NASA AT 50: PAST ACCOMPLISHMENTS AND FUTURE OPPORTUNITIES AND CHALLENGES

HEARING

BEFORE THE

COMMITTEE ON SCIENCE AND TECHNOLOGY HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

SECOND SESSION

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NASA'S FISCAL YEAR 2008 BUDGET REQUEST

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BEFORE THE

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BEFORE THE

SUBCOMMITTEE ON SPACE AND AERONAUTICS

COMMITTEE ON SCIENCE AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

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Fiscal Year 2007

109th CONGRESS, SECOND SESSION

H.R. 5672

PART 5

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DEPARTMENT OF JUSTICE
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BEFORE THE

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HOUSE OF REPRESENTATIVES

ONE HUNDRED NINTH CONGRESS

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U.S.-RUSSIAN COOPERATION IN SPACE

HEARING

BEFORE THE

SUBCOMMITTEE ON SPACE AND AERONAUTICS

COMMITTEE ON SCIENCE

HOUSE OF REPRESENTATIVES

ONE HUNDRED EIGHTH CONGRESS

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

June 11, 2008

The Honorable Mary L. Landrieu
United States Senate
Washington, D.C. 20510

Dear Senator Landrieu:

It was a pleasure meeting with you recently regarding NASA's transition from the Space Shuttle program to the Constellation program. Safely flying the Space Shuttle to assemble the International Space Station and then retiring the Space Shuttle in 2010, while developing and bringing online NASA's new human spaceflight capabilities with the Orion Crew Exploration Vehicle and Ares rockets thereafter, is NASA's greatest management challenge, and we will need your help in this endeavor.

I share your concern about the impacts of this transition on our workforce at the Michoud Assembly Facility (MAF) and am committed to ensuring that NASA carries out its mission in the most cost-effective manner possible and to minimizing the disruption to our workforce.

NASA's greatest asset is our people--thousands of civil service employees and contractors who conceive, design, build, operate, and manage an ambitious program of space exploration on behalf of our Nation. Without dedicated, skilled aerospace contractors and civil service employees, NASA would not have reached all of the historic milestones of the past and would not be able to achieve the new goals of the U.S. Space Exploration Policy, as endorsed by Congress in the NASA Authorization Act of 2005.

MAF has played a pivotal role in the manufacture and assembly of critical hardware components for the Space Shuttle program. NASA has selected MAF to support a number of major projects for the Constellation program, which is developing NASA's next generation of crew exploration and launch vehicles. MAF will manufacture and assemble the upper stage of the Ares I crew launch vehicle, as well as perform final systems integration and checkout for Ares I avionics systems, the core stage and Earth departure stage of the Ares V cargo launch vehicle, and the Orion crew exploration vehicle--the spacecraft that will carry a new generation of explorers to Earth orbit, the Moon, and beyond.

To implement transition as smoothly as possible, NASA is open to using a variety of tools, including the Enhanced Use Leasing authority that will be available to all NASA Centers as of December 31, 2008. NASA appreciates the efforts of the Senate

Committee on Appropriations to enact this expanded authority as part of the FY 2008 Omnibus Appropriations Act (P.L. 110-161) and anticipates that it will enable the effective use of underutilized NASA assets by commercial vendors. MAF is also evaluating opportunities for commercial partnerships to take advantage of the future Research and Development Administration Building, funded by the State of Louisiana, which will provide administrative office space as well as collaborative research and development space. In addition, NASA is exploring the potential of "bridge" employment at our impacted facilities, which may take the form of cross-training Shuttle personnel to work on Constellation projects and/or early builds of some Constellation hardware. Finally, in preparation for next year's budget submission to Congress, NASA is undertaking several programmatic trade studies for how best to plan and organize Constellation work, including the post-2010 flight test program, with an eye toward enhancing our test program and mitigating workforce impacts as we retire the Space Shuttle and transition to new Constellation Systems.

NASA will keep you informed as the transition proceeds and as we know more, award more contracts, or assign new roles and responsibilities to the NASA Centers most affected by the retirement of the Space Shuttle. I look forward to working with you on the complex challenges before us to ensure that critical skills are retained to carry out the exciting missions before us. I firmly believe that this transition to new Constellation Systems will reinvent and reinvigorate NASA.

Sincerely,

Michael D. Griffin
Administrator

MARY L. LANDRIEU
LOUISIANA

United States Senate
WASHINGTON, DC 20510-1804

April 2, 2008

The Honorable Michael Griffin
Administrator
National Aeronautics and Space Administration
300 E Street, SW, Suite 9L33
Washington, DC 20546

Dear Administrator Griffin:

I write to you regarding the Space Shuttle to Constellation Program Workforce Transition report which was provided to Congress yesterday. In particular, I am focused on the impact of this transition on the 1,900 National Aeronautics and Space Administration (NASA) employees at the Michoud Assembly Facility in New Orleans East. As you well know, Michoud and its employees weathered Hurricane Katrina and the subsequent Federal levee breaks, rebuilding the facility with the help of NASA and the Congress. With the report yesterday however, it seems that another storm lies on the horizon for Michoud. While I know that you and your team are focused on this issue, as a member of the Senate Appropriations Committee, I would like to request your continued cooperation to help mitigate significant workforce disruptions at our Michoud facility.

Since 1961, Michoud has been supporting the U.S. Space Program. For example, parts of the enormous Saturn rockets were manufactured at Michoud. On July 6, 1979, Michoud manufactured and delivered the first external tank for the first flight of the Space Shuttle Columbia in 1981. Michoud has continued its important role in the Space Program to this day – due to the hard work of the 1,900 NASA employees and additional contractors it employs. I understand that Michoud will also have a critical role in the Constellation Program, manufacturing major pieces of the Orion crew capsule as well as stages of the Ares I and Ares V launch vehicles. However, while these projects will generate employment, NASA has estimated that there is the potential for a loss of 1,300 jobs at Michoud over the next five years.

As NASA plans for the transition to the Constellation Program, I would like to highlight a couple of key areas which I believe could help provide "bridge" employment. In particular, as you have indicated, although NASA will be staffing down at Michoud, there may be opportunities to retain employment there through interim NASA operations at the facility. Also, in the FY08 Omnibus Appropriations Bill, I worked closely with the leadership on the Senate Commerce, Justice, Science Appropriations Subcommittee to provide NASA facilities, including Michoud, new enhanced-use lease authority which begins December 31, 2008. At Michoud, this expanded authority could allow the facility to expand its tenant base, which currently includes the Coast Guard and U.S. Department of Agriculture. Lastly, Michoud sits on 830 plus acres of land and certainly has a lot of room for future expansion. I understand that the State of Louisiana is investing $102 million in a new building onsite and sophisticated manufacturing equipment to enhance the competitiveness of Michoud. I would like to work with NASA and Governor Jindal to provide necessary resources to recruit additional industry which could serve as "bridge" employment until the Ares program ramps up.

Given the enormous impact of this workforce transition on the Michoud Assembly Facility, I would like to schedule a meeting with you to discuss the possible impact of these particular proposals as well as your ongoing work on this matter. I respectfully request a meeting no later than April 18, 2008 if possible. This is to ensure there is sufficient time, if needed, to work with you, the State of Louisiana and my Senate colleagues through the FY09 Appropriations process.

Thank you for your attention to this important matter.

Sincerely,

Mary L. Landrieu
United States Senator

MLL:brv

cc: The Honorable Barbara Mikulski
The Honorable Bobby Jindal

National Aeronautics and Space Administration

Headquarters
Washington, DC 20546-0001

July 25, 2006

Reply to Attn of: Office of Legislative Affairs
LC:mtg

The Honorable Sherwood L. Boehlert
Chairman
Committee on Science
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

The transition from the Space Shuttle to the Constellation Program is NASA's greatest management challenge over the next several years. In response to this challenge, NASA has developed a Human Space Flight Transition Plan which, at a strategic level, describes the transition. This transition is driven by the *Vision for Space Exploration*, retirement of the Space Shuttle by the end of FY 2010, and the Agency's need to capitalize on its overall human space flight investments and knowledge to date. NASA submits this plan pursuant to Section 502 (b) of the National Aeronautics and Space Administration Authorization Act of 2005 (P. L. 109-155). Also included in this plan are sections on the Commercial Orbital Transportation Services to the International Space Station, the proposed crew escape system for future human space systems, and the current plans for the lunar architecture and missions.

This plan documents desired outcomes, program-level requirements, and major processes that will facilitate a successful transition. It details the framework for ensuring cross-organizational integration, coordination of transition planning, requirements implementation, resource allocation, progress assessment, and risk identification and mitigation. In addition, the plan defines a framework in which transition, or termination of all capabilities that are no longer required, will be implemented within the appropriate timeframe offering the best overall Agency advantage, risk control and expanded work-force opportunity.

NASA anticipates that, with the flexibility that this plan affords, the Agency will have the necessary processes and procedures in place to meet the challenges associated with the retirement of the Space Shuttle, achieving the *Vision for Space Exploration* and ensuring the success of the space program through generations to come. We also anticipate that we will need the support of Congress to ensure that the transition can occur as efficiently as possible, and plan to work with you to make it happen.

We would be pleased to discuss NASA's Human Space Flight Transition Plan with you in greater detail, if you wish.

Sincerely,

Brian E. Chase
Assistant Administrator
Office of Legislative Affairs

Enclosure

National Aeronautics and Space Administration

Headquarters
Washington, DC 20546-0001

July 25, 2006

Reply to Attn of: Office of Legislative Affairs
LC:mtg

The Honorable Bart Gordon
Ranking Democrat
Committee on Science
House of Representatives
Washington, DC 20515

Dear Mr. Gordon:

The transition from the Space Shuttle to the Constellation Program is NASA's greatest management challenge over the next several years. In response to this challenge, NASA has developed a Human Space Flight Transition Plan which, at a strategic level, describes the transition. This transition is driven by the *Vision for Space Exploration*, retirement of the Space Shuttle by the end of FY 2010, and the Agency's need to capitalize on its overall human space flight investments and knowledge to date. NASA submits this plan pursuant to Section 502 (b) of the National Aeronautics and Space Administration Authorization Act of 2005 (P. L. 109-155). Also included in this plan are sections on the Commercial Orbital Transportation Services to the International Space Station, the proposed crew escape system for future human space systems, and the current plans for the lunar architecture and missions.

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Sincerely,

Brian E. Chase
Assistant Administrator
Office of Legislative Affairs

Enclosure

National Aeronautics and Space Administration
Headquarters
Washington, DC 20546-0001

July 25, 2006

Reply to Attn of: Office of Legislative Affairs
LC:mtg

The Honorable Ken Calvert
Chairman
Subcommittee on Space and Aeronautics
Committee on Science
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

The transition from the Space Shuttle to the Constellation Program is NASA's greatest management challenge over the next several years. In response to this challenge, NASA has developed a Human Space Flight Transition Plan which, at a strategic level, describes the transition. This transition is driven by the *Vision for Space Exploration*, retirement of the Space Shuttle by the end of FY 2010, and the Agency's need to capitalize on its overall human space flight investments and knowledge to date. NASA submits this plan pursuant to Section 502 (b) of the National Aeronautics and Space Administration Authorization Act of 2005 (P. L. 109-155). Also included in this plan are sections on the Commercial Orbital Transportation Services to the International Space Station, the proposed crew escape system for future human space systems, and the current plans for the lunar architecture and missions.

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Sincerely,

Brian E. Chase
Assistant Administrator
Office of Legislative Affairs

Enclosure

National Aeronautics and Space Administration

Headquarters
Washington, DC 20546-0001

July 25, 2006

Reply to Attn of: Office of Legislative Affairs
LC:mtg

The Honorable Mark Udall
Ranking Democrat
Subcommittee on Space and Aeronautics
Committee on Science
House of Representatives
Washington, DC 20515

Dear Mr. Udall:

The transition from the Space Shuttle to the Constellation Program is NASA's greatest management challenge over the next several years. In response to this challenge, NASA has developed a Human Space Flight Transition Plan which, at a strategic level, describes the transition. This transition is driven by the *Vision for Space Exploration*, retirement of the Space Shuttle by the end of FY 2010, and the Agency's need to capitalize on its overall human space flight investments and knowledge to date. NASA submits this plan pursuant to Section 502 (b) of the National Aeronautics and Space Administration Authorization Act of 2005 (P. L. 109-155). Also included in this plan are sections on the Commercial Orbital Transportation Services to the International Space Station, the proposed crew escape system for future human space systems, and the current plans for the lunar architecture and missions.

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Sincerely,

Brian E. Chase
Assistant Administrator
Office of Legislative Affairs

Enclosure

National Aeronautics and Space Administration

Headquarters
Washington, DC 20546-0001

July 25, 2006

Reply to Attn of: Office of Legislative Affairs
LC:mtg

The Honorable Ted Stevens
Chairman
Committee on Commerce, Science,
and Transportation
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

The transition from the Space Shuttle to the Constellation Program is NASA's greatest management challenge over the next several years. In response to this challenge, NASA has developed a Human Space Flight Transition Plan which, at a strategic level, describes the transition. This transition is driven by the *Vision for Space Exploration*, retirement of the Space Shuttle by the end of FY 2010, and the Agency's need to capitalize on its overall human space flight investments and knowledge to date. NASA submits this plan pursuant to Section 502 (b) of the National Aeronautics and Space Administration Authorization Act of 2005 (P. L. 109-155). Also included in this plan are sections on the Commercial Orbital Transportation Services to the International Space Station, the proposed crew escape system for future human space systems, and the current plans for the lunar architecture and missions.

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Sincerely,

Brian E. Chase
Assistant Administrator
Office of Legislative Affairs

Enclosure

National Aeronautics and Space Administration

Headquarters
Washington, DC 20546-0001

July 25, 2006

Reply to Attn of: Office of Legislative Affairs
LC:mtg

The Honorable Daniel K. Inouye
Co-Chairman
Committee on Commerce, Science,
and Transportation
United States Senate
Washington, DC 20510

Dear Senator Inouye:

The transition from the Space Shuttle to the Constellation Program is NASA's greatest management challenge over the next several years. In response to this challenge, NASA has developed a Human Space Flight Transition Plan which, at a strategic level, describes the transition. This transition is driven by the *Vision for Space Exploration*, retirement of the Space Shuttle by the end of FY 2010, and the Agency's need to capitalize on its overall human space flight investments and knowledge to date. NASA submits this plan pursuant to Section 502 (b) of the National Aeronautics and Space Administration Authorization Act of 2005 (P. L. 109-155). Also included in this plan are sections on the Commercial Orbital Transportation Services to the International Space Station, the proposed crew escape system for future human space systems, and the current plans for the lunar architecture and missions.

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Sincerely,

Brian E. Chase
Assistant Administrator
Office of Legislative Affairs

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National Aeronautics and Space Administration

Headquarters
Washington, DC 20546-0001

July 25, 2006

Reply to Attn of: Office of Legislative Affairs
LC:mtg

The Honorable Kay Bailey Hutchison
Chair
Subcommittee on Science and Space
Committee on Commerce, Science, and Transportation
United States Senate
Washington, DC 20510

Dear Madam Chair:

The transition from the Space Shuttle to the Constellation Program is NASA's greatest management challenge over the next several years. In response to this challenge, NASA has developed a Human Space Flight Transition Plan which, at a strategic level, describes the transition. This transition is driven by the *Vision for Space Exploration*, retirement of the Space Shuttle by the end of FY 2010, and the Agency's need to capitalize on its overall human space flight investments and knowledge to date. NASA submits this plan pursuant to Section 502 (b) of the National Aeronautics and Space Administration Authorization Act of 2005 (P. L. 109-155). Also included in this plan are sections on the Commercial Orbital Transportation Services to the International Space Station, the proposed crew escape system for future human space systems, and the current plans for the lunar architecture and missions.

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Sincerely,

Brian E. Chase
Assistant Administrator
Office of Legislative Affairs

Enclosure

National Aeronautics and Space Administration

Headquarters
Washington, DC 20546-0001

July 25, 2006

Reply to Attn of: Office of Legislative Affairs
LC:mtg

The Honorable Bill Nelson
Ranking Democrat
Subcommittee on Science and Space
Committee on Commerce, Science, and Transportation
United States Senate
Washington, DC 20510

Dear Senator Nelson:

The transition from the Space Shuttle to the Constellation Program is NASA's greatest management challenge over the next several years. In response to this challenge, NASA has developed a Human Space Flight Transition Plan which, at a strategic level, describes the transition. This transition is driven by the *Vision for Space Exploration*, retirement of the Space Shuttle by the end of FY 2010, and the Agency's need to capitalize on its overall human space flight investments and knowledge to date. NASA submits this plan pursuant to Section 502 (b) of the National Aeronautics and Space Administration Authorization Act of 2005 (P. L. 109-155). Also included in this plan are sections on the Commercial Orbital Transportation Services to the International Space Station, the proposed crew escape system for future human space systems, and the current plans for the lunar architecture and missions.

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Sincerely,

Brian E. Chase
Assistant Administrator
Office of Legislative Affairs

Enclosure

Human Space Flight Transition Plan

July 2006

Human Space Flight Transition Plan
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Space Shuttle Transition

Pursuant to Sec. 502 (b) of the National Aeronautics and Space Administration Authorization Act of 2005 (P.L. 109-155) the following report addresses the Shuttle transition plan, which includes:

- how NASA will deploy personnel from, and use the facilities of, the Space Shuttle program (SSP) to ensure that the Space Shuttle operates as safely as possible through its final flight and to ensure that personnel and facilities from the SSP are used in NASA's exploration programs in accordance with subsection (a);
- (2) the planned number of flights the Space Shuttle will make before its retirement;
- (3) the means, other than the Space Shuttle and the Crew Exploration Vehicle (CEV), including commercial vehicles, that may be used to ferry crew and cargo to and from the ISS;
- (4) the intended purpose of lunar missions and the architecture for those missions; and,
- (5) the extent to which the CEV will allow for the escape of the crew in an emergency.

Introduction

On January 14, 2004, the President announced the *Vision for Space Exploration,* which put NASA on a bold new mission: implementing a sustained and affordable human and robotic program to explore the solar system. Achieving the *Vision for Space Exploration* is a challenge, requiring new and innovative roles, responsibilities, capabilities, and relationships throughout NASA. Success requires that all parts of the Agency act as a team to make decisions for the common good, collaborate across traditional boundaries, and leverage the Agency's many unique capabilities in support of a single focus. The future of human space flight depends on a safe, successful, and smooth transition.

The Space Shuttle transition and phase-out effort will be one of the largest the Agency has undertaken. The SSP occupies 640 facilities, uses over 900,000 pieces of equipment, and employs over 2,000 civil servants and more than 15,000 work year equivalents in prime contractors. In addition, the SSP employs over 3,000 additional indirect workers through Center general and administrative and service pools. The total equipment value is over $12 billion, and there are literally hundreds of locations where Government property is used. The total facilities value is approximately $5.7 billion, which accounts for approximately one-fourth of the value of the Agency's total facility inventory. There are currently 1,542 active suppliers and 3,000 to 4,000 qualified suppliers geographically located throughout the country.

Goals of Transition

- **Evolving from current operations to future operations** – Transitioning first from flying the Space Shuttle and building and sustaining the International Space Station (ISS) to developing and flying the new CEV, Crew Launch Vehicle (CLV) and related exploration architecture systems. NASA's challenge is to identify opportunities to use existing operations capacity for development of these systems. This includes shifting, rather than growing a development and production capacity, transferring sustaining engineering capabilities to new systems design efforts, and evolving infrastructure to reduce operational costs.

- **Evolving the workforce** –Ensuring that the Agency has not only the right mix of skills to support the requirements of the Space Shuttle and ISS Programs but can also support the Constellation Systems Program.
- **Efficiency** – Achieving multi-program objectives at the best value to the Agency. This requires a strategic understanding and integration of program requirements and tactical execution.
- **Efficient and safe closeout of the SSP** —The final phase of the SSP will include transfer of assets to follow-on programs and field Center institutions and transition to the next era in NASA human space flight. This requires a structured, cost-effective approach for determining which capabilities are needed for the Constellation Systems Program and decommissioning and disposing of the rest.

The Space Shuttle transition and phase-out effort will be complex and challenging, especially when coupled with conducting potentially the most complicated sequence of Shuttle flights ever attempted. ISS construction represents one of the most challenging and difficult tasks that have been attempted in the history of space flight. Over the next 4 years, the Space Shuttle will carry over 440,000 pounds of hardware to the ISS, where astronauts and cosmonauts will conduct nearly 80 spacewalks to assemble, check out, and maintain the orbiting facility. Pending the successful demonstration of Return to Flight changes on STS-121, the Space Shuttle will also conduct a fifth servicing mission to the Hubble Space Telescope to replace critical subsystems and swap out astronomical instruments. Ensuring safe mission execution while simultaneously conducting an efficient and effective transition of current human space flight capabilities to future exploration missions will require finding new and innovative ways to leverage the existing human space flight workforce, hardware, and infrastructure. These parallel activities will require a delicate balancing act.

In accordance with the *Vision*, NASA will use the Space Shuttle to complete assembly of the ISS by 2010 using as few flights as possible, meeting our international commitments and enabling the Station to support research and Exploration Systems goals. The SSP's highest priority is to safely complete the mission manifest by 2010. Working through project, program, Directorate, and Agency-level processes, the SSP will also play a key role in coordinating the smooth transition of Space Shuttle assets and capabilities to the next generation of space exploration systems without compromising the safety of ongoing flight operations. Transition will be accomplished in a manner that safeguards the long-term viability of U.S. technical capabilities in anticipation of future challenges and opportunities. This report outlines how the Agency intends to facilitate the orderly and successful transition from the Space Shuttle to Exploration programs and also addresses related areas of interest to Congress, including the Commercial Orbital Transportation System, crew escape from the CEV, and lunar architecture.

Initial Transition Activities

Human space flight transition activities began shortly after the release of the *Vision for Space Exploration*. The SSP evaluated hardware, infrastructure, and workforce inventories needed to support a fly out through 2010. The ISS program identified the impact and challenges of Shuttle retirement on Station logistics support and utilization after 2010. NASA also undertook a number of benchmarking studies of previous large-scale, high-technology system transitions, including the Titan IV rocket fly out, the F/A-18 fighter production closeout, and the Navy Base Realignment and Closure activities. NASA has captured lessons learned that might be applicable in the current situation.

