 request for ESMD's Human Research Program (HRP) is \$151.9 million in direct program dollars. The HRP identifies risk for human exploration of space and measures to mitigate the risks. According to NASA's Fiscal Year 2009 Budget Request, the HRP includes \$19.9 million for the ISS Medical Project, which *"includes current ISS biomedical research capabilities and on-orbit validation of next generation on-orbit equipment medical operations procedures and crew training concepts."* ESMD's budget request also provides \$168 million for Exploration and Non-Exploration research to be conducted on the ISS, free-flyers, and through ground-based activities, of which \$138 million is for Exploration and \$30 million is for Non-Exploration research. Exploration research focuses on physical sciences in

overhead costs, to a direct cost budget. All overhead budget estimates are now consolidated into the Cross Agency Support budget line. NASA has stated that maintaining a full cost budget with seven appropriations accounts would be overly complex and inefficient. The direct cost budget shows program budget estimates that are based entirely on program content. Individual project managers continue to operate in a full-cost environment, including management of overhead costs.

the areas of life support, thermal control, fire prevent, detection, and suppression, and on fluid flow. Non-Exploration research supports fundamental research in the areas of material sciences, fluid physics, combustion sciences, cellular and animal research, and microbial research, among other areas.

Assumed Budget Growth for the ISS Program FY 2009 – FY 2013

NASA’s out-year projections for the ISS Program in the President’s FY 09 budget request show minor funding level changes through 2013

\$ in millions					
FY 2008 Enacted	FY2009 Request	FY 2010	FY2011	FY2012	FY2013
1,813.2	2,060.2	2,277.0	2,176.4	2,448.2	2,143.1

Key Challenges Related to the FY 09 Budget and Five-Year Runout

Key challenges related to the FY 09 budget request and five-year runout for the ISS program include:

- *Low level of program reserves.* The ISS program has depleted reserves through FY 2009 while facing the most challenging period of ISS assembly.
- *Uncertain status of the two logistics flights.* Two of the remaining Shuttle flights are listed as “contingency” and have not yet been approved by the Office of Management and Budget (OMB)—although NASA says sufficient funds have been included in the FY 09 budget request. NASA has indicated that the two flights needed to deliver spares and logistics in advance of the Shuttle’s retirement are necessary and of high priority.
- *Cuts in research funding.* Funding for ISS research has been cut back significantly over the last several years, and the research community that was intended to utilize the ISS has been decimated by reductions in funding. This raises the issue of reduced opportunity to attract top research scientists in the future.
- *Export control restrictions.* Current International Traffic in Arms Regulations (ITAR) restrictions on NASA “are a threat to the safe and successful integration and operations of the International Space

Station”, according to the ISS Independent Safety Task Force (IISTF) issued in 2007. The Task Force also found that workforce interactions must enable direct interfaces to assure safe and successful operations. These interactions, including the ability to exchange and discuss technical data relevant to vehicle operation, are hampered by the current ITAR restrictions.

ISS Cargo and Crew Transportation Services In the Post-Shuttle Era

The Commercial Crew and Cargo Program is NASA’s effort to foster the development of a cost-effective commercial space transportation capability for the post-Shuttle Era. This capability will initially be utilized to carry cargo to the ISS; future options could involve developing a crew transportation capability. The development of the commercial cargo/crew transportation capability is being funded in ESMD’s Constellation budget. Once the services have been demonstrated (Phase 1), the operational responsibility for the program will move to the ISS program within SOMD.

As the Space Shuttle nears retirement, NASA's stated preferred solution for ISS crew and cargo delivery and return requirements is to use commercial services provided by space transportation companies. NASA's Commercial Orbital Transportation Services (COTS) project is intended to facilitate U.S. private industry's development of cargo and crew space transportation capabilities with the goal of demonstrating reliable, cost effective access to low Earth orbit. NASA had initially selected two partners for its COTS project under Space Act Agreements. One partner failed to meet NASA’s milestones, and NASA terminated the Agreement. The other partner, SpaceX, recently announced that it has delayed the first demonstration flight for their Falcon 9 rocket for 6 to 9 months. Following GAO’s decision rejecting a challenge by the terminated partner to NASA’s plans to utilize a Space Act Agreement rather than a government contract, NASA made an award to Orbital Sciences Corporation in February 2008. Last week, NASA issued a Request for Proposals (RFP) for Phase 2 of the COTS program, now called Commercial Resupply Services, with a planned contract award by the end of the year. Both of the current COTS partners are working only on cargo carriers.

If NASA’s preferred solution of using commercial services is not attainable by the time the Shuttle is retired, the agency has indicated that it will rely on prepositioned spares to be sent up to the ISS before the Shuttle retires. In an

interview in Aviation Week last week, NASA's Associate Administrator for Space Operations said "*We recognized that there may be a little bit of a delay in the delivery of those [commercial] services*", adding that "*Our plan is that if we have a delay we would live off the spares we flew up on shuttle and take some limited degradation in space station capabilities until those commercial services come on line.*" However, this poses a risk since the last two Shuttle flights scheduled to bring up those spares have not been approved by the Administration. As to the use of international partner cargo capabilities, NASA said last week that it will not ask Congress for permission to continue buying cargo services from Russia after 2011. European Automated Transfer Vehicles (ATV) and Japanese H-II Transfer Vehicles (HTV) are alternatives but would require some time to procure.

Regarding crew transportation during "the gap", purchases of Russian capabilities beyond 2011 will require an extension of the waiver currently granted in the Iran, North Korea and Syria Non-Proliferation Act (INKSNA). Last week, NASA notified the Congress that it needs to continue using Russian Soyuz capsules to deliver crew to the ISS after the shuttle retires in 2010 and is thus seeking an extension of INKSNA waiver authority. A copy of NASA's letter to Chairman Udall transmitting the proposed waiver and the waiver itself are included as Attachment 1.

Research Objectives of the ISS

Although one NASA objective for the ISS was *to create a world-class laboratory*, cost overruns, a decision to focus on a "core complete" configuration, the elimination of several planned research facilities, and a smaller crew size led a National Research Council (NRC) committee to conclude in a 2003 report, *Factors Affecting the Utilization of the International Space Station*, that achieving that goal was "unlikely."

- Following President Bush's announcement of a Vision for Space Exploration in January 2004, NASA reoriented its goals for the ISS to focus on exploration.

A 2006 NRC report, *NASA's Plans for the International Space Station*, identified several priority areas of research to support NASA's exploration goals, including "*effects of radiation on biological systems, loss of bone and muscle mass during spaceflight, psychosocial and behavioral risks of long-term space missions, individual variability in mitigating a*

medical/biological risk, fire safety aboard spacecraft, and multiphase flow and heat transfer issues in space technology operations.”

In addition, the report recommended that NASA take several other actions in utilizing the ISS to support exploration missions. For example, the NRC recommended that:

- *“NASA should develop an agency-wide, integrated utilization plan for all ISS activities as soon as possible.”*
- *“NASA should develop and maintain a set of operations demonstrations that need to be conducted on the ISS to validate operational protocols and procedures for long-duration and long-distance missions such as the ones to Mars.”*
- *“NASA should plan options and decision points for obtaining a post-shuttle logistics capability for...demonstrating the technology and operations that will enable exploration missions. NASA should establish priorities and develop back-up plans to enable the post-2010 deployment of large ISS structural components and research facilities required to accomplish exploration mission objectives.”*

In 2007, at the House Committee on Science and Technology’s hearing on NASA’s Fiscal Year 2008 Budget Request, NASA provided material for the record noting that NASA’s research use of the ISS aligns with the Agency’s needs in the following areas:

- *Research, Development, Test, and Evaluation of Biomedical Protocols for Human Health and Performance on Long-Duration Space Missions*
- *Research, Development, Test, and Evaluation of Systems Readiness for Long-Duration Space Missions*
- *Development, Demonstration, and Validation of Operational Practices and Procedures for Long-Duration Space Missions.*

Congressional Policy Direction on ISS Utilization

Congress directed in the NASA Authorization Act of 2005 (P.L. 109-155) that NASA complete the assembly of the ISS and ensure its utilization for basic and applied research, as well as commercial research, and other benefits to the nation. As part of this policy direction, NASA is to sustain the necessary scientific expertise to support research in disciplines that require microgravity environments (e.g., molecular crystal growth, animal research, basic fluid physics, combustion research, and cellular research). To ensure that that NASA continues to sustain basic research in life and microgravity sciences, the Act directs NASA to allocate at least fifteen percent of ISS research funds to non-exploration research conducted on the ISS, free-flyers and ground. In addition, the Act designates the ISS as a National Laboratory to “*increase the utilization of the ISS by other Federal entities and the private sector through partnerships, cost-sharing agreements, and other arrangements that would supplement NASA funding of the ISS.*”