There were many common themes and lessons to be learned from the benchmarking exercises. The first was on the importance of having a plan. Effective planning saves time and money throughout the life of the effort. A strategic assessment early in the transition process to establish the scope of the activity aids in the development of an effective plan. Second, communication is critical throughout the transition process. It is imperative that key stakeholders are informed of the plan, the current activities, and the future work, and that they all agree on the basic goals and objectives. Continuous communication internally and externally facilitates a smooth and successful transition. The third lesson is directly related to the second: manage the human element. The impact on people's lives from the closure of a major program should not be underestimated. Program leadership is essential in this area as critical skills must be maintained for use by follow-on programs, to safely complete the Space Shuttle mission and to safely shut down the program. Fourth, execution requires the use of smart program management tools. The regulatory impacts, technical challenges, and requirements must be understood early in order to manage costs to a baseline. In addition, contracts must be structured to allow flexibility. Finally, transition is expensive and takes time. Historically, it takes 3.5 years to close down an installation and another 3 years to complete the transition of a property. While we have benchmarked other programs that are similar in scope to the Space Shuttle, the Shuttle is one of the largest single programs for which an orderly transition and disposal has ever been required. NASA must transition the Space Shuttle in a way that ensures continued safety in our ongoing operations, maximizes the efficiency with which we use our resources, respects the Space Shuttle workforce, and protects critical national capabilities that will be needed to support the *Vision for Space Exploration.*

To better implement the *Vision*, NASA reorganized and established the Exploration Systems Mission Directorate (ESMD). ESMD is responsible for developing new capabilities and supporting technologies, which will enable the *Vision* and the Constellation Systems Program. Next, NASA conducted a large-scale, system level, Exploration Systems Architecture Study (ESAS). The ESAS team examined a wide variety of architecture element configurations, functionality, subsystems, technologies, and implementation approaches. Figure 1 below provides a top-level roadmap to the ESAS architecture implementation.

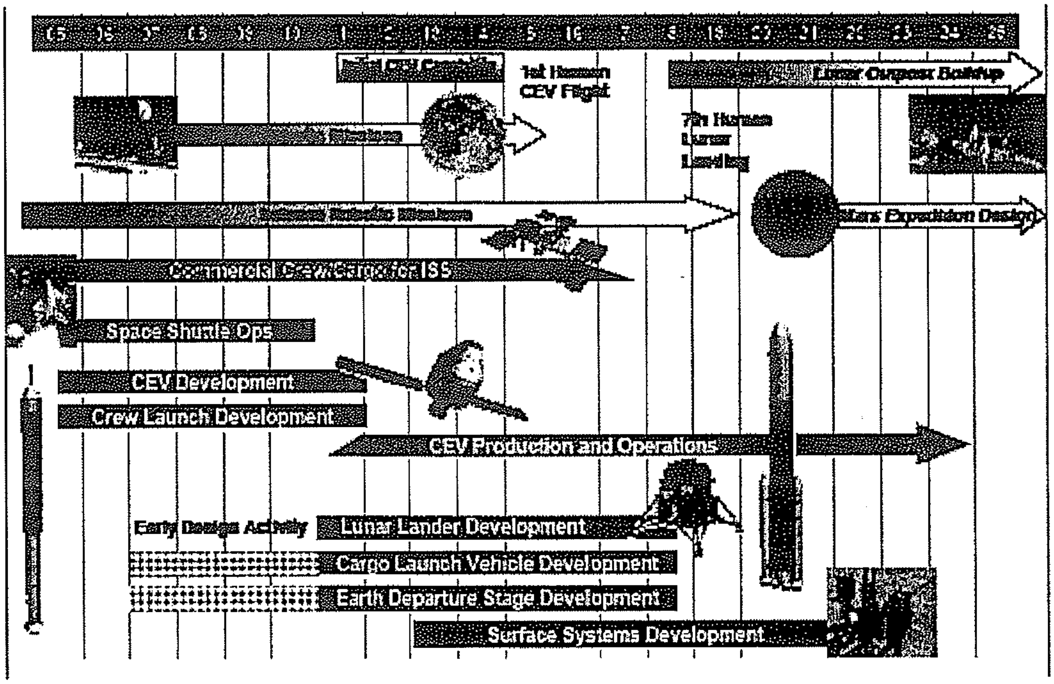

Figure 1 – Exploration Roadmap

An early exploration development will be the CEV. Like the Apollo Command Module, the CEV will have a crew escape system and represents one building block in the exploration architecture that can send astronauts to the Moon and form the basis for exploration missions to other destinations. It will be launched into orbit using a five-segment derivative of the Shuttle's Solid Rocket Booster (SRB) with a new liquid-propellant upper stage. It will continue to the Moon using redesigned J-2 engines originally used on the Saturn IB and Saturn V rocket engines designed for the Apollo Program. Before beginning its lunar mission, the CEV's capabilities will be demonstrated by carrying crew and cargo to the ISS.

The ESAS team ultimately chose a Shuttle-derived option for the transportation system, recognizing that prospects for the future are founded in the capacity and knowledge of the present. The team recommended use of certain Shuttle capabilities to accelerate development of future systems and provide developmental savings. The Shuttle-derived launch option was found to be more affordable, safe, and reliable and in addition provides an opportunity for a relatively smooth transition of existing facilities and workforce to ensure lower schedule, cost, and programmatic risks. As was learned from the benchmarking activities, a follow-on program, especially one that has strong ties to the current program, is the best retention tool available. Having the current workforce see a future and know that they are an integral part will help to alleviate fears and maintain focus on the current mission. It is essential that NASA leverage the value of past experiences to achieve the ultimate success of the Vision at the best value to the Agency.

Over the next several years, the Space Shuttle, ISS, and Constellation Systems Programs will work together to define an intelligent and efficient transition of hardware, software, people, and knowledge. The Human Space Flight programs and the Mission Directorates are encouraging close working relationships among the programs with the co-location of program management at the Johnson Space Center. This facilitates communication and ensures that all three programs effectively exchange knowledge, identify and appropriately disposition assets for transition. In addition, the SSP has hosted technical interchange meetings on transition to assess existing Agency capabilities in areas like human capital management, data archiving, environmental management, and historical preservation. At all levels, standing control boards have been established to provide insight, guidance, and to facilitate decisions on important transition issues. The opportunity exists to find real savings in both cost and schedule in the development of new systems, given their heritage with the Space Shuttle. This will be the critical factor in the successful transition from the SSP capabilities to the Constellation Program.

Transition Milestones

Meeting the ambitious schedule of flying out one program, continuing operations on another while developing and preparing for operations of a third makes coordination between all parties essential. Last need dates, first use dates, specifics of flight manifest and level loaded build/processing schedules are essential to the transition process and for providing accurate strategic guidance for the budget process. As was recommended by the benchmarking studies, NASA is in the process of completing a strategic assessment of all of our capabilities that support the Human Space Flight programs and determining their use in the follow-on programs. Assets, such as launch pads, should be maintained in usable condition until ready to be used by follow-on systems. An integrated multi-program schedule will be used to coordinate with relevant program offices and will provide a top-level overview reflecting decisions on major flight hardware elements and facility development and utilization. For example, the first piece of flight hardware transferred between SSP and Constellation is an old forward dome, from a SRB, which will be used as part of a mock up to start CEV parachute development work. Figure 2 provides a top-level view of this scheduling challenge facing NASA between now and 2014.

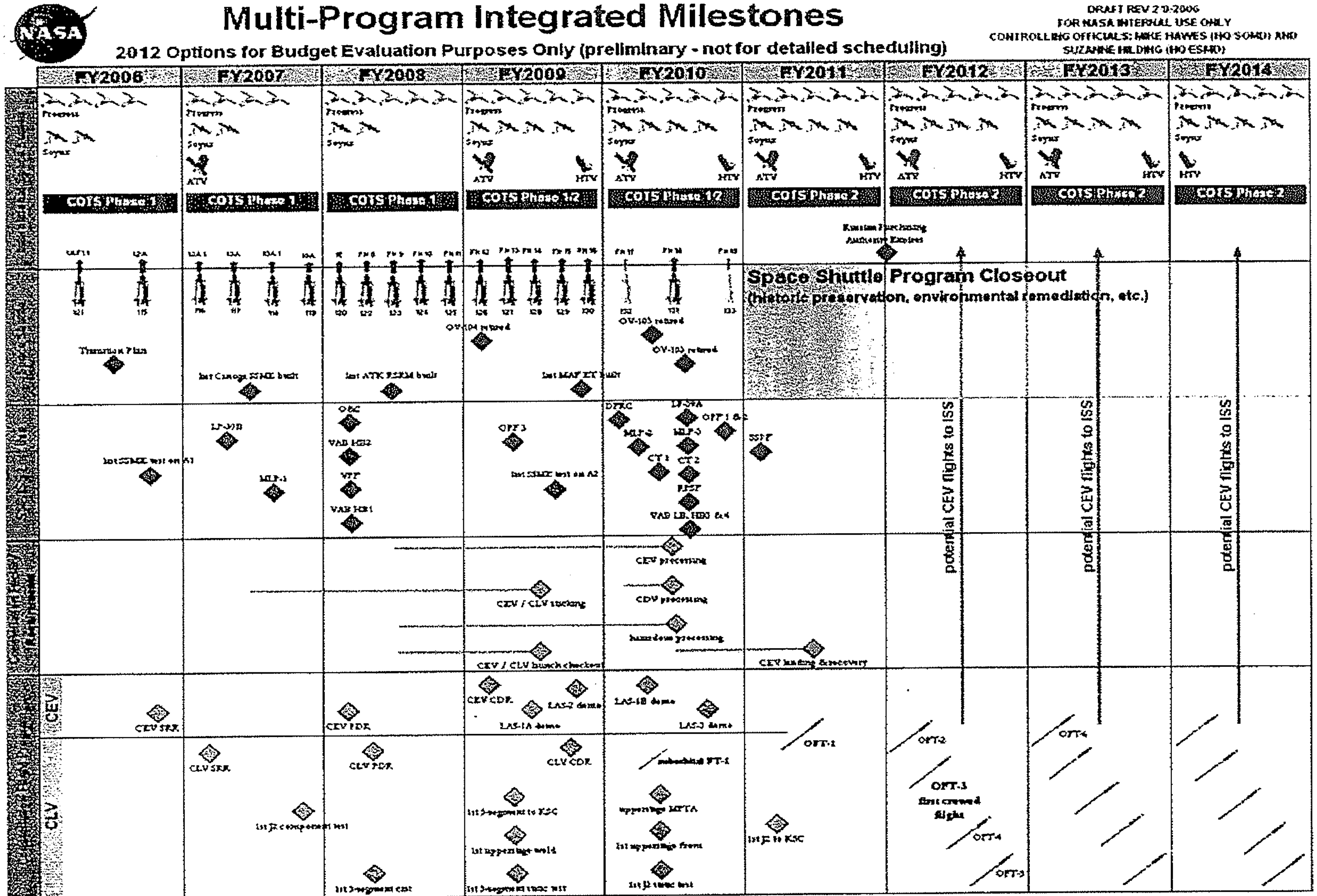

Figure 2 – Multi-Program Integrated Milestones, 2006 - 2014

SECOND ADDENDUM

TO THE IMPLEMENTING ARRANGEMENT ENTITLED

"PROTOCOL INCLUDING TERMS, CONDITIONS AND ASSUMPTIONS, SUMMARY BALANCE OF CONTRIBUTION AND OBLIGATIONS TO INTERNATIONAL SPACE STATION (ISS) AND RESULTING RIGHTS OF NASA AND RSA TO ISS UTILIZATION ACCOMMODATIONS AND RESOURCES, AND FLIGHT OPPORTUNITIES" (BALANCE AGREEMENT)

BETWEEN

THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OF THE UNITED STATES OF AMERICA

AND

THE FEDERAL SPACE AGENCY OF THE RUSSIAN FEDERATION

The National Aeronautics and Space Administration of the United States of America (hereinafter "NASA") and the Federal Space Agency of the Russian Federation (hereinafter "Roscosmos") (hereinafter, collectively, "the Parties"),

RECOGNIZING the Agreement between the United States of America and the Russian Federation concerning Cooperation in the Exploration and Use of Outer Space for Peaceful Purposes of June 17, 1992,

RECOGNIZING the Agreement among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station signed on January 29, 1998, (hereinafter the "Intergovernmental Agreement"),

RECOGNIZING the Memorandum of Understanding between the National Aeronautics and Space Administration and the Russian Space Agency Concerning Cooperation on the Civil International Space Station signed on January 29, 1998 (hereinafter the "MOU"),

RECOGNIZING the implementing arrangement to the MOU entitled the Protocol Including Terms, Conditions and Assumptions, Summary Balance of Contributions and Obligations to International Space Station (ISS) and Resulting Rights of NASA and RSA to ISS Utilization Accommodations and Resources, and Flight Opportunities signed on June 11, 1996, (hereinafter the "Balance Agreement"),

RECOGNIZING the Addendum to the Balance Agreement signed on September 9, 2004, (hereinafter the "First Addendum"),

CONVINCED that implementation of the agreements governing cooperation on the International Space Station will further expand cooperation through the establishment of a long-term and mutually beneficial relationship and will further promote cooperation in the exploration and peaceful use of outer space,

Have agreed as follows:

ARTICLE 1 – PURPOSE

The purpose of this Addendum is to adjust the balance of contributions of the Parties as previously set forth in the Balance Agreement and First Addendum, so as to maintain the balance of the Parties' respective contributions and obligations to the ISS program and the sharing of responsibilities associated with each Party's participation in accordance with the principles established in the Intergovernmental Agreement, the MOU, and the Balance Agreement. Adjustments are required at this time due to changes in the timeline for ISS assembly, programmatic changes on the part of both Parties, and the development of circumstances and plans that necessitate the exchange of goods and services not covered by the terms of the Balance Agreement. The specific objectives of this Addendum are to establish common approaches to key operational issues and effect a partial rebalance of the NASA and Roscosmos efforts until such time as a more complete evaluation and comprehensive rebalance can be completed through future adjustments of the Balance Agreement. In accordance with the provisions of Balance Agreement Paragraphs 3 and 4, and MOU Article 16.4, the Parties have sought to minimize the exchange of funds through the mutual provision of goods and services agreed to be of equivalent value (i.e. barter). This Addendum is also intended to provide a framework for the acquisition, through separate contractual or other arrangements between the Parties, of ISS goods and services that cannot be obtained through barter.

ARTICLE 2 – SCOPE AND BACKGROUND CONSIDERATIONS

A. This Addendum shall constitute an addendum to an implementing arrangement pursuant to Article 4(2) of the Intergovernmental Agreement and Article 1.1 of the MOU.

B. All terms and provisions of the Balance Agreement, as amended by the First Addendum, remain in effect unless otherwise specified by this Addendum.

ARTICLE 3 – TERMS

A. Crew size and composition:

Paragraph 11 of the Balance Agreement shall be amended by the following addition to the end of the article:

> "11.c. Based on program status as of January 1, 2006, the Parties have reached the following understandings:
>
> i. Crew Until 2009: The permanent ISS crew size will be increased via flight ULF1.1 in May 2006 from two to three and remain at three until the end of April 2009, assuming nominal Shuttle operations. Flight opportunities and crew time for a three-person crew shall continue to be allocated in accordance with the previous practice through Increment 6.
>
> ii. Crew from 2009 until U.S. Crew Rescue Vehicle Available: By the end of April 2009, the permanent ISS crew size will expand from three to six through NASA's provision of additional Soyuz vehicles for crew rotation and rescue and NASA habitation and logistics support of its three designated crewmembers. From the end of April 2009 after the permanent ISS crew size expands to six (1) Roscosmos shall have the rights to the flight opportunities for its three crewmembers and on-orbit crew time equivalent to three crewmembers and will retain those rights for the life of the ISS subject to Roscosmos' provision of support of those crewmembers (rescue, rotation, habitation) to perform Russian Segment systems operations and utilization activities; and (2)

NASA and the remaining ISS Partners shall share the remaining three flight opportunities and on-orbit crew time equivalent to three crewmembers continuous on-orbit per year and will retain those rights for the life of the ISS subject to their provision of support for those crewmembers (rescue, rotation, habitation) to perform U.S. on-orbit Segment systems operations and utilization activities until such time as a U.S. crew rescue vehicle is available. Nothing in this paragraph in any way implies that the ISS will be considered to have achieved the state of assembly complete when the permanent crew size expands from three to six. If it becomes apparent that NASA will be unable to provide habitation and logistics support required to add three crewmembers or will be unable to provide crew rescue, rotation, and logistics support for its three crewmembers after 2011, the Parties will meet to discuss appropriate action.

iii. Crew After a U.S. Crew Rescue Vehicle is Available: Following the availability of a U.S. crew rescue vehicle and when the ISS has a crew of 7, flight opportunities and crew time will be allocated in accordance with MOU Articles 8.3.c.2 and 11.1, and paragraph 11.b of the Balance Agreement."

B. Working Language: Translation services shall be provided by NASA only for critical operations and training documents. The transition period described in Balance Agreement paragraph 23 shall end with the expansion of the ISS permanent crew size to six persons.

C. NASA shall purchase crew rotation, crew rescue and cargo services, as needed, from Roscosmos through 2011, pursuant to mutually agreed contractual arrangements.

ARTICLE 4 – CHANGES IN CONTRIBUTIONS OF ROSCOSMOS AND NASA

A Science Power Platform and its arrays: In fulfillment of NASA and Roscosmos' respective obligations under Articles 3.3, point 5, 6.1.b.14 and 6.2.b.14 of the MOU, Roscosmos and NASA will continue to cooperate in assembling and operating the International Space Station as agreed in this Addendum. The following provisions of the Balance Agreement are superseded by the arrangements in this Second Addendum: paragraph 20; Appendix 2, page 1, items 8 and 9; and Appendix 3.

B. Upmass:

1. NASA's obligation to deliver a total of 20,500 kilograms upmass under the Balance Agreement plus an additional 707 kilograms upmass for non-Life Support Systems cargo launched by Roscosmos for NASA after February 1, 2003 was equal to 21,207 kilograms of total NASA upmass. The Parties agree to reduce the NASA obligation by 13,115 kilograms upmass and acknowledge NASA's delivery of 5,892 kilograms upmass as of January 1,

2006. Therefore, the remaining NASA obligation to Roscosmos is 2,200 kilograms upmass.

2. Accordingly, Appendix 2, page 1, item 11 is deleted.

3. Accordingly, Appendix 2, page 3, item 8 is amended to read:

"Delivery of 2.2 metric tons of cargo for the Russian Segment: This 2.2 metric tons of cargo includes, inter alia, outfitting equipment for the Russian Multipurpose Logistics Module (MLM). The total mass of this MLM equipment includes the flight hardware and the associated flight support equipment (FSE) and shall not exceed 2.2 metric tons. NASA shall be responsible for providing the carrier for transportation on the Space Shuttle, integration of Russian hardware onto the carrier, and supplying appropriate interface documentation. Roscosmos shall be responsible for providing MLM-associated FSE."

4. Roscosmos shall deliver 31 kilograms of cargo to the ISS for NASA in 2006, with manifesting details to be agreed through the existing processes. This cargo is in addition to that which has already been procured.

C. Habitation:

1. Appendix 2, page 2, item 6 is replaced in its entirety with:

"During the time when only 2 crewmembers are onboard the ISS, Roscosmos shall continue to provide habitation services for 1 equivalent NASA designated crewmember continuously on orbit per year until expansion of crew size to three persons, or April 2009, whichever comes first. After expansion of the crew to a total of 3 crewmembers on orbit, Roscosmos shall provide habitation services for 1.5 equivalent NASA designated crewmembers continuously on orbit per year until expansion of crew size to six persons or the end of April 2009, whichever comes first. This obligation is separate from the paragraph 16 obligation that NASA and Roscosmos are responsible for providing food, supplies, and personal items for their respective designated crewmembers. This obligation is also separate from the responsibility of NASA and Roscosmos for the collection, stowage, and disposal of waste commensurate with their respective designated crewmembers."

2. The following text is added as a new Appendix 2, page 1, item 11:

"NASA will continue to provide limited support for habitation, consistent with NASA's previous practice through Increment 6, until expansion of the permanent crew size to 6 persons or the end of April 2009, whichever comes first."

D. Electrical Power:

1. NASA agrees that pursuant to its original obligation under MOU Article 6.1.b.20, NASA is obligated to provide electrical power (in agreed amounts and subject to the limits of the US power system) to augment Roscosmos-generated power to support essential Roscosmos-provided flight element core systems, which is defined to include overall Russian Segment operations and utilization, throughout the remaining life of ISS. Therefore, pursuant to NASA's original obligations under Article 6 of the MOU to support Roscosmos' original plans to augment its own electrical power system and to provide adequate electrical power for the Russian Segment, NASA shall continue to provide to Roscosmos electrical power in accordance with the power transfer schedule and conditions below. Appendix 2, page 1, item 1 will be provided according to the schedule below. Appendix 2, page 3, item 1 is included in the power transfer quantities set forth in the power transfer schedule below.

		Power per Appendix 2, Page 1, Item 1, continuous (kW)	Power pursuant to Article 6 of MOU, continuous (kW)	Continuous power transfer limit (kW) (includes Col 1)	Contingency/ Peak power transfer limit (kW) (includes Col 1)	Est'd Amt Remaining of 615,000 kWh
2006						615,000
	until flt 12A.1	1.5	1.7	3.2	5.4	601,536
	post-12A.1	1.5	2.7	4.4	7.2	599,268
2007		1.5	2.7	4.4	7.2	575,397
2008						
	until arrival of MLM	1.5	2.7	4.4	7.2	553,815
	post-MLM	1.5	4.5	12	14.4	550,035
2009						
	until expansion to 6 crew	1.5	8	12	14.4	526,923
	post expansion to 6 crew	0	10.9	12	14.4	462,831
2010		0	10.6	12	14.4	369,756
2011		0	10.6	12	19.4	276,681
2012		0	10.7	12	19.4	182,730
2013		0	10.7	12	19.4	88,779
2014		0	10.7	12	19.4	0
2015		0	10.8	12	19.4	0

2. The figures in the above power transfer schedule do not include power to support the Automated Transfer Vehicle (ATV) docked to the Russian Segment.

3. NASA accepts loss of power in the power cables during transmission to the Russian power converters, while Roscosmos accepts loss of power due to conversion in the Russian power converters. Therefore, power quantity shall be measured at the inlet to Russian power converters.

4. The estimated amount of power transferred to the Russian Segment may be reallocated annually based on Roscosmos' request, within the bounds of the continuous/peak limits above, subject to the 615,000 kilowatt hour limit. The Parties have also agreed to provide for overall assessment of power usage from 2006 through 2009 and reallocate unused amounts to later periods. Or, upon mutual agreement of the Parties, the Parties may exchange excess kilowatt hours for other resources using a conversion factor of USD $718 per kilowatt hour.

E. Stowage: NASA shall provide stowage for total Russian cargo in the Zarya Control Module (FGB) (excluding .75 cubic meters for launch of FGB stowage enclosures) in the amount of 9.18 cubic meters in 2006, 7.18 cubic meters in 2007 and 2008 and 0.25 cubic meters in 2009 through 2011. NASA shall also provide stowage of 2.5 cubic meters as NASA's total portion of the Russian Life Support System consumables through April 2009. The amount of Roscosmos stowage, including NASA's total portion of Russian Life Support System consumables, shall not exceed 12.5 cubic meters in 2006, 10.5 cubic meters in 2007 and 2008 respectively, 3.5 cubic meters from January 1, 2009 through April 30, 2009, and 1.0 cubic meter from May 1, 2009 through December 31, 2011. Following the removal of items as identified on the return manifest of ISS flight ULF.1.1, Russian stowage in the USOS and FGB in excess of the above limits will require additional compensation, assuming not less than 4 Shuttle flights in a 12-month period beginning with the flight of ULF 1.1.