Status of NASA Plans for ISS Utilization and Ongoing Utilization Activities

In response to direction in the 2005 NASA Authorization Act, NASA submitted a report, the *NASA ISS Research and Utilization Plan*. The nature of that report was high-level, and as a follow-up, NASA submitted three additional documents detailing NASA plans for ISS utilization: 1) *Human Research Program Utilization Plan for the International Space Station*, 2) *ISS Exploration and Non-Exploration Research Project Plan for the NASA ISS Utilization Plan*, 3) *Consolidated Operations and Utilization Plan 2007 – 2015*. The first report identifies the human health risks to be addressed by the ISS Human Research Program, for which 25 of 32 risks require research on the ISS to mitigate the risk. The second report provides a top-level plan for ISS research to support NASA’s exploration objectives (applied) as well as non-exploration (basis) research. The third report details the operational plans for utilizing the ISS, including allocation of resources among partners. An overview summary of these documents states that “*human biomedical research is of the highest priority in order to prepare for longer duration human space exploration missions...*”

At a hearing of the House Committee on Science and Technology on NASA’s Fiscal Year 2008 Budget Request, the NASA Administrator

testified that “we are still building the Station, and its full capability as a research laboratory is mostly in front of us. But we can’t have a research laboratory until we get the power and the water and the air conditioning fully in place. And that is what we are doing right now.” He further stated that “I believe it [the Station] should be sustained as long as the costs of its operations and maintenance, once built...seem to be justified by the research, which is being returned...” The duration of Space Station operations has not yet been determined.

Upon request of the Committee, NASA provided material for the record noting that NASA has conducted 17 NASA Human Research Program investigations (the ISS component of that research was complete) which supported 44 researchers “worldwide.” NASA also reported that there were 16 investigations of the Human Research Program being conducted on the ISS in which 49 researchers “worldwide” were involved. NASA’s plans were to conduct 9 Human Research Program investigations over the next year, which would involve 25 researchers. NASA also conducts exploration and non-exploration research on the ISS, although it is not completely clear how many experiments have been flown or how many will be flown and when.

ISS as a National Laboratory

As directed in the 2005 NASA Authorization Act, NASA submitted a report to Congress on an *International Space Station National Laboratory Application Development*. NASA indicates that approximately 50 percent of planned U.S. utilization resources on ISS could be available for non-NASA use through the ISS National Laboratory. In August 2007, NASA solicited proposals for “*Opportunity For The Use Of The International Space Station By U.S. Non-Government Entities For Research And Development And Industrial Processing Purposes.*”

ISS National Laboratory Partners and Prospective Partners

In September 2007, NASA and the National Institutes of Health (NIH) signed a Memorandum of Understanding (MOU) for Cooperation on Space-Related Research. The MOU will foster synergies in research being sponsored by both agencies that will help ensure astronaut health, especially on long-duration missions, and yield benefits for medical science on Earth. For example, research on the loss of bone density and muscle mass resulting

from the effects of microgravity may improve treatment for bone and muscle diseases. Better understanding of the effects of gravity on astronauts' balance may increase our knowledge of conditions such as vertigo, problems of the inner ear, and dizziness. Research on how microorganisms respond to microgravity may also provide insights into the immune system's response to infectious diseases.

The MOU outlines NIH's particular interest in the use of the ISS for research in the following types of areas:

- *“Basic biological and behavioral mechanisms in the absence of gravity*
- *Human physiology and metabolism*
- *Spatial orientation and cognition*
- *Cell repair processes and tissue regeneration*
- *Pathogen infectivity and host immunity*
- *Medical countermeasures*
- *Health care delivery and health monitoring technologies”*

A copy of the MOU is included as Attachment 2.

In a Fall 2007 issue of NIH Medline Plus, Dr. Stephen Katz, National Institute of Arthritis and Musculoskeletal and Skin Diseases, said, *“An enormous amount of time will be required to develop the questions and experimental models for use on the space station....”* Members may wish to probe whether or not the Administration's current plans for operating the ISS until 2016 will be sufficient to accommodate the time NIH would need to prepare and carry out research investigations.