F. Communication Services: NASA shall provide Tracking and Data Relay Satellite System (TDRSS) S-Band and Ku-band services for Russian Segment systems and utilization activities on a noninterference basis, consistent with procedures and operational prioritization applicable to USOS usage, through December 31, 2011.

G. Propellant:

1. Paragraph 17 of the Balance Agreement is amended by adding the following final sentences:

"However, as part of the balance of contributions reached in the Second Addendum to this Agreement, NASA and Roscosmos agree to reduce the Roscosmos obligation to deliver 56,000 kilograms of propellant for NASA over the life of the Station by 16,325 kilograms; it is acknowledged that Roscosmos has delivered 13,857 kilograms of propellant for NASA through Dec. 31, 2005, thus the remaining Roscosmos obligation is to deliver 25,817 kilograms of propellant for NASA. Roscosmos also has an obligation to deliver 32,000 kilograms of propellant, in addition to its obligation to deliver propellant for NASA; through Dec. 31, 2005, it has delivered 5,813 kilograms, leaving a remaining balance of 26,187 kilograms. NASA has an obligation to deliver a total of 24,000 kilograms of propellant; through Dec. 31, 2005, it has delivered 4,961 kilograms and has a remaining balance of 19,039 kilograms of propellant.

The Parties recognize the need to determine the updated requirement for propellant, appropriate performance, and remaining obligations against assembly and assembly complete obligations with due consideration for changes in the configuration of the Russian and American segments and the impacts of those changes on propellant requirements and the Parties' obligations. Because the analysis is on-going among the NASA and Roscosmos technical specialists to determine the overall propellant requirements for the ISS both assembly and assembly complete, the Parties agree to document performance to date against the total obligation for each Party. Upon completion of the necessary analysis, the Parties shall document the agreed remaining obligations for propellant delivery for assembly and assembly complete in a separate arrangement.

H. Waste Removal Services: Roscosmos shall reduce NASA's total remaining debt for waste removal by 0.9 metric tons.

I. Water: NASA's obligation is to provide a total of 8 metric tons of water to the ISS, 3 metric tons during Assembly and 5 metric tons after Assembly Complete, as stated in Appendix 2, page 1, item 10 and Appendix 2, page 3, item 9. The remaining NASA obligation is 2 metric tons as of January 1, 2006.

J. Liaison Office and Travel Support: NASA will provide $680,000 of funding for support of the Roscosmos Houston liaison office and agreed travel for Russian personnel. The Parties will pursue mutually agreeable long term arrangements to continue this support beyond this funding level.

ARTICLE 5 – CONSISTENCY WITH DOMESTIC LAWS

All activities under this Addendum shall be conducted in a manner consistent with the respective laws and regulations of each Party.

ARTICLE 6 - AMENDMENT

This Addendum may be amended by the mutual written agreement of the Parties.

ARTICLE 7 - ENTRY INTO FORCE AND DURATION

This Addendum shall enter into force upon signature.

This Addendum shall remain in force until such time as the MOU ceases to be in force unless it is superseded by a later agreement.

ARTICLE 8 – WITHDRAWAL AND TERMINATION

If the United States or Russia gives notice of withdrawal from the Intergovernmental Agreement in accordance with Article 28 thereof, its corresponding Party shall be deemed to have withdrawn from this Addendum effective from the effective date of such withdrawal.

DONE at Kennedy Space Center, Florida, this 1st day of July, 2006, in two originals in the English and Russian languages, each text being equally authentic.

FOR THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OF THE UNITED STATES OF AMERICA:	FOR THE FEDERAL SPACE AGENCY OF THE RUSSIAN FEDERATION:
Michael Griffin Administrator	A.N. Perminov Head

Approved by: [signature] NASA Administrator 10/1/04 Sean O'Keefe

[signature] 3.10.04 г. Head of Roskosmos Anatoli Perminov

Addendum to the 1996 Balance of Contributions Protocol for Services to be Provided through December 2005 and Crew Rescue through April 2006

With regard to the near term update to the 1996 Balance of Contributions Protocol (the Balance Agreement) and the resolution of near term operational issues for the period covering calendar year 2005 and crew rescue through April 2006, NASA and Roskosmos (the Parties) agree to continue implementation of the original agreement amended as follows:

1. NASA will not plan on continued use of the contract crew hours beyond October 2004 and agrees to implement the necessary contract modifications by November 2004 to reflect that as of the end of Expedition 9 Roskosmos will have fully met its obligation for the crew hours and stowage obligations in Modification 44 of Contract NAS15-10110.

2. NASA agrees to continue to provide NASA environmental/health care system capability to support habitation of the Expedition crews, including the Roskosmos crewmembers, through December 2005.

3. NASA agrees to continue to supply Roskosmos with electrical power pursuant to the 1996 Balance Agreement.

4. NASA agrees to continue to provide Roskosmos with communications resources and stowage volume, as available, pursuant to current operational practice through December 2005.

5. For purposes of calculating the requirements and obligations through December 2005, the Parties assume the ISS will have a two-person crew in this timeframe.

   The Parties agree to share crew rotation responsibilities as follows: Roskosmos agrees to return the Expedition 10 crew (one NASA, one Roskosmos) on Soyuz 9. Roskosmos agrees to launch the Expedition 11 crew (one NASA, one Roskosmos) on Soyuz 10 in April 2005. Roskosmos agrees to return the Expedition 11 crew (one NASA, one Roskosmos) on Soyuz 10 and launch the Expedition 12 crew (one NASA, one Roskosmos) on Soyuz 11 in October 2005. This guarantees Roskosmos the ability to market the third seat on each Soyuz flight in 2005.

However, NASA agrees to continue to work an option, subject to the operational readiness of the Shuttle, of rotating the NASA Expedition 11 and Expedition 12 crewmembers on the Shuttle in the fall of 2005. This leaves open the possibility for Roskosmos to market an additional seat on Soyuz 11.

Should the Parties jointly determine that adequate operational capability is available to support the third crewmember on orbit, NASA agrees to provide launch and subsequent return of the third crewmember (provided by Roskosmos) on the Shuttle. If the increase to a three-person crew does not coincide with the Roskosmos long duration flight opportunity NASA will remedy this on the next rotation on the Shuttle.

The Parties agree that each side will then be considered to have fulfilled its obligations for crew rotation under the 1996 Balance Agreement. Crew rotation in 2006 and beyond will be the responsibility of each side to provide for its crewmembers through its own resources or by arranging for such services from the other partner.

6. Upon Shuttle Return to Flight NASA agrees to provide crew provisions and food on the Shuttle and ATV 1 vehicles to support the NASA crewmembers. In addition, NASA agrees to provide water for the entire Expedition crew, including Roskosmos crewmembers. NASA also agrees to continue to launch and return Roskosmos cargo in accordance with its obligations under the 1996 Balance Agreement and subsequent protocols.

7. Roskosmos agrees to provide crew rescue capability to the entire Expedition crew, including the NASA crewmembers, through April 2006.

   The Parties agree that, regardless of when the Assembly Phase is complete, Roskosmos will have fulfilled its obligations for crew rescue under the 1996 Balance Agreement to provide crew rescue on eleven Soyuz vehicles. Crew rescue after April 2006 and beyond will be the responsibility of each side to provide for its crewmembers through its own resources or by arranging for such services from the other partner.

8. Roskosmos agrees to continue to provide habitation to the entire Expedition crew, including the NASA crewmembers, including launch of life support systems resupply, water, and gas through December 2005.

9. In 2005, until such time as the Shuttle returns to flight, Roskosmos will launch some mutually agreed upon NASA cargo (crew provisions, food, critical spares, and utilization items) not to exceed a total of 1.7 MT. Upon Shuttle return to flight, the unlaunched balance of the 1.7 MT will be used to reduce NASA's existing debt to Roskosmos for Progress waste removal services. Additionally Roskosmos will accommodate a small, mutually agreed upon amount of

downmass on Soyuz, including utilization hardware, during the period before the Shuttle returns to flight.

This Addendum to the 1996 Balance Protocol represents an Implementing Arrangement within the framework of the Space Station Intergovernmental Agreement and NASA/RSA Memorandum of Understanding, and will enter into force following completion of the Parties' internal approval procedures. However, the Parties agree to implement the terms of this Addendum upon signature, pending such approval.

The Parties also agree to devote intensive efforts to the development of additional arrangements covering the period from the beginning of calendar year 2006 to the end of calendar year 2009. The Parties agree that the optimum date for conclusion of negotiations of such arrangements is not later than the end of March 2005.

Done in Moscow, in duplicate, September 9, 2004, in English and Russian languages, each text being equally authentic.

Charles J. Precourt

For NASA: Charles J. Precourt

For Roskosmos: Alexei B. Krasnov

Approved by: NASA RSA

June 11, 1996

PROTOCOL

INCLUDING TERMS, CONDITIONS AND ASSUMPTIONS, SUMMARY BALANCE OF CONTRIBUTIONS AND OBLIGATIONS TO INTERNATIONAL SPACE STATION (ISS) AND RESULTING RIGHTS OF NASA AND RSA TO ISS UTILIZATION ACCOMMODATIONS AND RESOURCES, AND FLIGHT OPPORTUNITIES

1. The National Aeronautics and Space Administration (NASA) and the Russian Space Agency (RSA), ("the Parties") will begin to implement the understandings outlined in this Protocol ("the Protocol") regarding the balance of the Parties' contributions and obligations immediately upon the written approval by the respective agencies. The terms, conditions and assumptions specified in this Protocol will be summarized and incorporated in and subject to the conclusion of the NASA/RSA Memorandum of Understanding ("NASA/RSA MOU"). Upon entry into force of the NASA/RSA MOU, the MOU will take precedence over this Protocol and this Protocol will constitute an implementing arrangement under the Space Station Intergovernmental Agreement (IGA) and the NASA/RSA MOU. The Parties recognize that the understandings documented in this Protocol exist within the framework of a single integrated Space Station. The Parties assume and intend that the terms of this Protocol are consistent with NASA's bilateral MOUs with the other ISS partners. These understandings will be implemented through the management mechanisms defined in the NASA/RSA MOU under the lead integration role of NASA. For the purposes of this Protocol, the ISS vehicle consists of two segments: the Russian Segment and the American Segment. The Russian Segment contains the Russian elements and the NASA-provided FGB, while the American Segment includes the remaining NASA-provided elements and the elements provided by all ISS international partners other than RSA.

2. This Protocol, except as otherwise specifically indicated, will not nullify or void any previous agreements reached by the technical teams or those agreements already contained in program documentation. In the case of conflict between such previous agreements and this Protocol, this Protocol will take precedence.

3. This Protocol, together with the IGA, the NASA/RSA MOU, and existing and any future contractual and cooperative arrangements, represents the complete arrangement between NASA and RSA regarding the balance of the Parties' respective contributions and obligations to the Program, and the sharing of responsibilities associated with each Party's participation in the Program. If it is necessary in the future to adjust the Parties' contributions and obligations, and those adjustments have cost implications, any issues arising from the adjustments will be resolved, if the Parties agree, through barters and will not require renegotiation of the terms of this Protocol or additional discussion to quantify the cost impact. NASA's and RSA's responsibilities for performance of common system operations (as defined in Article 9.3 of the existing Memoranda of Understanding between NASA and the European Space Agency (ESA), NASA and the Government of Japan (GOJ) and NASA and the Canadian Space Agency (CSA), and the draft NASA/RSA MOU), have been taken into account in the Protocol and are included in the resulting balance of the Parties' contributions and obligations. RSA will not claim further compensation for the performance of common systems operations. NASA will not claim further compensation from RSA for its performance of common system operations.

4. The Parties will each be responsible for support of their own elements unless otherwise specified in the Protocol. For example, the Parties will each be responsible for the launch of their own elements, spares, logistics, sustaining engineering and utilization costs absent a specific agreement to the contrary. The FGB and SPP are examples of "specific agreements to the contrary" and are discussed in paragraphs 19 and 20. The Parties' overall responsibilities with regard to their own elements will be set forth in the NASA/RSA MOU. The Parties will each retain the use and benefits of the elements and systems they each provide, except as otherwise specifically agreed. For example, RSA will retain full use of its research modules and the electrical power generated by the Russian Segment (RS), absent agreement to the contrary, and will not have utilization rights in the American Segment (AS), again unless otherwise specifically agreed. Similarly, NASA will retain full use of the laboratories and electrical power generated by the AS, and will not have utilization rights in the RS unless otherwise specifically agreed. The basis for the evaluation of the Parties' contributions reflected in this Protocol is that the Parties each "keep what they bring". Understandings on currently known exceptions to this approach are also documented in this Protocol. Nothing in this Protocol precludes the Parties from reaching mutually agreeable barters in the future.

5. The reference configuration for the ISS vehicle is the Preliminary ISS Assembly Sequence, Revision B, as of March 1, 1996 (Appendix 1).

6. For purposes of cost sharing and assessing the Parties' relative contributions, the capabilities of the Parties' transportation vehicles have been used. Specific flight rates, crew and cargo loads and vehicles used for transportation to the Space Station will be determined through the agreed upon Program management mechanisms and operations planning functions.

7. The Parties agree that NASA, the lead integrator, with support of RSA, will perform ISS systems engineering and integration, ISS operations integration, and ISS utilization integration as specified in Appendix 2. These integration activities include utilization planning, integration and coordination for the Space Station as a whole, as well as activities identified in the attached balance of contributions. RSA will provide data and personnel to support this overall program integration effort and participate in the integrated operations and utilization planning for the strategic, tactical and execution phases. NASA and RSA will additionally each perform integration tasks for their own elements and segments, although these activities were not considered services provided for one Party by another. Both Parties agree to minimize operations costs and exchange of funds.

8. NASA's utilization integration contribution consists of the station-level analyses and efforts, with support of RSA, required to incorporate the integrated payload complement of the RS into the ISS. RSA will integrate RS payloads up to the segment level. By agreeing on NASA's leading station-level payload integration role, the Parties do not intend to imply that RSA has an allocation of AS utilization accommodations or resources, or vice versa for NASA. In the event that NASA or other partners conclude other cooperative science agreements or barter arrangements with RSA which bestow AS utilization accommodations or resources on RSA, any payload integration costs NASA incurs for such cooperative activities will be negotiated on a case by case basis as part of the barter arrangement. The same is true in the reverse instance where cooperative science agreements or barter arrangements bestow RS utilization accommodations or resources on NASA. In that case, any payload integration costs RSA incurs for such cooperative activities will be negotiated on a case by case basis as part of the barter arrangement.

9. The Parties agree that the planning for implementation of any transfer of Space Station resources, i.e. electrical power, between the Parties will be addressed through ISS Program integrated operations and utilization planning processes (strategic Consolidated Operations and Utilization Plan (COUP) development, tactical Increment Definition and Requirements Documents (IDRDs) development, execution-level integrated engineering assessments and the short term plan development, etc.). It will be necessary for RSA to participate in the Program's integrated planning forums, (i.e. Space Station Control Board, Systems Operations Panel, User Operations Panel, Multilateral Operations and Utilization Analysis and Integration Team (AIT), integrated tactical operations organization and, if resources are to be transferred, the Payload Operations Integration Center (POIC), etc.).

10. It was assumed that the Space Station will have a crew of 3 during assembly and a crew of 7 after assembly complete. The NASA/RSA MOU will set forth the general process for allocating flight opportunities and crew time, but paragraphs 11 and 12, below, describe the Parties' specific assumptions for the purpose of determining the overall balance of the Parties' contributions and obligations in this Protocol. Allocation of crew time and flight opportunities to the other Space Station partners will be in accordance with the terms of NASA's bilateral Memoranda of Understanding (MOUs) with those partners. This Protocol will only address the understanding between the Parties.

11.a. Crew During Assembly (through flight 19A): NASA and RSA will each have the right to an average of 50% of the 3 available crew flight opportunities. Each crew should include at least one representative from NASA and at least one representative from RSA. The Parties will each bear the responsibility for transporting and supporting on-orbit 50% of the 3-person crew. While the Parties will each receive 50% of the flight opportunities, this is an average balance over the entire assembly time frame and the Parties may not have equal shares at any given time. Detailed operational plans for allocating individual flight opportunities will be developed through normal operations planning processes. Crew time will first be devoted to systems operations and maintenance required to perform assembly tasks and Space Station operations and maintenance. Any time remaining will be devoted to utilization. Of crew time available for utilization, from first element launch up to the time when the GOJ accrues rights to on-orbit crew time, 50% of available time will be used to perform utilization on RS payloads and the remaining 50% will be used to perform utilization on AS payloads. After the GOJ accrues rights to on-orbit crew time, through flight 19A, its allocation of on-orbit utilization crew time will be drawn equally from the AS on-orbit crew time allocation and the RS on-orbit crew time allocation. It is assumed that no other partner will have rights to on-orbit crew time through the completion of the assembly phase. In the event that the Parties end assembly with flight opportunities to their credit, those opportunities will be exercised in the assembly complete phase. If any other partner ends assembly with flight opportunities to their credit, those opportunities will be exercised in the assembly complete phase and drawn from the AS flight allocation. Each Party has a right to visiting crew. If the Parties have visiting crew, each Party will provide for the transport (including rescue), support (supplies and life support/habitation) and all expenses on Earth for those visiting crews. As a result, the visiting crews will not count as use of a Party's allocation of flight opportunities or crew time on-orbit rights. Plans for visiting crews will be coordinated through the standard ISS operations planning processes. As is the case for all utilization accommodations and resources, the Parties may receive additional rights to flight opportunities or crew time through barter.

11.b. Crew Post Assembly (after flight 19A): Following the completion of assembly of the Space Station and initial operational verification of the U.S.-provided crew rescue vehicle that allows an increase in the crew complement to 7, RSA will have the rights to the flight opportunities and on-orbit crew time of 3 crew to perform RS systems operations and utilization activities. NASA and the remaining Space Station partners will share the remaining four flight opportunities for their nationals and the time of the equivalent of four remaining crew to perform AS systems operations and utilization activities. In the event the crew rescue vehicle provided by the U.S. is not available immediately after flight 19A, and the ISS has crew complement of 6 and not 7, the Parties will meet to discuss appropriate action.

12. Crewmembers will work together as a single team. Regardless of nationality and tasks assigned to any individual crew person, the entire crew will train together and perform duties on-orbit as a single integrated international crew with one ISS Commander. Each Party will assign a crewmember to have primary responsibility for its segment. The ISS Crew Operations Board will further define the details of the integrated crew concept.

13. The Parties agree that RSA provides the capability to return the entire international crew (up to three) in off-nominal situations through the completion of assembly (flight 19A in June 2002). Since the entire vehicle capability of the Soyuz TM is assumed in determining RSA's cost credit for crew rotation and unplanned crew return, the seats required on the Soyuz (up to three) will remain available for use by the ISS crew. NASA will provide crew rescue capability following the completion of assembly. In the event the NASA crew rescue capability becomes available later than is currently planned (flight 19A in June 2002), RSA agrees to continue to provide the capability to rescue the entire international crew using the Soyuz for agreed upon compensation from NASA.

14. For purposes of determining the balance of the Parties' contributions, 6 Shuttle flights and 11 Soyuz flights rotating 51 crewmembers have been assumed for the assembly phase (after assembly complete, crew rotation was assumed to be provided by each Party proportional to its share of the crew, thus not requiring any exchange of compensation/contribution credit). Additional Shuttle flights (currently estimated at 5) during assembly might be used, upon mutual agreement of the Parties, when necessary to provide flexibility in the crew rotation model. NASA recognizes potential impacts to RSA if the use of additional Shuttle flights results in a Soyuz rotating less than three crew and these potential impacts have been taken into account in determining the balance of the Parties' contributions. NASA recognizes that Soyuz must fly with a minimum of two crew, but, as in the case of Shuttle-rotated crew, the mission tasks and required training will determine the details of crew rotation. NASA is not claiming contribution credit or compensation from RSA for the additional Shuttle crew rotation flights. The Parties agree to continue to work together on the optimum number and interval of Shuttle crew rotation flights and to resolve the issues of partial or full rotation of the crew.

15. Training expenses: Top level agreements regarding Space Station crew will be addressed in the context of the NASA/RSA MOU negotiations. Details of the crew training curriculum and process,.including the curriculum and sites for advanced and increment-specific training for Space Station crew, will be defined as part of normal operations planning processes. For the purposes of the Protocol, it is understood that each Party is financially responsible for all compensation (salary and per diem), travel, personal interpreters, medical expenses, lodging and other living costs on Earth for Space Station crew which it provides. However, it is further agreed that the training of the U.S. and Russian crew shall be provided by the host country free of charge. RSA will not be charged training costs for crew training in the United States and NASA will not be charged training costs for crew training in Russia. Crew training includes instruction, training materials and equipment, access to all necessary facilities and all costs for activities in the jointly agreed training plan and curriculum. This reciprocal bilateral waiver of training fees is intended to include cases where, pursuant to a cooperative agreement for example, someone other than a U.S. national is tendered for training in Russia as part of NASA's flight opportunity allocation or vice versa. NASA agrees to discuss adoption of a similar approach for all ISS partners during the course of its bilateral MOU negotiations with ESA, GOJ and CSA.

16. Each Party will be responsible for providing food, supplies and personal items for its astronauts and cosmonauts who serve as Space Station crew. Launch of these items has been taken into account in determining the balance of the Parties contributions during the assembly phase. After assembly complete, it is assumed each Party will supply and deliver these items for its own crew or arrange for launch at its own expense.

17. With regard to propellant delivery, the Parties based their arrangement on the assumption that the total propellant required for the life of the station is 112 MT (this estimate does not include the propellant required for off-nominal situations, such as abnormal solar cycles). Of that total, 71% is attributable to the AS (80 MT) and 29% is attributable to the RS (32 MT). NASA will deliver 24 MT after assembly complete. RSA will deliver the remaining 56 MT to ISS for the AS. Total RSA propellant delivery obligation over the life of the station is 88 MT (56 MT for the AS and 32 MT for the RS). At the conclusion of the assembly phase (or earlier if required), the Parties will review the actual use of propellant during assembly and consider whether propellant requirements for the remaining life of ISS should be reviewed and revised. In the event of revisions, the Parties will reach a mutually acceptable arrangement for the adjustment of their obligations. Barter at the technical level will be the primary goal, although other arrangements may be substituted in the event an acceptable barter is not feasible.

18. The Parties agree to continue efforts to improve operations efficiencies onboard the ISS, including common and interoperable systems and interfaces to crew.

19. The FGB is a U.S. element, technically integrated into the Russian Segment. For purposes of establishing the balance of the Parties' contributions, the FGB is considered NASA's responsibility, except as specifically otherwise agreed. This means for example that the FGB mass was attributed to the AS for purposes of assessing the relative shares of propellant required by both segments and NASA will have exclusive rights to the FGB's dry cargo stowage capability. The AS owns the interior stowage volume of the FGB. RSA is responsible for maintenance of the FGB and manufacture/delivery of FGB spares. The AS will provide the on-orbit stowage volume for FGB spares. RSA agrees the on-orbit stowage requirements for FGB spares will comply with requirements for AS stowage volume specified in ICD 42121 (PMA to FGB). The Parties have agreed to their respective responsibilities with regard to the FGB in the February 5, 1995 Protocol between RSA and NASA (the FGB protocol) and continue to honor those commitments. RSA has assumed the costs associated

with launching the FGB on Proton. This has been taken into account as a RSA contribution in the balance of contributions, along with all of RSA's other obligations referenced in the FGB Protocol.

20. NASA agrees to launch the SPP on the Shuttle and to deliver the SPP to the ISS. NASA further agrees to assemble the SPP on orbit with the cooperation and technical support of RSA. The technical tasks required to transfer and assemble the SPP have been defined and agreed to in Appendix 3. Funding responsibilities for the technical tasks have also been agreed to and identified in Appendix 3. As stated under section 4.1 of Appendix 3, NASA and RSA are jointly responsible for the certification of the SPP transfer and berthing operation. NASA assumes no liability for the operation or overall performance of the SPP. RSA is ultimately responsible for the certification of the SPP and its subsystems. RSA and NASA agree that the Non-Standard Shuttle Services referenced under section 6 of Appendix 3 are based on initial design requirements identified in March, 1996. Costs for additional Non-Standard Shuttle Services beyond those listed in Appendix 3 resulting from subsequent SPP design changes/modifications are not included in this agreement. Separate negotiations will be conducted between NASA and RSA to specify funding responsibility if any additional Non-Standard Shuttle Services are required.

21. In assessing the Parties' relative contributions for the ISS configuration referenced in paragraph 5, current or future losses or gains of efficiency caused by a change in inclination, altitude, launch delays or inability to utilize the full capability of a transportation system, etc. will not be considered a contribution unless otherwise specifically agreed. Loss of efficiency or cost impacts caused by changes from previous design configurations to the current baseline configuration will likewise not be considered a contribution. Financial and other impacts from any loss of efficiency or previous design changes will be the sole responsibility of the Party claiming the loss of efficiency or cost impact. Further, any modifications and upgrades carried out by NASA and RSA in collaboration with other Partners to transition from the Mir-2 Program (Service Module modifications, LTV development, etc.) and Freedom Program (Shuttle modifications, etc.) to the ISS Program have been considered and accepted as balanced.

22. For purposes of the Protocol, the hardware, software and data which the Parties exchange pursuant to the NASA/RSA Bilateral Hardware, Software and Data Exchange Agreements, are now and will continue to be upon completion, considered balanced and such agreed trades will require no additional exchange of goods, services or funds.

23. The Parties agree that the main operations language for activities under this Agreement will be the English language, and data and information generated or provided under this Agreement will be in the English language, unless otherwise agreed. For example, joint program meetings and telecons will be conducted in English. The Crew Operations Panel (under the Space Station Multilateral Coordination Board) will determine the language used for crew training. Therefore, the Parties will implement this understanding to the extent possible and documentation between NASA and the Russian side will be exchanged in English. However, in recognition of the need for a transition period for the Russian participants to undergo English language training, Program activities may be conducted in English through use of interpretation and translation services, and NASA and RSA will work on a reciprocal basis to provide appropriate and reasonable levels of interpretation and translation support for the technical and managerial meetings they host through the completion of the assembly and initial operational verification of the Space Station.

24. RSA will make available, arrange for availability or continue to provide for NASA use office space at the following facilities: RSA, RSC Energia, Khrunichev, TsUP, and Gagarin Cosmonaut Training Center. NASA will continue to make available office space at the Johnson Space Center for RSA's use. In the case of established offices, the Parties will continue to provide the scope of office space and support currently provided. In the case of offices yet to be established, the Parties will work together to reach mutually satisfactory arrangements, recognizing that the cost of the Parties' provision of such office space and support have been taken into account and are considered balanced from a financial perspective. NASA will continue to staff and operate the NASA Moscow Liaison Office within the US Embassy in Moscow at its own expense.

25. Once the funding identified in contract NAS 1510110 for Russian personnel travel is depleted, each Party will bear the costs incurred by its personnel (civil servants and contractors) traveling to participate in the Space Station Program activities.

26. The efforts of the Parties to monitor and provide warning on/ response to space debris have been considered and require no further compensation.

27. Except as otherwise specifically agreed in the Protocol, the Parties' provision of backup data transmission capability and backup command and control to each other for contingency purposes has been considered and deemed balanced.

28. The attached Appendix 2 further specifies the balance of goods and services which each Party contributes.

Done in Moscow, in duplicate, this 11th day of June, 1996, in English and Russian languages, each text being equally authentic.

For NASA

J. B. Waddell

For RSA

M. Sinelschikov

A. Krasnov

A. Derechin

Y. Kargapolov

000022

Preliminary ISS Assembly Sequence Rev B as of 1 March 1996

Planned Launch Date	Flight	Delivered Elements
11/97	1A/R	FGB (Launched on PROTON launcher)
12/97	2A	Node 1 (1 Storage racks), PMA1, PMA2
4/98	1R	Service Module
5/98	2R	Soyuz
7/98	3A	Z1 truss, CMGs, Ku-band, S-band Equipment, PMA3, EVAS (Spacelab Pallet)
11/98	4A	P6, PV Array (4 battery sets) / EATCS radiators, S-band Equipment
12/98	5A	Lab (4 Lab Sys racks)
12/98	4R	Docking Compartment (DC)
1/99	6A	7 Lab Sys racks (on MPLM), UHF, SSRMS (on Spacelab Pallet)
3/99	UF-1	ISPRs, 1 Storage rack (on MPLM), 2 PV battery sets (Spacelab Pallet)
4/99	7A	Airlock, HP gas (3 O2, 1 N2) (on Spacelab Pallet)
Phase 2 Complete		
6/99	8A	S0, MT, GPS, Umbilicals, A/L Spur
8/99	UF-2	ISPRs, 2 Storage Racks (on MPLM), MBS
9/99	9A	S1 (3 rads), TCS, CETA (1), S-band
11/99	9A.1	Science Power Platform w/4 solar arrays
1/00	11A	P1 (3 rads), TCS, CETA (1), UHF
2/00	12A	P3/4, PV Array (4 battery sets), 2 ULCAS
3/00	10A	Node 2 (4 DDCU racks), P5 w/radiator OSE
4/00	3R	Universal Docking Module (UDM)
6/00	1J/A	JEM ELM PS (5 JEM Sys, 2 ISPR, 1 Storage racks), SPDM, ULC w/HP Gas (1 O2, 1 N2)
8/00	13A	S3/4, PV Array (4 battery sets), 4 PAS
11/00	1J	JEM PM (3 JEM Sys racks), JEM RMS
12/00	UF-3	ISPRs, 1 Storage Rack (on MPLM)
1/01	UF-4	2 ULCs with attached payloads, ATA, NTA, 1 O2 tank
5/01	2J/A	JEM EF, ELM-ES, 4 PV battery sets (on ULC)
5/01	8R	Research Module #1 (RM-1)
8/01	UF-5	S5, Cupola (on mini-ULC), Port Rails, Attached payloads (on ULC)
9/01	14A	Centrifuge
11/01	2E	2 U.S. Storage, 7 JEM racks, 7 ISPRs (on MPLM)
12/01	15A	S6, PV Array (4 battery sets), Stbd MT/CETA rails
12/96	10R	Research Module #2 (RM-2)
2/02	16A	Hab (6 Hab racks)
2/96	11R	Life Support Module (LSM)
4/96	13R	Research Module #3 (RM-3)
4/02	UF-6	ISPRs, 1 Storage Rack (on MPLM)
5/02	17A	1 Lab Sys, 1 Storage, 8 Hab Sys racks (on MPLM), ULC w/1 O2 tank, 2 PV battery sets
6/02	18A	CTV #1 (Launch Vehicle TBD) [refered to as CRV in protocol]
6/02	19A	3 Hab Sys, 11 U.S. Storage racks (on MPLM)
U.S. Assembly Complete		
early 2003	1E	Columbus Orbital Facility

NAS15-10110

OMB Approval No. 2700-0042

AMENDMENT OF SOLICITATION/ MODIFICATION OF CONTRACT	1. CONTRACT ID CODE	PAGE OF PAGES 1 | 29

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. (If applicable)
170	4/09/2007	4200188471/4200194771	

6. ISSUED BY	CODE C01	7. ADMINISTERED BY (If other than Item 6)	CODE

NASA Space Station Program Office
Johnson Space Center
Attn: BG/M. Ruiz
Houston, TX 77058

APPROVED
JSC PROCUREMENT OFFICER
4/5/07
DATE

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State, and ZIP Code)

Federal Space Agency (Roscosmos)
42 Shchepkin Street
Attn: Alexey Krasnov
Moscow, 129857
Russia

CODE		FACILITY CODE
(x)	9A. AMENDMENT OF SOLICITATION NO.	9B. DATED (SEE ITEM 11)
X	10A. MODIFICATION OF CONTRACT/ORDER NO. NAS15-10110	10B. DATED (SEE ITEM 13) December 16, 1993

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended. Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and ☐ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)
N/A

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.(x)

(x)	
	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
X	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: FAR 52.243-1 and Agreement of the Parties
	d. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not, ☒ is required to sign this document and return 3 copies to the issuing office.

14. description of amendment/modification (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

A. The purpose of this modification is to 1) definitize UCA 149, updating the current Statement of Work (SOW); 2) extend the period of performance through December 31, 2011, extending the current contract requirements and purchasing additional delivery of Launch, Return, and Rescue of U.S. or U.S. Designated Crewmembers; Delivery of U.S. Cargo to ISS; Disposal of US trash on Russian vehicles; Docking Cargo Module (DCM) capabilities for accommodation of NASA cargo; and One Long Duration Increment Flight Opportunity 3) incrementally increasing the contract funding by $49,450,000 from $677,961,621 to $727,411,621 and; 4) increase the contract value by $719,000,000 from $787,451,621 to $1,506,451,621. All terms and conditions in previous modifications remain valid unless otherwise changed in the definitized contract.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
Alexey Krasnov		Marianne D. Ruiz, Contracting Officer	
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY (Signature of Contracting Officer)	16C. DATE SIGNED 4/4/07

NSN 7540-01-152-8070
PREVIOUS EDITION UNUSABLE

30-105
JSC MS Word (Aug 95)

STANDARD FORM 30 (Rev. 10-83)
Prescribed by GSA
FAR (48 CFR) 53.243

Block 14 Description of Amendment/Modification (continued):

B. The basic period of performance is extended for an additional 3 years through December 31, 2011, for the continuation of the current contract requirements and purchase of additional delivery of launch, return, and rescue of US or US designated crewmembers on Soyuz, delivery of US cargo to ISS, disposal of US trash on Russian vehicles, and the addition of new requirements of Docking Cargo Module (DCM) capabilities for accommodation of NASA cargo and One long duration increment flight opportunity. Requirements are identified in the attached sections 5 through 13 in the Statement of Work (SOW).

C. This modification constitutes full and complete equitable adjustment for the changes set forth herein. The parties agree that the invention and data rights set forth in Article G.7 and H.6 of this contract pertain only to the performance of work as set forth in the Statement of Work, and do not pertain to modifications of Soyuz and Progress space vehicles, DCM, ground and flight hardware used for manufacture and launch of the Soyuz and Progress space vehicles and/or the acquisition of equipment by the Contractor that are not deliverables provided to NASA under the contract. In consideration of this agreed to modification, the contractor hereby releases the Government from any and all liability under this contract for further equitable adjustments attributable to such facts or circumstances giving rise to these changes.

D. This modification includes the following changes:

- Clause B.1 SUPPLIES AND/OR SERVICES TO BE FURNISHED this provision is revised to change the name from RSA to Roscosmos, update the item number prices to cover continuation of contract requirements and incorporate phase 3 requirements.

- Clause B.2 Consideration and Payment this provision is revised to identify compliance with the Iran and Syria Nonproliferation Act (ISNA)

- Clause F.1 PERIOD OF PERFORMANCE this provision is modified to show the period of performance through December 31, 2011, and reflects the correct spelling of Roscosmos.

- Clause G.8 OBLIGATION OF FUNDS this provision is modified to show the amount of funds allotted to the contract.

- Clause H.10 LIMITATION OF FUNDS (FIXED PRICE CONTRACT) this provision is modified to show the funding and estimated date the funding covers.

- Clause H.16 LIQUIDATED DAMAGES, SPACE FLIGHT this provision is modified to reflect ISS applicability.

- Clause H.18 CROSS-WAIVER OF LIABILITY DURING THE PERFORMANCE OF THIS CONTRACT this provision is modified to reflect ISS applicability

- Section J-1 Paragraph 1.0 SCOPE, is modified to show the period of performance through December 31, 2011.

- Section J-1 Paragraph 1.2 ARRANGEMENT, this section is modified to reflect the 2005 and 2006 Addendums to the Balance of Trade Agreement.

- Sections J-1 Paragraphs 5, 7, 9, 12 and13 are modified to include additional requirements, for CY 2009 through CY 2011.

- Section J-4 is modified to include additional milestones.

Attached are the replacement sections of the contract. The revisions (which are bolded) have been made accordingly:

Delete Pages	**Replacement/New Pages**
B-1 through B-2	B-1 through B-3
F-1	F-1
G-8 and G-14	G-8 and G-14
H-18, H23 through H27	H-18, H23 through H27
J-1-1 through J-1-3	J-1-1 through J-1-3 J-1-65 through J-1-76
	J-4 (milestones for new requirements)

SECTION B - SUPPLIES OR SERVICES AND PRICE/COSTS

B.1 SUPPLIES AND/OR SERVICES TO BE FURNISHED
(NFS 18-52.210-72) (DEC 1988)
* The reference to NFS clauses is for NASA purposes as explained in Section I.1. This clause is based on the clause at NFS 18-52.210-72. **Due to the revision of the Russian Space Agency (RSA) name change to Federal Space Agency (Roscosmos), all references to RSA and Roscosmos are synonymous.**

RSA shall perform its obligations necessary to furnish the items below (and NASA shall perform its associated obligations, as set forth in the Statement of Work (SOW) and in Attachments J-7 & J-8, and G.10 and elsewhere in the contract) in accordance with the Description/Specifications/Work Statement in Section C and Attachment J-4, Milestone Billing Information.

ITEM NUMBER		PRICE
PHASE I		
0001	Management	$ 27,907,796
0002	Mir Lifetime Extension	26,190,000
0003	Mir Capabilities Expansion	142,070,121
0004	Mission Support (Missions to Mir)	133,189,000
PHASE 1 SUBTOTAL		$329,356,917
PHASE 2		
0005	Management	$ 22,225,627
0006	Advanced Technology	4,836,000
0007	International Space Station Elements	61,457,500
0008	Docking Mechanism Delivery	12,664,000
0009	Proton	200,000
00010	Soyuz Anthropometric Modification	38,700,000
00011	Soyuz Mockup	2,198,643
00012	Soyuz Part-Task Trainer	1,900,000
00013	ICM Docking Systems	9,095,000
00014	Soyuz Long Lead Activities	1,000,000
00015	Crew Hours and Russian Segment	60,000,000
00016	Russian Familiarization Training	1,150,000
00017	Ground Control, MCC-M & MCC-H Y2K Test	150,000
00018	Soyuz Training Catalog	310,000
00019	Russian Laptop Displays Mini-Trainer	110,000
00020	Propulsion Module Docking System	3,323,862
Contingency Reserves		**216,132**
PHASE 2 SUBTOTAL		**$219,536,764**

PHASE 3
All of line items 00021-00023 activities are as specified in modifications 149-169 with a total price of $238,557,940

00024a	Delivery of NASA cargo by Progress #1 (CY09-P1)	11,883,000
00024b	Delivery of NASA cargo by Progress #2 (CY09-P2)	11,883,000
00024c	Delivery of NASA cargo by Progress #3 (CY09-P3)	11,883,000
00024d	Delivery of NASA cargo by Progress #4 (CY09-P4)	11,888,000
00024e	Delivery of NASA cargo by Progress #5 (CY10-P1)	20,343,000
00024f	Delivery of NASA cargo by Progress #6 (CY10-P2)	20,343,000
00024g	Delivery of NASA cargo by Progress #7 (CY10-P3)	20,343,000
00024h	Delivery of NASA cargo by Progress #8 (CY10-P4)	20,343,000
00024i	Delivery of NASA cargo by Progress #9 (CY10-P5)	20,343,000
00024j	Delivery of NASA cargo by Progress #10 (CY11-P1)	13,605,000
00024k	Delivery of NASA cargo by Progress #11 (CY11-P2	13,605.000
00024l	Delivery of NASA cargo by Progress #12 (CY11-P3)	13,605,000
00024m	Delivery of NASA cargo by Progress #13 (CY11-P4)	13,605,000
00025a1	Disposal of NASA cargo on Progress #1 (CY09-P1)	1,320,000
00025a2	Disposal of NASA cargo on Progress #2 (CY09-P2)	1,320,000
00025a3	Disposal of NASA cargo on Progress #3 (CY09-P3)	1,320,000
00025a4	Disposal of NASA cargo on Progress #4 (CY09-P4)	1,320,000
00025a5	Disposal of NASA cargo on Progress #5 (CY10-P1)	2,260,000
00025a6	Disposal of NASA cargo on Progress #6 (CY10-P2)	2,260,000
00025a7	Disposal of NASA cargo on Progress #7 (CY10-P3)	2,260,000
00025a8	Disposal of NASA cargo on Progress #8 (CY10-P4)	2,260,000
00025a9	Disposal of NASA cargo on Progress #9 (CY10-P5)	2,260,000
00025a10	Disposal of NASA cargo on Progress #10 (CY11-P1)	1,512,000
00025a11	Disposal of NASA cargo on Progress #11 (CY11-P2)	1,512,000
00025a12	Disposal of NASA cargo on Progress #12 (CY11-P3)	1,512,000
00025a13	Disposal of NASA cargo on Progress #13 (CY11-P4)	1,512,000
00026a	Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #1 Services)	25,162,000
00026b	Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #2 Services)	25,167,000
00026c	Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #3 Services)	25,167,000
00026d	Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #4 Services)	25,167,000
00026e	Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #5 Services)	25,167,000
00026f	Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #6 Services)	25,167,000
00026g	Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #7 Services)	26,425,000
00026h	Train, deliver, return and rescue US designated astronaut for 1 Soyuz seat (Seat #8 Services)	26,425,000
00026i	Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #9 Services)	26,425,000
00026j	Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #10 Services)	26,425,000

00026k	**Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #11 Services)**	**26,425,000**
00026l	**Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #12 Services)**	**26,425,000**
00026m	**Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #13 Services)**	**27,717,000**
00026n	**Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #14 Services)**	**27,718,000**
00026o	**Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #15 Services)**	**27,718,000**
00027	**Docking Cargo Module (DCM) Capabilities for Accommodation of NASA cargo (CY09-DCM)**	**50,000,000**
00028	**Long Duration Increment Flight Opportunity (CY09-INC)**	**50,000,000**

PHASE 3 SUBTOTAL **$ 957,557,940**

Total Firm-Fixed Price Amount $1,506,451,621

All amounts set forth in this contract are expressed in United States Dollars (USD).
NOTE: Breakouts of prices below line-item level are reflected in Attachment J-4.

B.2 CONSIDERATION AND PAYMENT

Payment will be made in U.S. currency at the prices set forth in Clause B.1 provided that RSA submits proper invoices in accordance with the Invoices clause contained in Section G of this contract. **Roscosmos shall complete all requirements and submit all invoices in time to be paid on or before December 31, 2011. It is understood by both parties that, pursuant to the Iran and Syria Nonproliferation Act, no payments will be made on this contract after December 31, 2011.**

B.3 ADDITIONAL SUPPLIES/SERVICES

These unpriced activities are included pursuant to the agreement between the parties, as contained in the extra-contractual document entitled "Addendum to Program Implementation Plan, Alpha Station", dated November 1, 1993, for a provision to expand the scope of U.S.-Russian cooperation of a contractual nature beyond the items listed in B.1 above.

At such time as mutually agreed upon by the parties, such additional supplies and/or services may be defined, priced and procured in support of joint U.S.-Russian space activities for Phases Two and Three. Specific deliverables may be provided in support of the International Space Station activities, at prices mutually agreed upon at the time this option is exercised and subject to the availability of additional appropriations in excess of 400 million dollars.

B.4 RESERVED

B.5 RESERVED

B.6 OPTIONS FOR TRANSPORTATION

(a) NASA reserves the right, at its sole option, to require RSA to provide for the transportation (shipping and insurance) of end items required in the performance of this contract and identified in Attachments J-5 and J-6. NASA may exercise any of the options identified herein by issuance of a contract modification that specifically states which option listed below is exercised.

Option Number	Line Item	Title	FY95	FY96	FY97	Latest Date Option Can Be Exercised
1F1	0001F1	Option for Transportation Costs FY95	1,400,000			9/30/94
1F2	0001F2	Option for Transportation Costs FY96		1,400,000		9/30/95
1F3	0001F3	Option for Transportation Costs FY97			1,100,000	9/30/96

(b) If NASA exercises any of the options as provided for herein, the resultant contract shall include all terms and conditions of the contract as it exists immediately prior to the exercise of the option, except for the changes described below.

SECTION F – DELIVERIES OR PERFORMANCE

F.1 PERIOD OF PERFORMANCE AND COMPLETION OF WORK

All work required under this contract to provide supplies and services, including data deliverables, shall be completed **by December 31, 2011.**

F.2 DELIVERY SCHEDULE (NFS 18-52.212-73) (DEC 1988)

* The reference to NFS clauses is for NASA purposes as explained in Section I.1. This clause is based on the clause at NFS 18-52.212-73.

RSA shall deliver the items required to be furnished by this contract as identified in Attachment J-4, J-5, and J-6, Deliverable Items List.

F.3 DATA REQUIREMENTS

RSA shall deliver the data and information required under this contract as specified by Attachment J-2, Data Requirements Document.

F.4 PRINCIPLE PLACE OF PERFORMANCE

The effort required under this contract shall be principally performed at **Roscosmos** facilities in Russia and other states within the Commonwealth of Independent States (CIS). However, certain interface design reviews and related preparatory activities will take place in Houston, Texas and other locations in the U.S. as may be appropriate.

F.5 STOP-WORK ORDER (FAR 52.212-13) (AUG 1989) (DEVIATION)

* The reference to FAR clauses is for NASA purposes as explained in Section I.1. This clause is based on the clause at FAR 52.212-13.