NASA is currently working on an MOU with the U.S. Department of Agriculture. Potential UDSA-sponsored research on the ISS could help to advance knowledge in the areas of nutrition and animal and plant biology. Potential goals of the research include outcomes that could provide additional benefits in assuring food safety and the quality of agricultural products.

SPACEHAB, a commercial company that provides space products and services, is also discussing partnership opportunities with NASA as part of the ISS National Laboratory. The company announced in 2007 plans *“to develop a new company division that will focus on manufacturing pharmaceuticals and materials in space for distribution into the commercial*

marketplace”. Following on this path, SPACEHAB’s January 28, 2008 press release announced the company’s plans to use the ISS for “*research, development, and industrial processing purposes*”. SPACEHAB’s past relationship with NASA has been in providing pressurized habitation modules, unpressurized cargo carriers, and related spaceflight equipment and services to support research and other payloads for launch, operation, and return from NASA spaceflight and ISS missions. In addition, SPACEHAB has an unfunded Space Act Agreement with NASA to develop (along with several partner companies) a commercial transportation system (COTS) to provide logistical support to the ISS following the retirement of the Shuttle in 2010.

The ISS National Laboratory report refers to “*the availability of cost-effective transportation services*” as the most significant risk for the success of the National Laboratory. The report prepared for Congress did not indicate that NASA planned to provide transportation services to ISS National Laboratory partners. According to the ISS National Laboratory report to Congress, NASA plans to begin managing the operations and utilization of the ISS National Laboratory. NASA is also considering alternative approaches for managing the ISS national lab.

Readiness of the Life and Microgravity Sciences Research Community to Support ISS Research

At a hearing of the Subcommittee on Space and Aeronautics on “NASA’s Space Shuttle and International Space Station Programs: Status and Issues” in July 2007, Dr. G. Paul Neitzel, a professor of fluid mechanics, testified that “*At its zenith, the budget of the then Office of Biological and Physical Research...had grown to approximately \$1B and the FY03 OBPR Task Book...shows a broad research program containing roughly 1000 tasks, supporting over 1,700 PIs and co-investigators and nearly 3,000 students...*” Following the *Columbia* accident and the President’s announcement of a Vision for Space Exploration, NASA reduced the size of the life and microgravity sciences program. “*In December 2005, NASA sent letters to hundreds of investigators in the program, informing them of significant cuts in their funding for FY06 and the termination of their grants effective September 30, 2006.*” Dr. Neitzel further noted that “*The reestablishment of an external research community will take years, if it can be accomplished at all.*”

Existing and Planned Research Facilities for U.S. Use on the ISS

The U.S. laboratory module, Destiny, houses several research facilities.

These include the:

- Human Research Facility racks
- Microgravity Science Glovebox
- The Minus Eight-Degree Freezer for ISS that can store and freeze life science and biological samples
- Expedite the Processing of Experiments to Space Station (EXPRESS) racks, which can provide power, data, and fluids and other utilities needed to support research experiments that can attach to the racks.

The following are NASA facilities planned for inclusion on the ISS, and most, if not all, have been manifested on upcoming Shuttle flights to the ISS:

- Fluids and Combustion Facility (includes the Combustion Integrated Rack and the Fluids Integrated Rack)
- Microgravity Science Research Rack
- Space Dynamically Responding Ultrasound Matrix Facility
- Window Observation Research Facility
- EXPRESS Rack 6
- Muscle Atrophy Research Exercise System
- Five External Logistics Carriers (ELCs) each of which can support 2 payloads that do not require a pressurized environment.
- Several International Standard Payload Racks (ISPR)
- Other research facilities can be accommodated on international modules.

The Alpha Magnetic Spectrometer (AMS), a collaboration between the Department of Energy and international participants, had been planned for flight to the ISS, but is currently not manifested on any of the remaining Shuttle flights.

Use of ISS to Support Math and Science Education and Competitiveness

In exploring the opportunities for using the ISS National Laboratory for potential educational activities, a NASA-led task force produced the *International Space Station National Laboratory Education Concept Development Report*. The task force concluded “*that there is significant*

interest among other Federal agencies in the opportunity to further develop the ISS as an asset for education.”