(a) After appropriate consultation between NASA and **Roscosmos** at least 15 days prior to issuance of an order, the Contracting Officer may, upon approval of the NASA Space Station Program Manager, by written order to **Roscosmos**, require **Roscosmos** to stop all, or any part, of the work called for by this contract for a period up to 90 days after the order is delivered to **Roscosmos**, and for any further period to which the parties may agree. The order shall be specifically identified as a stop-work order issued under this clause. Upon receipt of the order, **Roscosmos** shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of costs allocable to the work covered by the order during the period of work stoppage. Within a period of 90 days after a stop-work order is delivered to **Roscosmos**, or within any extension of that period to which the parties shall have agreed, the Contracting Officer shall either -

(d) RSA agrees to execute or to secure the execution of such legal instruments as may be necessary to confirm and to protect the rights granted by paragraph (c) above, and supplemental agreements relating to rights in third countries, including papers incident to the filing and prosecution of patent applications.

(e) Upon completion of the contract work, and prior to final payment, RSA shall submit to the Contracting Officer a final report listing all inventions reportable under this contract or certifying that no such inventions have been made.

(f) In each subcontract, which RSA awards under this contract where the performance of research, experimental design, engineering, or developmental work is contemplated, RSA shall include this clause and the name and address of the Contracting Officer.

(g) Implementation of Clause G-7 is not applicable to inventions, discoveries, and improvements made before contract became effective and/or which were applied or demonstrated before contract became effective.

(h) Nothing in this contract shall be construed to create rights to, or title or interest in, inventions, discoveries, improvements, information and/or data which were conceived and demonstrated prior to the effective date of this contract notwithstanding whether such improvements, discoveries, information and/or data have been legally protected prior to this contract becoming effective.

(End of Clause)

G.8 OBLIGATION OF FUNDS

The total amount of funds allotted to this contract is **$727,411,621**. Each time additional funds are allotted the Contracting Officer shall amend this clause accordingly.

(End of Clause)

H.10 LIMITATION OF FUNDS (FIXED PRICE CONTRACT) (NFS 18-52.232-77) (MARCH 1989) (DEVIATION)

* The reference to NFS clauses is for NASA purposes as explained in Section I.1. This clause is based on the clause at NFS 18-52.232.77.

(a) Of the total price of **$1,506,451,621** for items 0001 through **00028**, the sum of **$727,411,621** is presently available for payment and allotted to this contract. It is anticipated that from time to time additional funds will be allocated to the contract until funds consistent with the total contract price are allotted.

(b) RSA agrees to perform or have performed work on the items specified in paragraph (a) above up to the point at which, if this contract is terminated pursuant to the Termination by the U.S. Government clause of this contract, the total amount payable by NASA (including amounts payable for subcontracts and settlement costs) pursuant to paragraphs (i) and (j) of that clause would, in the exercise of reasonable judgment by RSA, approximate the total amount at the time allotted to the contract. RSA is not obligated to continue performance of the work beyond that point. NASA is not obligated in any event to pay or reimburse RSA more than the amount from time to time allotted to the contract, anything to the contrary in the Termination by the U.S. Government (Fixed-Price) clause (Section I.8) notwithstanding.

(c) (1) It is contemplated that funds presently allotted to this contact will cover the work to be performed until **October 31, 2007.**

(2) If funds allotted are considered by RSA to be inadequate to cover the work to be performed until that date, or an agreed to date substituted for it, RSA shall notify the Contracting Officer in writing when within the next 60 days the work will reach a point at which, if the contract is terminated pursuant to the Termination by the U.S. Government clause of this contract, the total amount payable by NASA (including amounts payable for subcontracts and settlement costs) pursuant to paragraphs (i) and (j) of that clause will approximate 75 percent of the total amount then allotted to the contract.

(3) (i) The notice shall state the estimated date when the point referred to in subparagraph (2) above will be reached and the estimated amount of additional funds required to continue performance to the date specified in subparagraph (1) above, or an agreed date substituted for it.

September 1 of each year and these annual amounts will be payable to RSA after agreement on the amount and RSA's submission of a proper invoice. Negotiated annual amounts will be based on the relative amount of research to be conducted and implemented by RSA during the conduct of the Research Program each year.

H.16 LIQUIDATED DAMAGES, SPACE FLIGHT

(a) As provided in the Statement of Work, this contract is entered into with the intent of accomplishing a certain number of flights of U.S. astronauts onboard Space Station **MIR/Shuttle or Soyuz to ISS**. The successful accomplishment of these flights is dependent upon the successful and timely accomplishment of certain mutual obligations by both parties. It is recognized that RSA will incur significant expense and accomplish significant commitment of resources in order to fulfill its obligations in support of U.S. astronaut flight. It is further recognized that, should NASA fail to provide its astronauts in a reasonably timely manner, or fail to undertake necessary action in a timely manner, there needs to be established a schedule of liquidated damages to be paid by NASA which will fairly compensate RSA for its expenses and resource commitment, which occur whether or not the U.S. astronauts are actually flown aboard **MIR/Shuttle or Soyuz to ISS**.

(b) Similarly, it is recognized that NASA incurs significant expense in payments to RSA in preparation for U.S. astronaut flight, and that should such flight not be possible because of failure to perform by RSA, there needs to be established a procedure to address such expense.

(c) In the case in which NASA fails to deliver a U.S. astronaut **on Shuttle or Soyuz to ISS/MIR** in accordance with a mutually agreed schedule the following shall apply:

> (1) If NASA notifies RSA, more than 540 days prior to the intended date of arrival at **MIR/Launch of Shuttle or Soyuz to ISS**, that it has made a decision to not utilize the flight opportunity aboard **MIR/Shuttle or Soyuz to ISS**, such cancellation shall not incur any liquidated damages. In such a situation NASA shall be liable for payment of any services which may be ancillary to or which precede flight services and which NASA has received (for example, pre-flight astronaut training which has been received). NASA will not be responsible for payment for any services which may be ancillary to or which precede flight services and which NASA has not received (for example, pre-flight astronaut training which has not been received).
>
> (2) If NASA notifies RSA, between 540 days and 15 days prior to the intended date of arrival at **MIR/Launch of Shuttle or Soyuz to ISS,** that it has made a decision to not utilize the flight opportunity aboard **MIR/Shuttle or Soyuz to ISS**, such cancellation shall incur a liquidated damages charge against NASA in an amount ranging from 10% (at 540 days) to 85% (at 15 days) with a straight line proportional increase

computed for the percentage of liquidated damages charged for any point in days between the 540 day to 15 day points. Payment for services ancillary to or which precede flight services shall be governed as outlined in subparagraph (a) above.

(3) If NASA notifies RSA fewer than 15 days prior to the intended date of arrival on **Launch of Shuttle or Soyuz to ISS/MIR**, that it has made a decision to not utilize the flight opportunity aboard **MIR/Shuttle or Soyuz to ISS**, such cancellation shall incur a liquidated damages charge against NASA in an amount of not less than 85%. The exact amount of such percentage of liquidated damage shall be negotiated by the parties on a case by case basis. Payment for services ancillary to or which precede flight services shall be governed as outlined in subparagraph (a) above.

(d) The computation of the liquidated damages percentages addressed in paragraph's 2 and 3 above shall be made against only the prices associated with flight services; **including** line items entitled "Flight Control Mir Station/**ISS**" for Long Duration Missions or "Time Docked to Mir **Station/Shuttle or** Soyuz to ISS " for Short Duration Missions.." Such computations shall not be computed against services which are ancillary to or which precede flight services (for example, pre-flight astronaut training).

(e) In those cases in which NASA is prepared to fulfill its obligations for astronaut flight but where RSA is unable to fulfill its obligations as planned, it is agreed that RSA shall accomplish a re-scheduling of the planned flight at **a** time, to be negotiated between the parties, at no additional cost to NASA. This rescheduling at no additional cost shall include any Activities, such as astronaut training, which may have already been accomplished and for which payment has already been made but which must be reaccomplished in order to support the new flight schedule (for example, crew training which must be reaccomplished in order to maintain required crew training requirements because of the passage of time between the dates of the originally scheduled and re-scheduled flights).

(f) It is recognized by both parties that the scheduling of complex space activities is inherently difficult. With respect to such schedule issues, for the purposes of facilitating successful accomplishment of contractual commitments by both parties, it is agreed that a period of 14 calendar days shall exist, starting with the date established in the contract for flight services to begin, within which time if performance of contract requirements with regard to delivery of astronauts by the U.S. **on the Shuttle or Soyuz to ISS/MIR** is accomplished, such performance will be considered to have been performed on time and in accordance with the contract. In all cases where NASA makes a decision to not use a flight opportunity on board **Mir/Shuttle or Soyuz to ISS**, that decision cannot place on RSA any commitment to fulfill additional work on providing additional services that RSA would not have been obligated to perform if the mission took place.

(g) In the case where RSA fails to provide planned support requirements, services, or capabilities in a timely manner, the payment due from NASA for flight services shall be decreased by the same proportionate percentage as the percentage of planned work Activities which could not be accomplished as a result of the failure to provide the planned requirements, services, or capabilities. Such payment reduction shall not be accomplished in cases when such shortfall of planned requirements, services, or capabilities is the result of: (1) acts of God or of the public enemy, (2) fires, (3) floods, (4) epidemics, (5) quarantine restrictions, (6) strikes, (7) freight embargoes, (9) unusually severe weather and, (10) human error by members on the **Shuttle or Soyuz to ISS/MIR** while in orbit.

(h) Both NASA and RSA commit to utilize maximum flexibility in negotiating alternative schedules and procedures in order to work around problems and scheduling difficulties. Both parties commit to good faith negotiations in the spirit of cooperative space endeavor in order to minimize schedule delays, schedule conflicts, and lost research opportunities.

H.17 OPTION TO EXERCISE ADDITIONAL LINE ITEMS

(a) An option as used in this contract provides NASA with the unilateral right to elect to acquire, in additional to the Statement of Work RSA is required to perform under this contract, other supplies or services specified in Section B of this contract. RSA's obligation with regard to Attachment J-1 is limited to that effort funded by the basic contract which is without options provided by this clause. RSA shall only be obligated to perform the additional effort contained in Attachment J-1 when NASA exercises an option. The parties have agreed to the effort to be performed for these option items and have established a price for each option line item in Section B-1 of this contract. NASA shall obligate funds in addition to the total amount of this contract when it elects to exercise any option line item. Except for the options regarding transportation which may be exercised as provided in Section B.6 any option which will be exercised shall be in addition to the $400 million to be obligated on this contract. Additionally, the parties understand that if NASA fails to exercise any option line item by the date specified for that option item in paragraph (b) below, NASA loses its right to exercise the option unilaterally. At its own discretion, however, RSA can agree to permit NASA to exercise an option after the option exercise period has expired.

(b) The Government may require RSA to perform the numbered option line items listed below at the price(s) stated in Section B-1 of this contract. The Contracting Officer may unilaterally exercise these options, from time to time, by written notice to RSA on or before the dates set forth for each option line item identified below:

OPTION LINE ITEMS	DATES FOR EXERCISE

(See Section B for data)

H.18 CROSS-WAIVER OF LIABILITY DURING THE PERFORMANCE OF THIS CONTRACT

(a) The Intergovernmental Agreement (IGA) for the Space Station contains a broad cross-waiver provision which applies to the Partner States. The IGA requires the Space Station Partner States waive liability for claims for damage against other Partner States and related entities of such States, including contractors and subcontractors. The purpose of Section H.1 of this contract is implement NASA's obligation under the IGA to extend the IGA cross-waiver to RSA as a "related entity" of NASA. Because this contract provides for joint missions to OS Mir/**Shuttle, Soyuz and Progress to ISS**, this contract contains a separate cross-waiver clause between NASA and RSA for activities in space.

(b) As used in this clause, the term:

(1) "Damage" means:

(i) Bodily injury to, or other impairment of health of, or death of, any person;

(ii) Damage to, loss of, or loss of use of property;

(iii) Loss of revenue or profits; or

(iv) Other direct, indirect, or consequential damage.

(2) "Launch Vehicle" means an object (or any part thereof) intended for launch, launched from Earth, or returning to Earth which carries payloads or persons, or both.

(3) "Payload" means all property to be flown or used on or in launch vehicle or the OS Mir/ISS.

(4) "Protected Space Operations" means all launch vehicle activities, OS Mir/ **Shuttle, Soyuz and Progress to ISS** activities, and Shuttle activities which are performed in outer space, or in transit between Earth and outer space as required by this contract. "Protected Space Operations" excludes activities on Earth

which are conducted before or on return from the OS Mir/**ISS** as provided to develop further a payload's product or process. The excluded activities include, but are not limited to:

(i) Research, design, development, test, manufacture, assembly, integration, operation, or use of launch or transfer vehicles, payloads, related support equipment, and facilities and services.

(ii) All activities related to ground support, test training, simulation, guidance and control equipment and related facilities and services.

(c) RSA agrees to a cross-waiver of liability pursuant to which RSA waives all claims against NASA and its contractors and subcontractors or entities listed in C.1, i-iii, clause H-1 based on damage arising out of Protected Space Operations and the person, entity, or property damaged is damaged by virtue of its involvement in Protected Space Operations. RSA agrees to flowdown this clause to all its contractors and subcontractors performing this contract.

(d) NASA agrees to a cross-waiver of liability pursuant to which NASA waives all claims against RSA and its contractors and subcontractors or entities listed in C.1, i-iii, clause H-1 based on damage arising out of Protected Space Operations and the person, entity, or property damaged is damaged by virtue of its involvement in Protected Space Operations. NASA agreed to flowdown this clause to its contractors and subcontractors performing this contract.

(e) For avoidance of doubt, this cross-waiver includes a cross-waiver of liability arising from the Convention on International Liability for damage caused by Space Objects, (March 29, 1972, 24 United States Treaties and other International Agreements (U.S.T) 2389, Treaties and other International Acts Series (T.I.A.S.) No. 7762) in which the person, entity, or property causing the damage is involved in Protected Space Operations.

(f) Notwithstanding the other provisions of this clause, this cross-waiver of liability shall not be applicable to:

(1) claims made by a natural person, his/her estate, survivors, or subrogees for injury or death of such natural person;

(2) claims for damage caused by willful misconduct; and

(3) intellectual property claims.

STATEMENT OF WORK

1.0 SCOPE

This Statement of Work (SOW) describes the Phase 1, selected Phase 2 elements and selected phase 3 other elements required to implement the joint human space activities between the U.S. National Aeronautics and Space Administration (NASA) and the Federal Space Agency (**Roscosmos**) that are procured through this contract. Under this contract, **Roscosmos** agrees to furnish and NASA agrees to purchase supplies and services for **Phase 1, mutually agreed Phase 2 activities, and mutually agreed Phase 3 activities to be provided through December 31, 2011,** as set forth in the Contract Schedule and Terms and Conditions attached hereto and made a part hereof. This SOW further defines and expands activities agreed to as part of the signed Letter Contract NAS15-10110.

1.1 OVERVIEW

On October 5, 1992, the National Aeronautics and Space Administration (hereafter referred to as NASA) and the Russian Space Agency (hereafter referred to as RSA) concluded the cooperative Implementing Agreement on Human Space Flight Cooperation, pursuant to the June 1992 U.S./Russian Civil Space Agreement. The activities to be conducted under this agreement, referred to as the Shuttle/MIR Program, include the flight of cosmonauts on the Space Shuttle, the flight of a U.S. astronaut on Soyuz and MIR, the docking of the Shuttle to the MIR space station, the exchange of the MIR crew using the Shuttle, and a joint science program involving all of these components. These activities will be conducted on a cooperative, no-exchange-of-funds basis.

On September 2, 1993, a Joint Statement on Cooperation in Space was issued by U.S. Vice-President Gore and Russian Prime Minister Chernomyrdin as a result of discussions at the Joint Commission on Economic and Technology Cooperation. The Joint Statement calls for expanded cooperation between the two governments in the field of human space flight in three phases, culminating in the construction of an international space station involving the U.S., Russia, and current space station partners.

Phase 1 expands the Shuttle/MIR Program to include additional activities. The expanded Phase 1 will include:

will take place through subsequent NASA/**Roscosmos** arrangements." This contract is that arrangement. The December 15, 1993, Protocol to the Human Spaceflight Agreement covers Phase 1 activities and selected Phase 2 activities. **The Memorandum of Understanding (MOU) between NASA and RSA Concerning Cooperation on the Civil International Space Station, signed January 29, 1998 and the Protocol Including Terms, Conditions and Assumptions, Summary Balance of Contributions and Obligations to International Space Station (ISS) and Resulting Rights of NASA and RSA to ISS Utilization Accommodations and Resources, and Flight Opportunities, signed on June 11, 1996 (Balance Agreement) established between the parties identifies the responsibilities of both parties in Phases 2 and 3, as partners in the development and operation of the International Space Station. In addition, the First Addendum to the Balance Agreement, signed September 9, 2004, and the Second Addendum to the Balance Agreement, signed July 1, 2006, further delineates the responsibilities of both parties in Phases 2 and 3.**

The documents referenced above establish a framework for detailed activities described in this Statement of Work.

1.3 OVERALL MANAGEMENT AND INTEGRATION

The International Space Station (ISS) Program, including the associated Russian activities such as the effort procured under this contract, is managed from the program office located at Johnson Space Center, the NASA host center. The Boeing Company is NASA's Prime Contractor for developing the ISS. Within NASA, the ISS Program Office is responsible for all phases of this effort.

The November 1 Addendum to the PIP and the December 15 Protocol state that the Phase 1 activities will continue to be managed through the U.S./Russian Joint Working Groups (JWG) established under the October 5, 1992 Agreement. A management JWG leads 8 JWG's with areas such as safety, crew training, flight operations and integration, science and technology utilization, and public affairs. These groups will coordinate the Phase 1 program and will provide technical input to the Contracting Officer for activities affected by the contract.

The program uses a product-oriented system structure with clear lines of authority and accountability. Each product is managed by a team of government and contractor personnel, with appropriate representation of the International Partners, consistent with the International Space Station agreements.

The Prime Contractor, Boeing Company, is responsible for the functional performance of the U.S. portion of the ISS. In this capacity, the Prime Contractor will analyze and integrate the International Partners' systems and elements into launch packages/stages and will be responsible for verification of the total system performance.

The Prime Contractor will not be responsible for the functional performance of the International Partners' segments. The Prime Contractor will support NASA in developing and maintaining interfaces between the U.S.-provided and Russian-provided elements and systems. Additionally, the Prime Contractor will provide and maintain for NASA a common management information system available for access by all International Partners.

NASA and Roscosmos agreed to hold regular management meetings to review the work performance under this Contract. The purpose of these meetings in the particular will be the review of the ongoing fulfillment of the Parties' responsibilities, accounting of the services and resources, review of the changes and anomalies which could occur during the implementation of this Contract. It is understood that information to be exchange between the Parties would be provided based on the existent practice and subject to appropriate laws and regulations. One of the main purposes of these meetings is to minimize the Parties' concern to the maximum extent on the possible negative situations and/or anomalies.

Within one week of the occurrence of an anomaly that can affect crew interfaces, ISS or crew safety, ISS requirements or vehicle performance on the Soyuz or Progress vehicle used for performance of services under this contract, Roscosmos shall designate to NASA a point of contact (POC,) who is a system expert in the technical field of the anomaly and who can verbally provide information to NASA concerning the anomaly. The initial information should include a description of the event, planned course of action, and the anomaly's potential impact to continued ISS and vehicle operation. During the course of the investigation committee activity, the POC shall provide NASA with updates of investigation activities at mutually agreed intervals. Within one week of the conclusion of the investigation committee activity, the POC shall provide NASA with a complete verbal summary of the investigation committee report on any anomaly that occurs during flight of the Soyuz or Progress vehicle. Roscosmos shall provide to NASA a copy of the GDR briefing charts after the GDR. The above are all subject to existing Russian laws and regulations.

Paragraph 5 of the statement of work is revised to reflect CY 2009 through CY 2011 requirements:

5.0 Launch, return, and rescue of U.S. or U.S. Designated Crewmembers

5.0.1 NASA is planning crew rotations on Soyuz vehicles in the following amounts:

	CY09	CY10	CY11	Total
Delivery to ISS	6	6	3	15
Return from ISS	3	6	6	15

The above rotations will be provided by the following number of vehicles:

	CY09	CY10	CY11	Total
Soyuz vehicle launches	4	4	2	10
Soyuz vehicle landings	2	4	4	10

(The total number of Soyuz vehicles in 2009 through the fall of 2011 providing services under this contract is 10)

5.1 Deliver the Assigned U.S. or U.S. Designated Crewmember to the ISS, provide rescue capability for the crewmember, and return the Assigned U.S. or U.S. Designated Crewmember to Earth on Soyuz.

5.1.a Crew Soyuz training (one prime and one backup)

5.1.a.1 Provide theoretical and practical crew training, according to functional duties on Soyuz, including equipment (e.g. sokol suit, seat liner, cold weather suit, water survival suit and elemental survival suit), facility access and certification for the prime and backup Assigned U.S. or U.S. Designated Crewmember to ensure delivery to and return from the ISS by a Soyuz vehicle and landing in a Soyuz vehicle. Utilize the most recent versions of necessary training materials in both Russian and English for training.

5.1.a.2 New unmarked Soyuz Flight Data File (FDF) shall be utilized to train the assigned U.S. or U.S. designated crewmembers.

5.1.a.3 Develop and implement a training plan and corresponding crew travel template as part of an ISS integrated training plan.

5.1.a.4 Except for the last training session, interpretation shall be provided for the prime and backup Assigned U.S. or U.S. Designated Crewmembers for all training events as required by each of crewmembers.

5.1.b Transportation and Lodging (other than Baikonur) for NASA personnel.

5.1.b.1 Provide transportation and facility access (subject to the internal regulations and due provision of personal data) as required for prime and backup Assigned U.S. or U.S. Designated Crewmember and 3 NASA designated support personnel (e.g. trainers, crew surgeon, crew support astronauts & interpreter) for survival training. When 2 seats on the same Soyuz have been procured by NASA, the number of travelers in addition to the prime and backup crewmembers shall be 4. For survival training, meals and lodging shall be provided as well.

5.1.c Baikonur services for NASA personnel

5.1.c.1 Provide for pre-launch and launch security services in Baikonur and necessary document clearances and appropriate facility access (subject to the internal regulations and due provision of personal data) for prime and backup Assigned U.S. or U.S. Designated Crewmembers and 13 NASA designated support personnel (e.g. crew surgeons, NISN computer communication specialist, public affairs official (PAO), NASA management personnel and interpreter) as mutually agreed for duration of stay. When 2 seats on the same Soyuz have been procured by NASA, the number of NASA designated travelers in addition to the prime and backup crewmembers shall be 27.

5.1.c.2 Roscosmos shall provide access (subject to the internal regulations and due provision of personal data) for NASA NISN specialists to maintain telephone and computer connectivity in the Cosmonaut Hotel, Energia Hotel 3, FGUP TsENKI building and at the NASA office in area 254 (Soyuz Assembly building) based on the existing communication configuration and in accordance with existing practice.

5.1.c.3 Provide transportation for prime and backup Assigned U.S. or U.S. Designated Crewmember and 13 NASA designated crew support personnel (e.g. crew surgeons, NISN computer communication specialist, PAO, NASA management personnel and interpreter) from Moscow to Baikonur and return; and locally in Baikonur as required for training events, pre-launch and launch activities. When 2 seats on the same Soyuz have been procured by NASA, the number of NASA designated travelers in addition to the prime and backup crewmembers shall be 27.