In 2007, Congress passed the America COMPETES Act, which became Public Law 110 – 69. Section 2006 of the law directs NASA to use the results of the ISS education task force report to *“develop a detailed plan for implementation of 1 or more education projects that utilize the resources offered by the International Space Station.”*

In addition, Section 2006 directs NASA to *“develop a detailed plan for identification and support of research to be conducted aboard the International Space Station, which offers the potential enhancement of United States competitiveness in science, technology, and engineering.”* NASA is to work with agencies and organizations that have entered into agreements as partners on the ISS National Laboratory.

Establishing ISS Program Service Life

NASA indicates that while the FY 09 budget run out does not presently allocate funds for operating ISS beyond 2016, it is not taking any action to preclude it. Likewise, out year projections do not include costs to retire and decommission ISS.

Two new issues have bearing on the ISS’s life expectancy:

1. Reports of sooner-than-expected wear on components, such as the beta gimbal assembly (BGA) and the Solar Array Rotary Joint (SARJ) could be indications that NASA may need to re-analyze its sparing strategy due to uncertainties about the last two Shuttle logistics flights and resupply options after the Shuttle is retired in 2010.
2. It was recently reported that Russia will ask partners in June to extend the utilization of the ISS until 2020 because a Russian segment would take longer to complete. Russia still does not have a research module on the ISS and the Multi-Purpose Laboratory Module (MLM) would provide the expanded research capability desired. The MLM will be Russia's primary research module as part of the ISS. According to news reports, funding issues had delayed the MLM from an initial 2007 date. A NASA official has told Subcommittee staff that NASA will discuss these issues at a meeting of the partner Space agencies in July of this year.

Attachment 1

National Aeronautics and Space Administration
Office of the Administrator
Washington, DC 20546-0001



April 11, 2008


The Honorable Mark Udall
Chairman
Subcommittee on Space and Aeronautics
Committee on Science and Technology
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

The National Aeronautics and Space Administration (NASA) proposes the enclosed amendment to the Iran, North Korea, and Syria Nonproliferation Act (50 USC 1701 note). The purpose of the amendment is to permit NASA to continue to procure Russian support for the International Space Station (ISS) until suitable U.S. capabilities are in place. We urge enactment of this important amendment.

The amendment provides a balanced approach, maintaining both U.S. nonproliferation principles and objectives as well as a U.S. presence on ISS. The justification and purpose for this proposed amendment are stated more fully in the enclosed sectional analysis. As an overview, NASA has procured Soyuz services through the fall of 2011, consistent with existing authority under the Act. However, U.S. obligations to provide crew transportation and emergency services to the ISS continue beyond 2011, and Soyuz will be the only viable option for the United States to meet these obligations until the U.S. Orion Crew Exploration Vehicle or U.S. commercial providers can provide such transportation and rescue services. Fabrication of Soyuz vehicles must begin approximately 36 months prior to launch, according to the responsible Russian entities. Thus, unless contractual arrangements for the provision of crew rescue and rotation services beyond 2011 are concluded in 2008, the production of Soyuz vehicles for U.S. crew transportation requirements will be at risk. This, in turn, means that prompt legislative action is needed to provide further relief beyond 2011 and allow for the negotiation of these arrangements.

The Office of Management and Budget advises that there is no objection to the submission of this legislation from the standpoint of the Administration's program.

Sincerely,

Michael D. Griffin
Administrator

2 Enclosures

Amendment to the Iran, North Korea, and Syria Nonproliferation Act

The Iran, North Korea, and Syria Nonproliferation Act (50 USC 1701 note) is amended—

In subsection 7(1)(B) —

- (a) after the phrase “except that such term does not mean” insert a “.”;
- (b) indent the following phrase and insert “(i)” at the beginning;
- (c) replace the final period with a “; or”; and
- (d) add the following new subsection:

“(ii) payments in cash or in kind made or to be made by the United States Government between January 1, 2012 and reentry into the Earth’s atmosphere of the International Space Station at its end of life, for work to be performed or services to be rendered during that period necessary to meet United States obligations under the Agreement Concerning Cooperation on the Civil International Space Station, with annex, signed at Washington on January 29, 1998, and entered into force March 27, 2001, or any protocol, agreement, memorandum of understanding, or contract related thereto, except that this subsection does not allow for payments in cash or in kind to be made by the United States Government for:

- (a) any cargo services provided by a Progress vehicle; or
- (b) any crew transportation or rescue services provided by a Soyuz vehicle once (1) the Orion Crew Exploration Vehicle reaches Full Operational Capability or (2) a United States commercial provider of crew transportation and rescue services demonstrates the capability to meet International Space Station mission requirements.”