5.1.c.4 Provide meals (when normally included as part of lodging) and lodging for the prime and backup Assigned U.S. or U.S. Designated Crewmember and 13 NASA designated crew support personnel (e.g. crew surgeons, NISN computer communication specialist, PAO, NASA management personnel and interpreter) in Baikonur during any required training events, pre-launch and launch activities. When 2 seats on the same Soyuz have been procured by NASA, the number of NASA designated travelers in addition to the prime and backup crewmembers shall be 27. Food and lodging for three NASA designated personnel (e.g. launch team coordinator, chief astronaut office or his representative, and the crew flight surgeon) will be provided at the Cosmonaut Hotel with the prime and backup crewmembers. When 2 seats on the same Soyuz have been procured by NASA, the number of NASA designated travelers in addition to the prime and backup crewmembers staying at the Cosmonaut Hotel shall be 4, and lodging shall be in two 2-bedroom suites. Lodging for the remaining NASA designated personnel will be provided at existing adjacent hotels as mutually agreed.

5.1.d Landing site deployment airfield and Search and Rescue services under normal (including ballistic within the nominal landing site) conditions of landing and weather.

5.1.d.1 Provide for security services, airport access, agreed upon facilities access and necessary document clearances for Assigned U.S. or U.S. Designated Crewmember and 10 NASA designated crew support personnel (e.g. crew surgeons, crew support astronaut, PAO, NASA management and interpreter) at the deployment airfields. The actual number of NASA designated personnel to the landing site is governed by the provisions in section 5.1.d.4. When 2 seats on the same Soyuz have been procured by NASA, the number of NASA designated travelers shall be 14.

5.1.d.2 Provide transportation for 10 NASA designated crew support personnel (e.g. crew surgeons, crew support astronauts, PAO, NASA management personnel and interpreter) from GCTC to the deployment airfields and return and locally at the deployment airfields as required to support crew recovery operations. The NASA delegation will pay for its own lodging and meals. When 2 seats on the same Soyuz have been procured by NASA, the number of NASA designated travelers shall be 14, with the understanding that 2 of the 14 (crew surgeons) shall be seated in GCTC airplane compartments with the US crewmembers during the return to GCTC. Roscosmos shall arrange for lodging at the same location(s) as the search and rescue personnel. The actual number of NASA designated personnel to the landing sites is governed by the provisions in section 5.1.d.4.

5.1.d.3 Provide transportation for the Assigned U.S. or U.S. Designated Crewmember from the landing site deployment airfield to GCTC and locally at the landing site deployment airfield as required to support crew recovery operations.

5.1.d.4 Provide transportation, with the Search and Rescue Forces helicopters, for up to 5 (as determined by NASA) or up to 6 if agreed by both parties (plus 2 for ballistic landing within the nominal landing site) NASA designated crew support personnel (e.g. crew surgeons, crew support astronauts, PAO, NASA management personnel and interpreter) from the deployment airfield to the nominal landing site and return; and to other required locations during the Soyuz recovery operations. When 2 seats on the same Soyuz have been procured by NASA, the number of NASA designated travelers shall be up to 8 (as determined by NASA) or up to 9 if agreed by both parties (plus 2 for ballistic landing within the nominal landing site) NASA designated crew support personnel.

5.1.e Health care/Medical care

5.1.e.1 Provide information on the overall medical mission operations program. Conduct medical support activities consistent with these requirements and mutually agreed upon requirements in the Medical Operations Requirement Document (MORD) (SSP-50260). Facilitate the activities of U.S. flight surgeon in monitoring the health and well being of the Assigned U.S. or U.S. Designated Crewmember.

5.1.e.2 Facilitate the activities necessary for U.S. flight surgeons to brief the State Medical Commission (GMK) in GCTC in order to obtain medical certification of Assigned U.S. or U.S. Designated Crewmember to fly in Soyuz prior to launch.

5.1.e.3 Provide post-flight rehabilitation in accordance with existing practice

5.1.f Consumables

5.1.f.1 Soyuz crew consumable services to the Assigned U.S. or U.S. Designated Crewmember shall be provided during ascent and decent of the Soyuz. Items included but not limited to: food, habitation, clothing, crew support equipment, and life support consumables.

5.1.g Individual crewmember equipment (prime and backup)

5.1.g.1 Provide for use by the assigned U.S. or U.S. Designated Crewmember all required Soyuz crewmember standard flight hardware including: sokol suit, seatliner, cold weather suit, water survival suit and elemental survival kit.

5.1.g.2 Provide all necessary measurements and fit check for the Assigned U.S. or U.S. Designated Crewmember, including safety assessments and familiarization with the flight equipment.

5.1.h Visa Support

5.1.h.1 Provide visa support, including issuing letters of invitation, for the Assigned U.S. or U.S. Designated Crewmember, NASA crew support, and management personnel for access to the Russian Federation.

5.1.i Mission/Flight support for Soyuz

5.1.i.1 Services shall be provided during all stages of Soyuz flight including docked operations for overall mission cognizance in accordance with existing practice.

5.1.i.2 Provide for MCC-H requested Soyuz Telemetry in the Russian Telemetry From Moscow (RTFM) stream from MCC-M to MCC-H during Russian Ground Site (RGS) coverage.

5.2 Return of approximately 3kg of downmass with volume density as mutually agreed.

5.2.1 Base services to be provided in support of U.S. cargoes to be returned from ISS

5.2.a Cargo Transportation and Shipping

5.2.a.1 Upon return of cargo to Kazakhstan, provide for the transport of the assigned cargo to NASA in Moscow in a conditioned state (coordinated in advance) based on NASA provided requirements.

5.2.a.2 Provide for customs clearances and necessary ministry services to allow for the transport of the returned cargo to the U.S. from Kazakhstan and or Moscow based on NASA provided documentation.

5.2.b Documentation and Analysis

5.2.b.1 Provide for the integration (modeling) of the descent cargoes prior to return from the ISS.

5.2.c Early de-stow of Soyuz returned cargo at NASA's option

5.2.c.1 Provide early de-stow for NASA cargo at landing as concurred with Roscosmos, but before crew departure from the landing site.

5.2.c.2 Provide transfer of early de-stow cargo to NASA in Moscow, subject to applicable laws.. After handover to NASA, Roscosmos is no longer responsible for early de-stow hardware.

5.2.c.3 Provide NASA transportation for early de-stow from landing site to Moscow including customs clearance. NASA will provide documentation as needed.

Paragraph 7 of the statement of work is revised to reflect CY 2009 through CY 20011 requirements:

7.0 Delivery of U.S. cargo to ISS -

7.0.1 NASA is planning to deliver upmass on Russian vehicles using the following procedures in the following amounts:

CY09	CY10	CY11	Total
1400 kg	2800 kg	1400 kg	5600 kg (+/- 10 kg)

7.0.2 It is assumed that there will be 350 kg of NASA cargo per each of 4 Progress flights in CY09; 560 kg per each of 5 Progress flights in CY10; and 350 kg per each of 4 Progress flights in CY11. If the planned number of Progress vehicles differs from these assumptions, the amount of NASA cargo assumed shall be calculated by dividing the upmass in a given year by the number of Progress vehicles planned to be flown in that year. Cargoes should have an average volume density per vehicle of 250 grams per liter or greater.

7.0.3 At 4 months prior to the start of each calendar year, NASA shall identify to Roscosmos the amount of cargo for each of the upcoming calendar year's Progress flights. This amount per Progress flight shall be in a range from +/- 150 kg of the amount used in 7.0.2, with the total amount per year consistent with 7.0.1.

7.0.4 At Launch-2 months NASA may adjust the mass of the cargo for the upcoming Progress flight. This amount shall be in a range from +/- 50 kg of the amount identified by NASA in 7.0.3, but shall in no circumstances fall outside of a range of +/- 150 kg of the amount in 7.0.2. The amount identified at L-2 months shall be the amount credited against the annual upmass. Roscosmos shall be entitled to keep and/or receive payment, according to J-4, unless Roscosmos fails to perform delivery of US cargo to ISS.

7.0.5 If the cargo adjustments in 7.0.3 results in less than the annual amount of upmass identified in 7.0.1, it is agreed that NASA shall have the ability to rollover up to 200 kg from one year into the next, but never more than 200 kg in total. This amount shall be in addition to the amount of upmass in 7.0.1 for the upcoming calendar year(s).

7.0.6 Upmass may be provided on Soyuz vehicles if space is available and mutually agreed in advance, and shall be credited toward the total procured by NASA in a given year.

7.0.7 Should a Progress vehicle slip from one calendar year into the next, NASA shall not determine that Roscosmos is in breach of its contractual obligations, so long as the procured amount of cumulative upmass is made available to NASA as stated in 7.0.1.

7.1 Services to be provided in support of delivery of U.S. cargo on Progress, Soyuz vehicles. NASA agrees to provide ISS safety certified cargo for launch.

7.1.a Transportation, Customs and Sanitation Clearance for U.S. Cargo.

7.1.a.1 Provide for cargo transportation from Roscosmos facilities or that of their contractors to Baikonur in accordance with ISS documentation including late access cargo.

7.1.a.2 Provide for the customs clearance and required ministry services in Moscow and Kazakhstan. NASA will provide documentation as needed.

7.1.a.3 Provide for the coordination of sanitary hygiene certifications as required for customs clearance. NASA will provide documentation as needed.

7.1.a.4 Provide travel for up to 2 Russian specialist(s) for 1 week to the US to support NASA activities relating to cargo review and cargo documentation in support of 7.1.a.2 and 7.1.a.3 as required.

7.1.b Documentation and Analysis

7.1.b.1 Document the manifest of designated Progress vehicle in the international coordination protocol and the IDRD.

7.1.b.2 Provide for the integration (modeling) of the U.S. cargo prior launch to the ISS.

7.1.b.3 Certify the integrated U.S. cargo for launch on the Progress, Soyuz vehicle for safe flight.

7.1.b.4 The Preliminary ICD for each flight (Soyuz and Progress) will be provided to NASA for joint signature at L-1 month. The Final ICD (Soyuz and Progress) for each flight will be provided to NASA for joint signature at L+2 weeks.

7.1.b.5 Provide to NASA prior to Soyuz and Progress launch detailed photos showing how NASA cargo is packed within the vehicle as well as closeout photos (if technically feasible) of the packing layers shall be provided. Photos of individual items within NASA pre-packs are excluded from photography requirements.

7.1.c Personnel Transportation and Lodging

7.1.c.1 Continue to provide transportation from Moscow to Baikonur for 3 cargo integration personnel assigned to support cargo loading, and one additional NASA personnel two times per year to support cargo loading as operationally required, and 3 cargo personnel for launch of Progress flights.

7.1.c.2 For personnel as identified in 7.1.c.1, provide meals, lodging in Baikonur at Energia Hotel 1 or Hotel 3 and access to appropriate facilities for cargo integration personnel assigned to support cargo loading and for launch of Progress flights, for the duration of their stay.

7.1.c.3 Provide visa support, including issuing letters of invitation, for NASA cargo integration personnel for access to the Russian Federation.

7.1.d Cargo Services in Baikonur

7.1.d.1 Provide for secure, controlled environment storage in Baikonur for U.S. cargo delivered to Baikonur for launch, in accordance with existing practice. Secure environment shall be defined as a locked area that requires keyed (or equivalent) entry and documentation of personnel entering. Controlled environment shall be defined as a standard Baikonur atmospheric pressure and temperature control between 15 to 27 degrees Celsius.

7.1.d.2 Transportation, packing, and handling of NASA cargo in Moscow and Baikonur, and at Baikonur shall be implemented in accordance with mutually agreed procedures.

7.1.e Late access to Soyuz and Progress vehicle

7.1.e.1 Provide late access/stowage for NASA cargo at L-1 to 2 days with the ability for late stowage of 2 half CTBs up to 10 kg each .

7.1.e.2 Provide transportation for NASA late access cargo from Moscow to Baikonur to include customs clearance, subject to NASA provided documentation.

7.1.e.3 Cargo not launched shall be stored in the NASA office at Baikonur if possible. If storage there is not possible, or if NASA desires the return of the cargo to the U.S., the parties will jointly arrange for the packing and return to the U.S. at NASA's expense.

7.1.f Hard mounting

7.1.f.1 For cargo items to be transported on Progress vehicles that require integration hardware, or that require special transportation frames, Roscosmos shall develop and provide the special mounting, fastening and packing systems if this has no impact on the design and schedule of the vehicle. For this reason, NASA and Roscosmos will coordinate and concur the related interface and accommodation requirements for the cargo at L-3 month's period.

7.1.f.2 For cargo items to be transported on Soyuz vehicles that require integration hardware, or that require special transportation frames, Roscosmos shall develop and provide the special mounting, fastening and packing systems if this has no impact on the design and schedule of the vehicle. For this reason, NASA and Roscosmos will coordinate and concur the related interface and accommodation requirements for the cargo at L-3 month's period.

Paragraph 9 of the statement of work is revised to reflect CY 2009 through CY 20011 requirements:

9.0 Disposal of U.S. trash on Russian vehicles -

9.0.1 NASA is planning to dispose of trash on Russian vehicles using the following procedures in the following amounts:

CY09	CY10	CY11	Total
1400 kg	2800 kg	1400 kg	5600 kg (+/- 10 kg)

9.0.2 It is assumed that there will be 350 kg of NASA trash disposed per each of 4 Progress flights in CY09; 560 kg per each of 5 Progress flights in CY10; and 350 kg per each of 4 Progress flights in CY11. If the planned number of Progress vehicles differs from these assumptions, the amount of NASA trash assumed shall be calculated by dividing the trash disposed in a given year by the number of Progress vehicles planned to be flown in that year. When planning trash disposal in 2011, it is understood that all services shall be delivered and invoiced prior to the end of CY2011.

9.0.3. At Progress undock minus 2 months, NASA shall identify to Roscosmos the amount of cargo to be disposed on the upcoming Progress departure. This amount shall be in a range from +/- 150 kg of the amount identified in 9.0.2, with the total amount per year consistent with 9.0.1. The amount identified at L-2 months shall be the amount credited against the annual trash disposal. Roscosmos shall be entitled to keep and/or receive payment, according to J-4, unless Roscosmos fails to perform disposal of US trash.

9.0.4 If the cargo adjustments in 9.0.3 results in less than the annual amount of trash disposal identified in 9.0.1, it is agreed that NASA shall have the ability to rollover up to 200 kg from one year into the next, but never more than 200 kg in total. This amount shall be in addition to the amount of trash disposal in 9.0.1 for the upcoming calendar year(s).

9.0.5 Trash disposal may be provided on Soyuz vehicles if space is available and mutually agreed in advance, and shall be credited toward the total procured by NASA in a given year.

9.0.6. Should a Progress vehicle slip from one calendar year into the next, NASA shall not determine that Roscosmos is in breach of its contractual obligations, so long as the procured amount of cumulative trash disposal is made available to NASA as stated in 9.0.1.

The statement of work is modified to add paragraph 12 and 13 of the statement of work:

12.0 A long duration increment flight opportunity

12.1 Provide the right to implement a long duration increment flight for a US or US designated crewmember, within the rights owned by Roscosmos. This increment opportunity shall begin with the return to earth of the Expedition 18 crewmembers by Soyuz and ends with the return of the first Soyuz in the fall of 2009.

12.2 During the period of time between launches of Soyuz 1 and Soyuz 2 in 2009, currently planned for not more than 1 month, when there are only 3 crewmembers onboard ISS (2 US and 1 Russian), the crew will operate in accordance with the GGR&C and NASA shall have the right to crewtime per agreements as documented in the GGR&C. If the time between Soyuz 1 and Soyuz 2 is greater than 1 month, this is considered off nominal and the Parties will meet and discuss. After expansion of the permanent ISS crew to 6, NASA shall have the right to total crew time of the NASA crewmember flying on the acquired long duration flight.

12.3 Delivery to and return from the ISS, for the US or US designated crewmember for this increment opportunity will be arranged by NASA separately. The actual duration of this increment, within the bounds of the timeframe detailed in 12.1, shall be the responsibility of NASA. Should the actual duration of this increment be shorter than the timeframe specified in 12.1, it shall not be considered as a failure of Roscosmos to perform its obligations under this contract.

12.4 Habitation for the US designated crewmember is arranged in a separate protocol. All other resources will be provided by NASA. Crew rescue services will be acquired by NASA.

13.0 Docking Cargo Module (DCM) capabilities for accommodation of NASA cargo

The DCM is a module docked to the FGB Nadir port that provides additional docking capability for Progress and Soyuz vehicles needed for implementation of cargo and crew member launch, return and rescue services.

13.1 DCM shall be designed to provide to NASA the capability to deliver to the ISS the outfitting equipment for the Multipurpose Laboratory Module (MLM) in order that NASA may fulfill its obligations under the 2nd Addendum to the Balance of Contributions. This hardware currently includes:

- 13.1.1 MLM Airlock
- 13.1.2 MLM Radiator
- 13.1.3 European Robotic Arm components
- 13.1.4 Portable Workstation

The integrated element (DCM, MLM outfitting hardware, and NASA cargo) shall not exceed a length of 6.6 meters, nor a mass of 7900 kg. All other specifications shall be agreed in separate documents.

13.2 Roscosmos shall provide to NASA the capability to accommodate delivery to ISS of up to 1.4 metric tons of U.S. dry cargo in the pressurized volume. NASA is responsible for providing the physical and analytical integration of the DCM (which shall include MLM hardware and NASA cargo) into the Shuttle, with support from Roscosmos, as specified in jointly agreed protocol. Roscosmos is responsible for analytical and physical integration of the U.S. dry cargo and MLM hardware into the DCM, with NASA support as specified in jointly agreed protocol. Turn over of the integrated module to NASA at KSC for flight on ULF-4 is the responsibility of Roscosmos, the specific roles and responsibilities, as well as schedule of these activities, will be described in a separate protocol.

13.3 DCM stowage configurations shall accommodate US items in US food containers and Cargo Transfer Bags (CTB) sized as follows:

13.3.1 Half CTB
13.3.2 Single CTB
13.3.3 Double CTB
13.3.4 Triple CTB
13.3.5 M-02 Bag

It is assumed that cargo should have an average volume density of 250 kg per cubic meter or greater.

Section J-4 MILESTONE BILLING

NAS15 - 10110

Line Items/Milestone #	Description	Completion Date	Amount ($M)	Total value for Line Items
00024a	**Delivery of NASA cargo by Progress #1 (CY09-P1)**			11.883
00024a1	Cargo space allocation for CY09 Progress: CY09-P1	Apr-07	3.960	
00024a2	Review the status of work per SOW 1.3 to determine compliance with preparation of services on CY09 Progress: CY09-P1	Dec-07	4.962	
00024a3	Delivery of NASA cargo to ISS on CY09 Progress: CY09-P1	Mar-09	2.961	
00024b	**Delivery of NASA cargo by Progress #2 (CY09-P2)**			11.883
00024b1	Cargo space allocation for CY09 Progress: CY09-P2	Dec-07	3.961	
00024b2	Review the status of work per SOW 1.3 to determine compliance with preparation of services on CY09 Progress: CY09-P2	Dec-07	4.961	
00024b3	Delivery of NASA cargo to ISS on CY09 Progress: CY09-P2	Jun-09	2.961	
00024c	**Delivery of NASA cargo by Progress #3 (CY09-P3)**			11.883
00024c2	Cargo space allocation for CY09 Progress: CY09-P3	Dec-07	3.961	
00024c3	Review the status of work per SOW 1.3 to determine compliance with preparation of services on CY09 Progress: CY09-P3	Sep-08	2.961	
00024c1	Delivery of NASA cargo to ISS on CY09 Progress: CY09-P3	Sep-09	4.961	
00024d	**Delivery of NASA cargo by Progress #4 (CY09-P4)**			11.888
00024d1	Cargo space allocation for CY09 Progress: CY09-P4	Dec-07	3.961	
00024d2	Review the status of work per SOW 1.3 to determine compliance with preparation of services on CY09 Progress: CY09-P4	Sep-08	2.966	
00024d3	Delivery of NASA cargo to ISS on CY09 Progress: CY09-P4	Dec-09	4.961	
00024e	**Delivery of NASA cargo by Progress #5 (CY10-P1)**			20.343
00024e1	Cargo space allocation for CY09 Progress: CY10-P1	Dec-07	6.781	
00024e2	Review the status of work per SOW 1.3 to determine compliance with preparation of services on CY09 Progress: CY10-P1	Dec-08	7.781	
00024e3	Delivery of NASA cargo to ISS on CY09 Progress: CY10-P1	Mar-10	5.781	
00024f	**Delivery of NASA cargo by Progress #6 (CY10-P2)**			20.343
00024f1	Cargo space allocation for CY10 Progress; CY10-P2	Dec-07	6.781	
00024f2	Review the status of work per SOW 1.3 to determine compliance with preparation of services on CY10 Progress: CY10-P2	Jun-09	6.781	
00024f3	Delivery of NASA cargo to ISS on CY10 Progress: CY10-P2	Jun-10	6.781	
00024g	**Delivery of NASA cargo by Progress #7 (CY10-P3)**			20.343
00024g1	Cargo space allocation for CY10 Progress: CY10-P3	Sep-08	5.050	
00024g2	Review the status of work per SOW 1.3 to determine compliance with preparation of services on CY10 Progress : CY10-P3	Sep-09	8.512	
00024g3	Delivery of NASA cargo to ISS on CY10 Progress: CY10-P3	Sep-10	6.781	
00024h	**Delivery of NASA cargo by Progress #8 (CY10-P4)**			20.343
00024h1	Cargo space allocation for CY10 Progress: CY10-P4	Sep-08	5.050	
00024h2	Review the status of work per SOW 1.3 to determine compliance with preparation of services on CY10 Progress : CY10-P4	Sep-09	8.512	
00024h3	Delivery of NASA cargo to ISS on CY10 Progress: CY10-P4	Sep-10	6.781	
00024i	**Delivery of NASA cargo by Progress #9 (CY10-P5)**			20.343
00024i1	Cargo space allocation for CY10 Progress: CY10-P5	Dec-08	6.781	
00024i2	Review the status of work per SOW 1.3 to determine compliance with preparation of services on CY10 Progress : CY10-P5	Dec-09	8.261	
00024i3	Delivery of NASA cargo to ISS on CY10 Progress: CY10-P5	Dec-10	5.301	

* $ in Millions

Section J-4 MILESTONE BILLING

NAS15 - 10110

Line Items/Milestone #	Description	Completion Date	Amount ($M)	Total value for Line Items
00024j	**Delivery of NASA cargo by Progress #10 (CY11-P1)**			13.605
00024j1	Cargo space allocation for CY10 Progress: CY11-P1	Dec-08	4.535	
00024j2	Review the status of work per SOW 1.3 to determine compliance with preparation of services on CY10 Progress: CY11-P1	Dec-09	5.535	
00024j3	Delivery of NASA cargo to ISS on CY10 Progress: CY11-P1	Mar-11	3.535	
00024k	**Delivery of NASA cargo by Progress #11 (CY11-P2)**			13.605
00024k1	Cargo space allocation for CY11 Progress: CY11-P2	Jun-09	4.535	
00024k2	Review the status of work per SOW 1.3 to determine compliance with preparation of services on CY11 Progress : CY11-P2	Jun-10	5.535	
00024k3	Delivery of NASA cargo to ISS on CY11 Progress: CY11-P2	Jun-11	3.535	
00024l	**Delivery of NASA cargo by Progress #12 (CY11-P3)**			13.605
00024l1	Cargo space allocation for CY11 Progress: CY11-P3	Sep-09	5.535	
00024l2	Review the status of work per SOW 1.3 to determine compliance with preparation of services on CY11 Progress: CY11-P3	Sep-10	4.722	
00024l3	Delivery of NASA cargo to ISS on CY11 Progress: CY11-P3	Sep-11	3.348	
00024m	**Delivery of NASA cargo by Progress #13 (CY11-P4)**			13.605
00024m1	Cargo space allocation for CY11 Progress: CY11-P4	Dec-09	4.535	
00024m2	Review the status of work per SOW 1.3 to determine compliance with preparation of services on CY11 Progress: CY11-P4	Sep-10	6.535	
00024m3	Delivery of NASA cargo to ISS on CY11 Progress: CY11-P4	Dec-11	2.535	
00025a1	Disposal of NASA cargo on Progress #1 (CY09-P1)	Jun-09	1.320	1.320
00025a2	Disposal of NASA cargo on Progress #2 (CY09-P2)	Sep-09	1.320	1.320
00025a3	Disposal of NASA cargo on Progress #3 (CY09-P3)	Dec-09	1.320	1.320
00025a4	Disposal of NASA cargo on Progress #4 (CY09-P4)	Mar-10	1.320	1.320
00025a5	Disposal of NASA cargo on Progress #5 (CY10-P1)	Jun-10	2.260	2.260
00025a6	Disposal of NASA cargo on Progress #6 (CY10-P2)	Sep-10	2.260	2.260
00025a7	Disposal of NASA cargo on Progress #7 (CY10-P3)	Dec-10	2.260	2.260
00025a8	Disposal of NASA cargo on Progress #8 (CY10-P4)	Dec-10	2.260	2.260
00025a9	Disposal of NASA cargo on Progress #9 (CY10-P5)	Mar-11	2.260	2.260
00025a10	Disposal of NASA cargo on Progress #10 (CY11-P1)	Jun-11	1.512	1.512
00025a11	Disposal of NASA cargo on Progress #11 (CY11-P2)	Sep-11	1.512	1.512
00025a12	Disposal of NASA cargo on Progress #12 (CY11-P3)	Dec-11	1.512	1.512
00025a13	Disposal of NASA cargo on Progress #13 (CY11-P4)	Dec-11	1.512	1.512

* $ in Millions

Section J-4 MILESTONE BILLING

NAS15 - 10110

Line Items/Milestone #	Description	Completion Date	Amount ($M)	Total value for Line Items
00026a	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #1 Services)**			25.162
00026a1	Reservation of 1 CY09 Soyuz seat for US designated crew member: CY09-S1	Apr-07	6.315	
00026a2	Review status of work per SOW 1.3 to determine compliance with preparation of services on CY09 Soyuz flight: CY09-S1	Dec-08	8.522	
00026a3	Delivery to ISS of 1 US designated crew member on CY09 Soyuz: CY09-S1	Jun-09	6.792	
00026a4	Return/rescue of 1 US designated crew member from CY09 launched Soyuz: CY09-S1	Dec-09	3.533	
00026b	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #2 Services)**			25.167
00026b1	Reservation of 1 CY09 Soyuz seat for US designated crew member: CY09-S2	Mar-07	6.320	
00026b2	Review status of work per SOW 1.3 to determine compliance with preparation of services on CY09 Soyuz flight: CY09-S2	Dec-08	8.522	
00026b3	Delivery to ISS of 1 US designated crew member on CY09 Soyuz: CY09-S2	Jun-09	6.792	
00026b4	Return/rescue of 1 US designated crew member from CY09 launched Soyuz: CY09-S2	Dec-09	3.533	
00026c	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #3 Services)**			25.167
00026c1	Reservation of 1 CY09 Soyuz seat for US designated crew member: CY09-S3	Dec-07	7.550	
00026c2	Review status of work per SOW 1.3 to determine compliance with preparation of services on CY09 Soyuz flight: CY09-S3	Dec-07	6.287	
00026c3	Delivery to ISS of 1 US designated crew member on CY09 Soyuz: CY09-S3	Jun-09	7.797	
00026c4	Return/rescue of 1 US designated crew member from CY09 launched Soyuz: CY09-S3	Dec-09	3.533	
00026d	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #4 Services)**			25.167
00026d1	Reservation of 1 CY09 Soyuz seat for US designated crew member: CY09-S4	Dec-07	8.550	
00026d2	Review status of work per SOW 1.3 to determine compliance with preparation of services on CY09 Soyuz flight: CY09-S4	Dec-08	6.292	
00026d3	Delivery to ISS of 1 US designated crew member on CY09 Soyuz: CY09-S4	Dec-09	5.292	
00026d4	Return/rescue of 1 US designated crew member from CY09 launched Soyuz: CY09-S4	Jun-10	5.033	
00026e	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #5 Services)**			25.167
00026e1	Reservation of 1 CY09 Soyuz seat for US designated crew member: CY09-S5	Dec-07	8.550	
00026e2	Review status of work per SOW 1.3 to determine compliance with preparation of services on CY09 Soyuz flight: CY09-S5	Dec-08	6.292	
00026e3	Delivery to ISS of 1 US designated crew member on CY09 Soyuz: CY09-S5	Dec-09	5.292	
00026e4	Return/rescue of 1 US designated crew member from CY09 launched Soyuz: CY09-S5	Jun-10	5.033	
00026f	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #6 Services)**			25.167
00026f1	Reservation of 1 CY09 Soyuz seat for US designated crew member: CY09-S6	Dec-07	8.550	
00026f2	Review status of work per SOW 1.3 to determine compliance with preparation of services on CY09 Soyuz flight: CY09-S6	Dec-08	6.292	
00026f3	Delivery to ISS of 1 US designated crew member on CY09 Soyuz: CY09-S6	Dec-09	5.292	
00026f4	Return/rescue of 1 US designated crew member from CY09 launched Soyuz: CY09-S6	Jun-10	5.033	
00026g	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #7 Services)**			26.425
00026g1	Reservation of 1 CY10 Soyuz seats for US designated crew member: CY10-S1	Dec-07	7.928	
00026g2	Review status of work per SOW 1.3 to determine compliance with preparation of services on CY10 Soyuz flight: CY10-S1	Jun-09	7.606	
00026g3	Delivery to ISS of 1 US designated crew member on CY10 Soyuz: CY10-S1	Jun-10	5.606	
00026g4	Return/rescue of 1 US designated crew member from CY10 launched Soyuz: CY10-S1	Dec-10	5.285	

* $ in Millions

Section J-4 MILESTONE BILLING

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Line Items/Milestone #	Description	Completion Date	Amount ($M)	Total value for Line Items
00026h	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #8 Services)**			26.425
00026h1	Reservation of 1 CY10 Soyuz seats for US designated crew member: CY10-S2	Dec-07	7.928	
00026h2	Review status of work per SOW 1.3 to determine compliance with preparation of services on CY10 Soyuz flight: CY10-S2	Jun-09	7.606	
00026h3	Delivery to ISS of 1 US designated crew member on CY10 Soyuz: CY10-S2	Jun-10	5.606	
00026h4	Return/rescue of 1 US designated crew member from CY10 launched Soyuz: CY10-S2	Sep-10	5.285	

* $ in Millions

Section J-4 MILESTONE BILLING
NAS15 - 10110

Line Items/Milestone #	Description	Completion Date	Amount ($M)	Total value for Line Items
00026i	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #9 Services)**			26.425
00026i1	Reservation of 1 CY10 Soyuz seats for US designated crew member: CY10-S3	Dec-07	7.928	
00026i2	Review status of work per SOW 1.3 to determine compliance with preparation of services on CY10 Soyuz flight: CY10-S3	Jun-09	7.606	
00026i3	Delivery to ISS of 1 US designated crew member on CY10 Soyuz: CY10-S3	Jun-10	5.606	
00026i4	Return/rescue of 1 US designated crew member from CY10 launched Soyuz: CY10-S3	Sep-10	5.285	
00026j	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #10 Services)**			26.425
00026j1	Reservation of 1 CY10 Soyuz seat for US designated crew member: CY10-S4	Dec-08	8.928	
00026j2	Review status of work per SOW 1.3 to determine compliance with preparation of services on CY10 Soyuz flight: CY10-S4	Sep-09	5.606	
00026j3	Delivery to ISS of 1 US designated crew member on CY10 Soyuz: CY10-S4	Dec-10	7.795	
00026j4	Return/rescue of 1 US designated crew member from CY10 launched Soyuz: CY10-S4	Jun-11	4.096	
00026k	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #11 Services)**			26.425
00026k1	Reservation of 1 CY10 Soyuz seat for US designated crew member: CY10-S5	Dec-08	8.928	
00026k2	Review status of work per SOW 1.3 to determine compliance with preparation of services on CY10 Soyuz flight: CY10-S5	Sep-09	5.606	
00026k3	Delivery to ISS of 1 US designated crew member on CY10 Soyuz: CY10-S5	Dec-10	7.795	
00026k4	Return/rescue of 1 US designated crew member from CY10 launched Soyuz: CY10-S5	Jun-11	4.096	
00026l	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #12 Services)**			26.425
00026l1	Reservation of 1 CY10 Soyuz seat for US designated crew member: CY10-S6	Dec-08	8.928	
00026l2	Review status of work per SOW 1.3 to determine compliance with preparation of services on CY10 Soyuz flight: CY10-S6	Sep-09	5.606	
00026l3	Delivery to ISS of 1 US designated crew member on CY10 Soyuz: CY10-S6	Dec-10	7.794	
00026l4	Return/rescue of 1 US designated crew member from CY10 launched Soyuz: CY10-S6	Jun-11	4.097	
00026m	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #13 Services)**			27.717
00026m1	Reservation of 1 CY11 Soyuz seats for US designated crew member: CY11-S1	Jun-09	8.316	
00026m2	Review status of work per SOW 1.3 to determine compliance with preparation of services on CY11 Soyuz flight: CY11-S1	Jun-10	6.929	
00026m3	Delivery to ISS of 1 US designated crew member on CY11 Soyuz: CY11-S1	Jun-11	6.929	
00026m4	Return/rescue of 1 US designated crew member from CY11 launched Soyuz: CY11-S1	Sep-11	5.543	
00026n	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #14 Services)**			27.718
00026n1	Reservation of 1 CY11 Soyuz seats for US designated crew member: CY11-S2	Jun-09	8.316	
00026n2	Review status of work per SOW 1.3 to determine compliance with preparation of services on CY11 Soyuz flight: CY11-S2	Jun-10	6.929	
00026n3	Delivery to ISS of 1 US designated crew member on CY11 Soyuz: CY11-S2	Jun-11	5.672	
00026n4	Return/rescue of 1 US designated crew member from CY11 launched Soyuz: CY11-S2	Dec-11	6.801	
00026o	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #15 Services)**			27.718
00026o1	Reservation of 1 CY11 Soyuz seats for US designated crew member: CY11-S3	Jun-09	8.316	
00026o2	Review status of work per SOW 1.3 to determine compliance with preparation of services on CY11 Soyuz flight: CY11-S3	Jun-10	6.929	
00026o3	Delivery to ISS of 1 US designated crew member on CY11 Soyuz: CY11-S3	Jun-11	5.673	
00026o4	Return/rescue of 1 US designated crew member from CY11 launched Soyuz: CY11-S3	Dec-11	6.800	

* $ in Millions

Section J-4 MILESTONE BILLING

NAS15 - 10110

Line Items/Milestone #	Description	Completion Date	Amount ($M)	Total value for Line Items
00027	**Docking Cargo Module (DCM) accomodation capability for delivery of NASA upmass to ISS**			50.000
00027a1	Definition of the requirements and interfaces for accomodation capabilities of US cargo in Docking Cargo module (DCM)	Dec-07	16.356	
00027a2	Review of status of work per SOW 1.3 to determine compliance with the preparation of services on DCM	Dec-08	18.187	
00027a3	Provide DCM interfaces for accomodation of US cargo: CY09-DCM	Dec-09	15.457	
00028	**Increment Flight Opportunity (CY09-INC)**			50.000
00028a1	Russian approval of Crew Assignment Resolution showing U.S. designated astronaut in Russian Increment Opportunity in CY09: CY09-INC	Mar-08	10.000	
00028a2	Beginning Russian increment opportunity in CY09 as defined in p.12.1 of SOW: CY09-INC	Sep-09	30.554	
00028a3	Ending Russian increment opportunity as defined in p.12.1 of SOW: CY09-INC	Dec-09	9.446	

* $ in Millions

OMB Approval No. 2700-0042

AMENDMENT OF SOLICITATION/ MODIFICATION OF CONTRACT	1. CONTRACT ID CODE	PAGE OF PAGES 1 | 6

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO	5. PROJECT NO. *(If applicable)*
196		4200292126	

6. ISSUED BY CODE

NASA/ Johnson Space Center
Space Station Procurement Office
Attn: BG/K. Jennings
Houston, TX 77058

7. ADMINISTERED BY *(If other than Item 6)* CODE

APPROVED
JSC PROCUREMENT OFFICER
5/28/09
DATE

8. NAME AND ADDRESS OF CONTRACTOR *(No., street, county, State, and ZIP Code)*

Federal Space Agency (Roscosmos)
42 Schepkina Street
Attn: Alexey Krasnov
Moscow, 129857
Russia

CODE | FACILITY CODE

(x)	9A. AMENDMENT OF SOLICITATION NO.	9B. DATED *(SEE ITEM 11)*
X	10A. MODIFICATION OF CONTRACT/ORDER NO. NAS15-10110	10B. DATED *(SEE ITEM 13)* December 16, 1993

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended. Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing items 8 and 15, and ☐ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted, or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)*
Funding Increase: $38,300,000

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.(x)

	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
X	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: FAR 6.302-1 and Agreement of the Parties
	d. OTHER *(Specify type of modification and authority)*

E. IMPORTANT: Contractor ☐ is not, [X] is required to sign this document and return 3 copies to the issuing office.

14. description of amendment/modification *(Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

A. The purpose of this modification is to: 1) to extend the period of performance through December 31, 2013; 2) modify the Statement Of Work (SOW) to procure additional services for Launch, Return, and Rescue of U.S. or U.S.-designated astronauts with associated Launch/Return services; 3) increase the contract value by $306,000,000 from $1,648,125,257.17 to $1,954,125,257.17; and 4) increase the contract funding by $38,300,000 from $1,100,279,176 to $1,138,579,176.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER *(Type or print)*		16A. NAME AND TITLE OF CONTRACTING OFFICER *(Type or print)*	
Alexey Krasnov		Marianne D. Ruiz, Contracting Officer	
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
(Signature of person authorized to sign)	05/24/09	BY (Signature of Contracting Officer)	5/28/09

NSN 7540-01-152-8070
PREVIOUS EDITION UNUSABLE

30-105
JSC MS Word (Aug 95)

STANDARD FORM 30 (Rev. 10-83)
Prescribed by GSA
FAR (48 CFR) 53.243

Block 14 Description of Amendment/Modification (continued):

B. All terms and conditions in the basic contract and previous modifications remain valid unless otherwise changed in this modification.

C. The basic period of performance is extended for 1 year through December 31, 2013, for the continuation of the current contract requirements and purchase of additional services for Launch, Return, and Rescue of U.S. or U.S. designated astronauts with associated Launch/Return services. Requirements are identified in sections 14 through 16 in the Statement of Work (SOW). Section 14.01 is revised to provide for 6 seats in CY2012 and CY2013. Clause F.14a included in this modification only applies to requirements under milestones 00032 through 00037.

D. The changes herein outlined below only apply to this modification:

1. Clause B.1 SUPPLIES AND/OR SERVICES TO BE FURNISHED this provision is revised to include additional services
2. Clause B.2 CONSIDERATION AND PAYMENT is revised to extend the completion date to December 31, 2013.
3. Clause F.1 PERIOD OF PERFORMANCE AND COMPLETION OF WORK is revised to update the completion date.
4. Clause F.14a EXCHANGE RATE ADJUSTMENT this provision is included to cover milestones 00032 through 00037 and includes the exchange rates, as of the date Mod 196 is signed.
5. Clause G.8 OBLIGATION OF FUNDS this provision is modified to show the amount of funds allotted to the contract.
6. Clause H.10 LIMITATION OF FUNDS (FIXED PRICE CONTRACT) this provision is modified to show the funding and estimated date the funding covers
7. Section J-1 this attachment is revised to include CY2012 and CY2013 requirements increasing the number of complete Soyuz seats by 6.
8. Section J-4 MILESTONES with milestone prices and respective milestone dates

The parties agree to make the following changes to NAS15-10110. These changes shall only apply to the services placed under this modification.

1.0 Clause B.1 is revised to include the following:
00032 Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #1 associated services per SOW 14-16) $51,000,000
00033 Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #2 associated services per SOW 14-16) $51,000,000
00034 Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #3 associated services per SOW 14-16) $51,000,000
00035 Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #4 associated services per SOW 14-16) $51,000,000

00036 Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat
(Seat #5 associated services per SOW 14-16) <u>$51,000,000</u>
00037 Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat
(Seat #6 associated services per SOW 14-16) <u>$51,000,000</u>

2.0 Clause B.2 is revised to as follows:
Payment will be made in U.S. currency at the prices set forth in Clause B.1 and F.14a provided that RSA submits proper invoices in accordance with the Invoices clause contained in Section G of this contract. Roscosmos shall complete all requirements and submit all invoices in time to be paid on or before December 31, 2013.

3.0 Clause F.1 is revised as follows:
All work required under this contract to provide supplies and services, including data deliverables, shall be completed by December 31, 2013.

4.0 F. 14a EXCHANGE RATE ADJUSTMENT (ERA)

The parties agree that the ERA shall be applied to milestone line items 00032 through 00037 under this modification. Invoices shall be submitted in US dollars. The parties agree to utilize the currency conversion exchange rate values published by the Central Bank of Russia available at the following website:

http://www.cbr.ru/eng/currency_base/daily.asp

Payment will be made within 7 working days after the invoice is accepted for payment. The invoice submitted by the Contractor must be a proper invoice in accordance with clause G.5. Validation of a proper invoice is in accordance with clause G.1.

The parties agree to reassess the price for payment for services for seats as listed in Clause B.1 in the event the dollar falls below a value of 24.59 or rises above a value of 40.99rubles at the time the invoice is to be made.

(End of clause)

5.0 Clause G.8 is revised as follows:
The total amount of funds allotted to this contract is $1,138,579,176. Each time additional funds are allotted the Contracting Officer shall amend this clause accordingly.

6.0 Clause H.10 is revised as follows:
The reference to NFS clauses is for NASA purposes as explained in Section I.1. This clause is based on the clause at NFS 18-52.232.77.

(a) Of the total price of $1,954,125,257.17 for items 0001 through 00037, the sum of $1,138,579,176 is presently available for payment and allotted to this contract. It is anticipated that from time to time additional funds will be allocated to the contract until funds consistent with the total contract price are allotted.

(b) RSA agrees to perform or have performed work on the items specified in paragraph (a) above up to the point at which, if this contract is terminated pursuant to the Termination by the U.S. Government clause of this contract, the total amount payable by NASA (including amounts payable for subcontracts and settlement costs) pursuant to paragraphs (i) and (j) of that clause would, in the exercise of reasonable judgment by RSA, approximate the total amount at the time allotted to the contract. RSA is not obligated to continue performance of the work beyond that point. NASA is not obligated in any event to pay or reimburse RSA more than the amount from time to time allotted to the contract, anything to the contrary in the Termination by the U.S. Government (Fixed-Price) clause (Section I.8) notwithstanding.

(c) (1) It is contemplated that funds presently allotted to this contact will cover the work to be performed until **Dec 2009.**

(2) If funds allotted are considered by RSA to be inadequate to cover the work to be performed until that date, or an agreed to date substituted for it, RSA shall notify the Contracting Officer in writing when within the next 60 days the work will reach a point at which, if the contract is terminated pursuant to the Termination by the U.S. Government clause of this contract, the total amount payable by NASA (including amounts payable for subcontracts and settlement costs) pursuant to paragraphs (i) and (j) of that clause will approximate 75 percent of the total amount then allotted to the contract.

7.0 The following amendment is made to paragraph 14.0 of the Statement of Work (attachment J-1)

14.0.1.a NASA is acquiring crew rotations on Soyuz vehicles for the services and capabilities of one complete Soyuz seat, including but not limited to launch, rescue, cargo services, and return, as described in the SOW.