Enclosure 1

Amendment to the Iran, North Korea, and Syria Nonproliferation Act

Sectional Analysis

The Administration remains committed to the important objective of persuading the Russian Government and Russian entities to improve their nonproliferation efforts regarding Iran, North Korea, and Syria. Accordingly, the proposed amendment to the Iran, North Korea, and Syria Nonproliferation Act (the Act) would maintain key existing U.S. nonproliferation tools while allowing payments to Russian entities that support U.S. obligations to the International Space Station (ISS) beyond December 31, 2011.

The provision would extend the Act's exception to the prohibition on "extraordinary payments" to the Russian government and Russian entities for goods or services relating to the ISS from January 1, 2012 to the end of the life of the ISS. It would exclude from the exception any payments after December 31, 2011, for cargo services provided by a Progress vehicle. The new provision would also exclude from the exception payments for crew transportation or rescue services provided by a Soyuz vehicle once (1) the U.S. Orion Crew Exploration Vehicle reaches Full Operational Capability or (2) a U.S. commercial provider of crew transportation and rescue services demonstrates the capability to meet ISS mission requirements.

An international partnership governed by an Intergovernmental Agreement (IGA) among the United States, Canada, multiple European States, Japan, and Russia established the ISS. This partnership is a long-standing and interdependent one, with roles and responsibilities outlined in the IGA and subordinate agreements for design, development, and operations of the program. Pursuant to the IGA and subordinate agreements, NASA has an obligation to its non-Russian ISS Partners to provide crew rotation and rescue services during the life of the ISS. Currently, the Russian vehicle Soyuz is the sole provider of rescue services, with the Space Shuttle providing crew transportation. After Shuttle retirement, the partnership will be dependent on Russia to provide both crew transportation and rescue services with Soyuz until the U.S. Orion Crew Exploration Vehicle (CEV) achieves Full Operational Capability (currently projected for 2016) and can provide crew transportation and rescue services or a U.S. commercial provider can demonstrate the capability to provide crew transportation and rescue services to meet ISS mission needs.

NASA has procured Soyuz services through the fall of 2011, consistent with existing authority under the Act. Fabrication of Soyuz vehicles must begin approximately 36 months prior to launch based upon information provided by the Russian entities responsible for manufacturing these vehicles. Thus, unless contractual arrangements for rescue and crew rotation services after 2011 are concluded in 2008, the production of Soyuz vehicles for U.S. crew transfer and rescue will be at risk. This in turn means that prompt legislative action is needed to provide further relief beyond 2011 and allow for the negotiation of these arrangements.

Enclosure 2

Absent the proposed relief, the United States will be unable to meet one of its most critical partner obligations: providing crew transportation and rescue services to European, Japanese and Canadian crews. The United States would not have an American "presence" aboard the ISS, either in terms of astronauts or access to research facilities for the U.S. scientific community, if we could not purchase crew transportation and rescue services from Russia, as no non-Russian crew transfer vehicles will be available until the CEV reaches Full Operational Capability or a U.S. commercial provider demonstrates the capability to meet ISS crew transportation and rescue needs. Given NASA's operational, engineering, safety, and other responsibilities for the ISS, NASA is concerned whether the ISS could remain fully operational for any significant time period absent an American presence.

Moreover, the authority under the present exception to the Act has been used to obtain ancillary goods and services from Russia in addition to crew transport and rescue. For example, although purchased from Russia, the Zarya module is legally a U.S. element under the Space Station agreements, and NASA must purchase unique tools and engineering support, such as sustaining software, from Russia for the continued operation of the module. NASA will have a continuing requirement to procure certain goods and services where Russia offers unique capabilities, such as those related to Russian space suits, software and hardware engineering support, and Extravehicular Activity tools and training, which are required for effective operations onboard the ISS. This amendment will allow NASA to continue to purchase such goods and services that are necessary to meet U.S. responsibilities under the Space Station Agreements.

In addition, this limited relief being requested (*i.e.*, through the life of the ISS) may be necessary even after a U.S. commercial capability is available, because some potential U.S. commercial providers of cargo services and of crew transportation and rescue services have Russian contractors or other relationships with Russian entities that, without this amendment, could trigger the Act's "extraordinary payment" prohibition.

With respect to furthering the United States' nonproliferation objectives and tools, in addition to the positive incentive provided by prudent, closely monitored space cooperation in areas of great benefit to the United States, the proposed amendment would not affect the current nonproliferation framework. The first five sections of the Act establish a requirement to report to Congress on every foreign person that transfers controlled items to, or acquires controlled items from, Iran, Syria, or North Korea and authorizes sanctions against such foreign persons. These key reporting and sanctions provisions would not be affected by the proposed amendment. In addition, the amendment leaves in place the ban on any United States Government agency making extraordinary payments in connection with the ISS or other human space flight to any persons (including entities) subject to sanctions under the Act or the Proliferation of Weapons of Mass Destruction Executive Order (E.O. 12938, as amended by E.O. 13094) or if the U.S. Government agency (in consultation with other interested U.S. Government agencies) anticipates that such payments will be passed on to such persons. Finally, specific proposals for cooperation with Russia would continue to be subject to review under relevant mechanisms such as the Department of State's Circular 175 process for

interagency review of international agreements. Likewise, export and import licensing regulations would ensure that U.S. nonproliferation objectives are maintained.

Attachment 2

September 12, 2007

Memorandum of Understanding between the National Institutes of Health and the National Aeronautics and Space Administration for Cooperation in Space-Related Health Research

I. PURPOSE AND SCOPE

This Memorandum of Understanding (MOU) sets forth a framework of cooperation between the National Institutes of Health (NIH) and the National Aeronautics and Space Administration (NASA) to encourage:

- Communication and interaction between the NIH and NASA research communities to facilitate space-related research and to integrate results from that research into an improved understanding of human physiology and human health.
- Exchange of ideas, information, and data arising from their respective research efforts.
- Development of biomedical research approaches and clinical technologies for use on Earth and in space.
- Research in Earth- and space-based facilities that could improve human health on Earth and in space.

Of particular interest is the application of the U.S. portion of the International Space Station (ISS) as a National Laboratory, as established by P.L. 109-155. The designation as a National Laboratory underscores the significance and importance that the United States places on the scientific potential of the ISS for research in areas including, but not limited to,

- Basic biological and behavioral mechanisms in the absence of gravity.
- Human physiology and metabolism.
- Spatial orientation and cognition.
- Cell repair processes and tissue regeneration.
- Pathogen infectivity and host immunity.
- Medical countermeasures.
- Health care delivery and health monitoring technologies.

Each agency has existing programs and resources for facilitating health research and technology development. Research facilitated by this MOU will be complementary to studies supported by the NIH, its Institutes and Centers, and NASA, at the agencies' intramural or extramural laboratories.

In pursuing objectives through this MOU, the NIH and NASA shall manage their own activities and use their own resources, including the expenditure of their own funds unless otherwise agreed in specific implementing agreements.

II. AUTHORITY

The NIH enters into this MOU in accordance with section 301 of the Public Health Service Act, which authorizes NIH to cooperate with public authorities and scientific institutions.

The NASA enters into this MOU, pursuant to section 203(c) of the National Aeronautics and Space Act of 1958, as amended [42 U.S.C. 2473 (c)].

The NIH and NASA may be individually referred to as a "Party" and collectively referred to as the "Parties." Nothing in this MOU alters the statutory authorities of the NIH or NASA. It is intended to facilitate cooperative efforts in the conduct of research and development of technologies in the area of space-related health research. It does not supersede or void existing agreements between NASA and the NIH or any of its Institutes or Centers.

III. **BACKGROUND**

The programmatic strengths of the NIH and NASA offer opportunities for synergy that can accelerate basic knowledge and technology development that can be applied to humans in space and on Earth. For example, NASA enables research in reduced gravity by facilitating access to the unique environment of space and has created systems that are analogous to the space environment. NASA also supports technologies that are not yet available to Earth-based researchers that could contribute greatly to biomedical advances. Likewise, the NIH, with its 27 Institutes and Centers, is capable of reaching a broad range of basic and clinical biomedical researchers whose involvement in space-related projects would create an intellectual environment where unanticipated breakthroughs could occur.

In a report accompanying the National Aeronautics and Space Administration Authorization Act of 2005 (P.L. 109-155), the Senate Committee on Commerce, Science, and Transportation repeatedly emphasized that a primary justification for support of the ISS is its scientific and research potential (Senate Report 109-108). Recognizing that the ISS will be capable of hosting a wide range of scientific research that can only be undertaken in a microgravity environment, the authors of P.L. 109-155 specifically noted that the NASA portfolio should include microgravity research that is not related directly to its human exploration efforts (e.g., growth of molecular crystals, development of cell-based technologies).

When complete, the ISS will provide a unique life sciences laboratory and will be able to facilitate testing of new biosensors and telemedicine technologies. It also may promote development of international research collaborations that would improve the lives of people around the world or accelerate fundamental discoveries. The U.S. segment of the ISS will have laboratory space, data processing capabilities, and crew time for experiments conducted on the ISS once it is fully operational in 2011. Because commitment of ISS resources is likely to be made on a first come, first serve basis, now is an appropriate time for researchers to begin proposing studies, conducting preliminary experiments on Earth, and arranging with NASA to have their hypotheses tested on the ISS.

IV. **RESPONSIBILITIES**

This MOU is intended to provide an enabling mechanism for coordination and cooperation whenever appropriate and mutually beneficial, subject to program priorities and availability of funds and personnel.

Within the context of the Purpose and Scope above, the NIH agrees to use reasonable efforts to:

- Publicize, to the intramural and extramural communities, the availability of the ISS as a research environment that can accommodate a variety of experimental approaches and can address a vast range of research questions. In the course of its communications with the scientific community, NIH will note that, with respect to the placement of any article on the ISS, liability is governed by Article 16 of the 1998 ISS Intergovernmental Agreement requiring cross waivers of liability, as implemented by 14 CFR Part 1266. Separate launch services or payload integration agreements, as appropriate, may be required prior to flight.
- Give careful consideration through the standard review process to well-developed, investigator-initiated extramural applications and potential intramural activities related to space-related health research that are developed in response to the publicity noted above.

Within the context of the Purpose and Scope above, NASA agrees to use reasonable efforts to:

- Advise investigators on implementation of NIH-funded projects that would use the ISS.

Within the context of the Purpose and Scope above, the NIH and NASA agree to use reasonable efforts to:

- Encourage space-related health research through the exchange of expertise, scientific and technical information, data, and publications.
- Provide technical expertise for performance, planning, review, or consultation in areas of mutual interest, subject to program priorities and availability of funds and personnel.
- Facilitate and enhance research and development activities by either agency.
- Coordinate publicity of mutually reinforcing activities, publications, and research results.
- Include representatives from each agency in workshops, working groups, seminars, and other related activities.

V. **RESPONSIBLE OFFICERS/AGENCY CONTACTS**

For the National Institutes of Health:

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For the National Aeronautics and Space Administration:

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VI. **FINANCIAL OBLIGATIONS**

This MOU does not constitute any obligations of funds by either party. There will be no transfer of funds or other financial obligations between NASA and NIH under this Agreement. Each Party will fund its own participation. All activities under or pursuant to this agreement are subject to the availability of appropriated funds, and no provision herein shall be interpreted to require obligations or payment of funds in violation of the Anti-Deficiency Act, 31 U.S.C. § 1341.

VII. **DATA RIGHTS**

The Parties agree that, to the extent permitted by law, the information and data exchanged in furtherance of the activities under this MOU will be exchanged without use and disclosure restrictions unless required by national security regulations or otherwise agreed to by the Parties

for specifically identified information or data (e.g., information or data specifically marked with a restrictive notice).

VIII. AMENDMENT AND TERMINATION

The MOU may be amended at any time by the mutual written consent of the Agencies. On an annual basis, the Parties will conduct a review of this MOU to evaluate progress and achievement of mutual goals and objectives consistent with the purpose and scope.

Either Party may unilaterally terminate this MOU by providing 90 calendar days written notice to the other Party.

IX. TERM OF AGREEMENT

This MOU will be effective upon the date of the last signature below, and shall remain in effect for 5 years. At the conclusion of 5 years, the parties will consider the development of a new agreement.

X. ACCEPTANCE AND APPROVAL OF AUTHORIZING OFFICIALS

Agreed to by:

NATIONAL INSTITUTES OF HEALTH

Elias A. Zerhouni, M.D. Date
Director

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Michael Griffin, Ph.D. Date
Administrator