NASA is acquiring crew rotations on Soyuz vehicles in the following amounts:

	CY12	CY13	Total
Delivery to ISS	6		6
Return from ISS	3	3	6

The above rotations will be provided by the following number of vehicles:

	CY12	CY13	Total
Soyuz vehicle launches	4		4
Soyuz vehicle landings	2	2	4

8.0 Below are the new J-4 milestones:

Line Items/ Milestone #	Description	Completion Date	Amount ($M)	Total Value for Line Items
00032	**Launch, return and rescue of US designated crew for 1 Soyuz seat (Seat #1 associated services per SOW 14-16) ($51 000 000)**			$51 000 000
00032a	Reservation of 1 CY12 Soyuz seat for US designated crew member: CY12-S1	May-09	17 850 000	
00032b	Review status of work per SOW 14.0 to determine compliance with preparation of services on CY12 Soyuz flight: CY12-S1	May-10	12 750 000	
00032c	Review status of work per SOW 14.0, and completion of 50% of crew training for U.S. designated crewmember: CY12-S1	May-11	12 750 000	
00032d	Delivery to ISS of 1 US designated crewmember on CY12 Soyuz flight: CY12-S1	May-12	2 550 000	
00032e	Return/Rescue of 1 US designated crewmember from CY12 launched Soyuz: CY12-S1	Dec-12	5 100 000	
00033	**Launch, return and rescue of US designated crew for 1 Soyuz seat (Seat #2 associated services per SOW 14-16) ($51 000 000)**			$51 000 000
00033a	Reservation of 1 CY12 Soyuz seat for US designated crew member: CY12-S2	May-09	17 850 000	
00033b	Review status of work per SOW 14.0 to determine compliance with preparation of services on CY12 Soyuz flight: CY12-S2	May-10	12 750 000	
00033c	Review status of work per SOW 14.0, and completion of 50% of crew training for U.S. designated crewmember: CY12-S2	May-11	12 750 000	
00033d	Delivery to ISS of 1 US designated crewmember on CY12 Soyuz flight: CY12-S2	May-12	2 550 000	
00033e	Return/Rescue of 1 US designated crewmember from CY12 launched Soyuz: CY12-S2	Dec-12	5 100 000	
00034	**Launch, return and rescue of US designated crew for 1 Soyuz seat (Seat #3 associated services per SOW 14-16) ($51 000 000)**			$51 000 000
00034a	Reservation of 1 CY12 Soyuz seat for US designated crew member: CY12-S3	May-09	17 850 000	
00034b	Review status of work per SOW 14.0 to determine compliance with preparation of services on CY12 Soyuz flight: CY12-S3	May-10	12 750 000	
00034c	Review status of work per SOW 14.0, and completion of 50% of crew training for U.S. designated crewmember: CY12-S3	May-11	12 750 000	
00034d	Delivery to ISS of 1 US designated crewmember on CY12 Soyuz flight: CY12-S3	May-12	2 550 000	
00034e	Return/Rescue of 1 US designated crewmember from CY12 launched Soyuz: CY12-S3	Dec-12	5 100 000	
00035	**Launch, return and rescue of US designated crew for 1 Soyuz seat (Seat #4 associated services per SOW 14-16) ($51 000 000)**			$51 000 000
00035a	Reservation of 1 CY12 Soyuz seat for US designated crew member: CY12-S4	Nov-09	17 850 000	
00035b	Review status of work per SOW 14.0 to determine compliance with preparation of services on CY12 Soyuz flight: CY12-S4	Nov-10	12 750 000	
00035c	Review status of work per SOW 14.0, and completion of 50% of crew training for U.S. designated crewmember: CY12-S4	Nov-11	12 750 000	
00035d	Delivery to ISS of 1 US designated crewmember on CY12 Soyuz flight: CY12-S4	Nov-12	2 550 000	
00035e	Return/Rescue of 1 US designated crewmember from CY12 launched Soyuz: CY12-S4	Jun-13	5 100 000	
00036	**Launch, return and rescue of US designated crew for 1 Soyuz seat (Seat #5 associated services per SOW 14-16) ($51 000 000)**			$51 000 000
00036a	Reservation of 1 CY12 Soyuz seat for US designated crew member: CY12-S5	Nov-09	17 850 000	
00036b	Review status of work per SOW 14.0 to determine compliance with preparation of services on CY12 Soyuz flight: CY12-S5	Nov-10	12 750 000	
00036c	Review status of work per SOW 14.0, and completion of 50% of crew training for U.S. designated crewmember: CY12-S5	Nov-11	12 750 000	
00036d	Delivery to ISS of 1 US designated crewmember on CY12 Soyuz flight: CY12-S5	Nov-12	2 550 000	
00036e	Return/Rescue of 1 US designated crewmember from CY12 launched Soyuz: CY12-S5	Jun-13	5 100 000	
00037	**Launch, return and rescue of US designated crew for 1 Soyuz seat (Seat #6 associated services per SOW 14-16) ($51 000 000)**			$51 000 000
00037a	Reservation of 1 CY12 Soyuz seat for US designated crew member: CY12-S6	Nov-09	17 850 000	
00037b	Review status of work per SOW 14.0 to determine compliance with preparation of services on CY12 Soyuz flight: CY12-S6	Nov-10	12 750 000	
00037c	Review status of work per SOW 14.0, and completion of 50% of crew training for U.S. designated crewmember: CY12-S6	Nov-11	12 750 000	
00037d	Delivery to ISS of 1 US designated crewmember on CY12 Soyuz flight: CY12-S6	Nov-12	2 550 000	
00037e	Return/Rescue of 1 US designated crewmember from CY12 launched Soyuz: CY12-S6	Jun-13	5 100 000	

NAS15-10110

MODIFICATION 188

OMB Approval No. 2700-0042

AMENDMENT OF SOLICITATION/ MODIFICATION OF CONTRACT

1. CONTRACT ID CODE

APPROVED
JSC PROCUREMENT OFFICER
12/2/08
DATE

PAGE OF PAGES: 1 | 15

2. AMENDMENT/MODIFICATION NO. 188

3. EFFECTIVE DATE

4. REQUISITION/PURCHASE REQ. NO. 420...

5. PROJECT NO. (If applicable)

6. ISSUED BY — CODE

NASA/ Johnson Space Center
Space Station Procurement Office
Attn: BG/Y. Marquez
Houston, TX 77058

7. ADMINISTERED BY (If other than Item 6) — CODE

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State, and ZIP Code)

Federal Space Agency (Roscosmos)
42 Schepkina Street
Attn: Alexey Krasnov
Moscow, 129857
Russia

CODE | FACILITY CODE

(x)	9A. AMENDMENT OF SOLICITATION NO.	9B. DATED (SEE ITEM 11)
X	10A. MODIFICATION OF CONTRACT/ORDER NO. NAS15-10110	10B. DATED (SEE ITEM 13) December 16, 1993

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended. Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and ☐ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)
Net increase: $42,300,000

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.(x)

	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
X	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: FAR 52.243-1 "Changes-Fixed Price " and Agreement of the Parties
	d. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not, [X] is required to sign this document and return 3 copies to the issuing office.

14. description of amendment/modification (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

A. The purpose of this modification is to: 1) to extend the period of performance through December 31, 2012; 2) modify the SOW to procure additional services for Launch, Return, and Rescue of U.S. or U.S.-designated astronauts with associated Launch/Return services; 3) increase the contract value by $141,273,636.17 from $1,506,851,621 to $1,648,125,257.17; 4) increase the contract funding by $42,300,000 from $1,057,623,457 to $1,099,923,457. All terms and conditions in the basic contract and previous modifications remain valid unless otherwise changed in this modification.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print) Alexey Krasnov		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) Marianne D. Ruiz, Contracting Officer	
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED 12/2/08	16B. UNITED STATES OF AMERICA BY (Signature of Contracting Officer)	16C. DATE SIGNED 12/2/08

Block 14 Description of Amendment/Modification (continued):

B. The new terms and conditions herein only apply to requirements under modification 188.

C. The modification will include additional requirements for launch, return, and rescue of U.S. or U.S.-designated astronauts on Soyuz. Requirements are identified in the attached sections 14 through 16 in the Statement of Work (SOW).

D. The changes herein outlined below only apply to this modification:

1. Clause B.1 SUPPLIES AND/OR SERVICES TO BE FURNISHED this provision is revised to include additional services
2. Clause B.2 CONSIDERATION AND PAYMENT is revised to remove INKSNA language and revise the completion date to December 31, 2012.
3. Clause F.1 PERIOD OF PERFORMANCE AND COMPLETION OF WORK is revised to update the completion date.
4. Clause F.14 EXCHANGE RATE ADJUSTMENT this provision will account for exchange rate fluctuations
5. Clause G.8 OBLIGATION OF FUNDS this provision is modified to show the amount of funds alloted to the contract.
6. Clause H.10 LIMITATION OF FUNDS (FIXED PRICE CONTRACT) this provision is modified to show the funding and estimated date the funding covers
7. Clause H.27 RETENTION OF PAYMENT this provision will allow the Contractor to retain 50% of the related seat price in case of a crew delivery/return/rescue failure, which results in partial delivery of the services to be provided
8. Section J-1 this attachment adds paragraphs 14 through 16 which specifies the Statement of Work for the additional requirements for launch, return, and rescue of U.S. or U.S.-designated astronauts on the Soyuz
9. Section J-4 MILESTONES with milestone prices and respective milestone dates

The parties agree to make the following changes to NAS15-10110. These changes shall only apply to the services placed under this modification.

1.0 Clause B.1 is revised to include the following:
00029 Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #1 associated services per SOW 14-16) $47,091,212.06*
00030 Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #2 associated services per SOW 14-16) $47,091,212.06*
00031 Train, deliver, return and rescue US designated Astronaut for 1 Soyuz seat (Seat #3 associated services per SOW 14-16) $47,091,212.06*

* The price of the service for seats procured are subject to clause F.14 and the current approved contract value will be adjusted accordingly.

2.0 Clause B.2 is revised to as follows:
Payment will be made in U.S. currency at the prices set forth in Clause B.1 and F.14 provided that RSA submits proper invoices in accordance with the Invoices clause contained in Section G of this contract. Roscosmos shall complete all requirements and submit all invoices in time to be paid on or before December 31, 2012.

3.0 Clause F.1 is revised as follows:
All work required under this contract to provide supplies and services, including data deliverables, shall be completed by December 31, 2012.

4.0 F. 14 EXCHANGE RATE ADJUSTMENT (ERA)

The parties agree that the ERA shall be applied to milestone line items beginning with the first order placed under this modification. The ERA will account for exchange rate fluctuations between the US dollar and the Russian ruble above or below the constant value exchange rate from the time of modification 188 signing, within the limits set forth in this clause. Invoices shall be submitted in US dollars. The parties agree to utilize the currency conversion exchange rate values published by the Central Bank of Russia available at the following website:

http://www.cbr.ru/eng/currency_base/daily.asp

In the payment of each individual invoice, the exchange rate used shall be as quoted by the Central Bank of Russia and shall be calculated on the date the agreed upon validated invoice is accepted. Payment will be made within 7 working days after the invoice is accepted for payment. The invoice submitted by the Contractor must be a proper invoice in accordance with clause G.5. Validation of a proper invoice is in accordance with clause G.1.

The parties agree to use the exchange rate as of the date modification 188 was signed as a constant value in the adjustment formula which is **27.6060** rubles per dollar. The ERA shall not result in any payments being adjusted upward, due to a decline in the value of the dollar of more than 20% over the life of any order placed under this modification. This equates to a minimum allowable exchange rate value of **22.0848** rubles per dollar (27.6060 – 20%=22.0848). The parties agree to reassess the limitations regarding adjustments established by this clause in the event the dollar falls below a value of 22.0848 rubles at the time the invoice is paid.

Calculation of the ERA is expressed by the following formula:

$$ERA = \left[1 + \left(\frac{27.6060 - e_c}{27.6060}\right)\right] \times P$$

e_c = current exchange rate, expressed as rubles per dollar

P = negotiated milestone price, in dollars

Example:

If the ruble/dollar exchange rate is 23.8 rubles per $1USD, the ERA price would be calculated as follows for a $250,000.00 milestone:

$$ERA = \left[1 + \left(\frac{27.6060 - 23.8}{27.6060}\right)\right] \times \$250{,}000.00$$

$$ERA = \$284{,}467.14$$

(End of clause)

5.0 Clause G.8 is revised to as follows:
The total amount of funds allotted to this contract is $1,099,923,457. Each time additional funds are allotted the Contracting Officer shall amend this clause accordingly.

6.0 Clause H.10 is revised as follows:
The reference to NFS clauses is for NASA purposes as explained in Section I.1. This clause is based on the clause at NFS 18-52.232.77.

(a) Of the total price of $1,648,125,257.17 for items 0001 through 00031, the sum of $1,099,923,457 is presently available for payment and allotted to this contract. It is anticipated that from time to time additional funds will be allocated to the contract until funds consistent with the total contract price are allotted.

(b) RSA agrees to perform or have performed work on the items specified in paragraph (a) above up to the point at which, if this contract is terminated pursuant to the Termination by the U.S. Government clause of this contract, the total amount payable by NASA (including amounts payable for subcontracts and settlement costs) pursuant to paragraphs (i) and (j) of that clause would, in the exercise of reasonable judgment by RSA, approximate the total amount at the time allotted to the contract. RSA is not obligated to continue performance of the work beyond that point. NASA is not obligated in any event to pay or reimburse RSA more than the amount from time to time allotted to the contract, anything to the contrary in the Termination by the U.S. Government (Fixed-Price) clause (Section I.8) notwithstanding.

(c) (1) It is contemplated that funds presently allotted to this contact will cover the work to be performed until **June 2009.**

(2) If funds allotted are considered by RSA to be inadequate to cover the work to be performed until that date, or an agreed to date substituted for it, RSA shall notify the Contracting Officer in writing when within the next 60 days the work will reach a point at which, if the contract is terminated pursuant to the Termination by the U.S. Government clause of this contract, the total amount payable by NASA (including amounts payable for subcontracts and settlement costs) pursuant to paragraphs (i) and (j) of that clause will approximate 75 percent of the total amount then allotted to the contract.

7.0 H.27 RETENTION OF PAYMENT
The parties agree that the Contractor shall be entitled to retain 50% of the related seat price in case of a crew delivery/return/rescue failure, which results in partial delivery of the services to be provided hereunder. The parties agree that notwithstanding anything to the contrary in the contract, the Contractor shall retain the right of ownership to Soyuz space vehicles and their components during their being on the Earth before and after a flight, during a flight and in case of early termination of the contract.

8.0 The following change is made to paragraph 1.0 of the Statement of Work (attachment J-1)

1.0 SCOPE

This Statement of Work (SOW) describes the Phase 1, selected Phase 2 elements and selected Phase 3 other elements required to implement the joint human space activities between the U.S. National Aeronautics and Space Administration (NASA) and the Federal Space Agency (Roscosmos) that are procured through this contract. Under this contract, Roscosmos agrees to furnish and NASA agrees to purchase supplies and services for Phase 1, mutually agreed Phase 2 activities, and mutually agreed Phase 3 activities to be provided in accordance with clause F.1, as set forth in the Contract Schedule and Terms and Conditions attached hereto and made a part hereof. This SOW further defines and expands activities agreed to as part of the signed Letter Contract NAS15-10110.

The following Statement of Work language is included in attachment J-1:

14.0 OVERALL MANAGEMENT AND INTEGRATION

NASA and Roscosmos agreed to hold regular management meetings to review the work performance under this Contract. The purpose of these meetings in the particular will be the review of the ongoing fulfillment of the Parties' responsibilities, accounting of the services and resources, review of the changes and anomalies which could occur during the implementation of this Contract. It is understood that information to be exchanged between the Parties would be provided based on the existent practice and subject to appropriate laws and regulations. One of the main purposes of these meetings is to minimize the Parties' concern to the maximum extent on the possible negative situations and/or anomalies.

Within one week of the occurrence of an anomaly that can affect crew interfaces, ISS or crew safety, ISS requirements or vehicle performance on the Soyuz vehicle used for performance of services under this contract, Roscosmos shall designate to NASA a point of contact (POC) who is a system expert in the technical field of the anomaly and who can verbally provide information to NASA concerning the anomaly. The initial information should include a description of the event, planned course of action, and the anomaly's potential impact to continued ISS and vehicle operation. During the course of the investigation committee activity, the POC shall provide NASA with updates of investigation activities at mutually agreed intervals. Within one week of the conclusion of the investigation committee activity, the POC shall provide NASA with a complete verbal summary of the investigation committee report on any anomaly that occurs during flight of the Soyuz vehicle. Roscosmos shall provide to NASA a copy of the GDR briefing charts after the GDR. The above are all subject to existing Russian laws and regulations.

14.0.1 NASA is acquiring crew rotations on Soyuz vehicles for the services and capabilities of one complete Soyuz seat, including but not limited to launch, rescue, cargo services, and return, as described in the SOW.

NASA is acquiring crew rotations on Soyuz vehicles in the following amounts:

	CY11	CY12	Total
Delivery to ISS	3	0	3
Return from ISS	0	3	3

The above rotations will be provided by the following number of vehicles:

	CY11	CY12	Total
Soyuz vehicle launches	2	0	2
Soyuz vehicle landings	0	2	2

14.0.2 Soyuz vehicles will be piloted by Russian commanders utilizing Russian flight opportunities, for all Soyuz services procured under this contract.

14.1 Deliver the assigned US or US designated crewmembers to the ISS, provide rescue capability for the crewmembers, and return the crew safely to Earth on Soyuz.

14.1.a Crew Soyuz training (one prime & one backup)

14.1.a.1 Provide theoretical and practical crew training, according to functional duties on Soyuz, including equipment (e.g. Sokol suit, seat liner, cold weather suit, water survival suit and elemental survival suit), facility access and certification for the prime and backup Assigned U.S. or U.S. designated Crewmember to ensure delivery to and return from the ISS by a Soyuz vehicle and landing in a Soyuz vehicle. Utilize the most recent versions of necessary training materials in both Russian and English for training.

14.1.a.2 Beginning at the start of on-board training, current unmarked on-board documentation shall be provided to each US or US designated astronaut in accordance with their functional duties. This documentation will be provided in both electronic and hard copy format. Appropriate updates will be provided.

14.1.a.3 Develop and implement a training plan and corresponding crew travel template as part of an ISS integrated training plan.

14.1.a.4 Except for the last training session, interpretation shall be provided for the prime and backup Assigned U.S. or U.S. designated astronauts for all training events as required by each of the astronauts.

14.1.a.5 It is acceptable to make available to NASA the same set of data available to the Moscow Support Group in Houston. Real-time Soyuz processed telemetry for dynamic operations shall be provided to NASA for display in the ISS flight control room in MCC-H.

14.1.b Transportation and Lodging (other than Baikonur) for NASA personnel.

14.1.b.1 Provide transportation and facility access (subject to the internal regulations and due provision of personal data) as required for prime and backup Assigned U.S. or U.S. designated crewmember and 3 NASA designated support personnel (e.g. trainers, crew surgeon, crew support astronauts & interpreter) for survival training. When 2 seats on the same Soyuz have been procured by NASA, the number of travelers in addition to the prime and backup astronauts shall be 4. For survival training, meals and lodging shall be provided as well.

14.1.c Baikonur services for NASA personnel

14.1.c.1 Provide for pre-launch and launch security services in Baikonur and necessary document clearances and appropriate facility access (subject to the internal regulations and due provision of personal data) for prime and backup Assigned U.S. or U.S. designated astronauts and 13 NASA designated support personnel (e.g. crew surgeons, NISN computer communication specialist , public affairs official (PAO), NASA management personnel and interpreter) as mutually agreed for duration of stay. When 2 seats on the same Soyuz have been procured by NASA, the number of NASA designated travelers in addition to the prime and backup astronauts shall be 27.

14.1.c.2 Roscosmos shall provide access (subject to the internal regulations and due provision of personal data) for NASA NISN specialists to maintain NASA telephone and computer connectivity in the Cosmonaut Hotel, Energia Hotel 3, FGUP TsENKI building and at the NASA office in area 254 (Soyuz Assembly building) based on the existing communication configuration and in accordance with existing practice.

14.1.c.3 Provide transportation for prime and backup Assigned U.S. or U.S. designated crewmember and 13 NASA designated crew support personnel (e.g. crew surgeons, NISN computer communication specialist, PAO, NASA management personnel and interpreter) from Moscow to Baikonur and return; and locally in Baikonur as required for training events, pre-launch and launch activities. When 2 seats on the same Soyuz have been procured by NASA, the number of NASA designated travelers in addition to the prime and backup astronauts shall be 27.

14.1.c.4 Provide meals (when normally included as part of lodging) and lodging for the prime and backup Assigned U.S. or U.S. designated crewmember and 13 NASA designated crew support personnel (e.g. crew surgeons, NISN computer communication specialist, PAO, NASA management personnel and interpreter) in Baikonur during any required training events, pre-launch and launch activities When 2 seats on the same Soyuz have been procured by NASA, the number of NASA designated travelers in addition to the prime and backup astronauts shall be 27. Food and lodging for three NASA designated personnel (e.g. launch team coordinator, chief astronaut office or his representative, and the crew flight surgeon) will be provided at the Cosmonaut Hotel with the prime and backup astronauts. When 2 seats on the same Soyuz have been procured by NASA, the number of NASA designated travelers in addition to the prime and backup astronauts staying at the Cosmonaut Hotel shall be 4, and lodging shall be in two 2-bedroom suites. Lodging for the remaining NASA designated personnel will be provided at existing adjacent hotels as mutually agreed.

14.1.d Landing site deployment airfield and Search and Rescue services under normal (including ballistic within the nominal landing site) conditions of landing and weather.

14.1.d.1 Provide for security services, airport access, agreed upon facilities access and necessary document clearances for Assigned U.S. or U.S. designated crewmember and 10 NASA designated crew support personnel (e.g. crew surgeons, crew support astronaut, PAO, NASA management and interpreter) at the deployment airfields. The actual number of NASA designated personnel to the landing site is governed by the provisions in section 14.1.d.4. When 2 seats on the same Soyuz have been procured by NASA, the number of NASA designated travelers shall be 14.

14.1.d.2 Provide transportation for 10 NASA designated crew support personnel (e.g. crew surgeons, crew support astronauts, PAO, NASA management personnel and interpreter) from GCTC to the deployment airfields and return and locally at the deployment airfields as required to support crew recovery operations. The NASA delegation will pay for its own lodging and meals. When 2 seats on the same Soyuz have been procured by NASA, the number of NASA designated travelers shall be 14. 12 personnel will be returned on GCTC airplane (or up to 14 if agreed by both parties). If only 12 are returned on GCTC airplane, Roscosmos will be responsible for the 2 personnel using commercial transportation. Roscosmos shall arrange for lodging at the same location(s) as the search and rescue personnel. The actual number of NASA designated personnel to the landing sites is governed by the provisions in section 14.1.d.4.

14.1.d.3 Provide transportation for the Assigned U.S. or U.S. designated crewmember from the landing site deployment airfield to GCTC and locally at the landing site deployment airfield as required to support crew recovery operations.

14.1.d.4 Provide transportation, with the Search and Rescue Forces helicopters, for up to 5 (as determined by NASA) or up to 6 if agreed by both parties (plus 2 for ballistic landing within the nominal landing site) NASA designated crew support personnel (e.g. crew surgeons, crew support astronauts, PAO, NASA management personnel and interpreter) from the deployment airfield to the nominal landing site and return; and to other required locations during the Soyuz recovery operations. When 2 seats on the same Soyuz have been procured by NASA, the number of NASA designated travelers shall be up to 8 (as determined by NASA) or up to 9 if agreed by both parties (plus 2 for ballistic landing within the nominal landing site) NASA designated crew support personnel.

14.1.e Health care/Medical care

14.1.e.1 Provide information on the overall medical mission operations program. Conduct medical support activities consistent with these requirements and mutually agreed upon requirements in the Medical Operations Requirement Document (MORD) (SSP-50260). Facilitate the activities of U.S. flight surgeon in monitoring the health and well being of the Assigned U.S. or U.S. designated crewmember.

14.1.e.2 Facilitate the activities necessary for U.S. flight surgeons to brief the State Medical Commission (GMK) in GCTC in order to obtain medical certification of Assigned U.S. or U.S. Designated Crewmember to fly in Soyuz prior to launch.

14.1.e.3 Provide post-flight rehabilitation in accordance with existing practice.

14.1.f Consumables

14.1.f.1 Soyuz crew consumable services to the Assigned U.S. or U.S. designated crewmember shall be provided during ascent and decent of the Soyuz. Items included but not limited to: food, habitation, clothing, crew support equipment, and life support consumables.

14.1.g Individual crewmember equipment (prime and backup)

14.1.g.1 Provide to the assigned U.S. or U.S. designated crewmember all required Soyuz crewmember standard flight hardware including: sokol suit, seatliner, cold weather suit, water survival suit and elemental survival kit.

14.1.g.2 Provide all necessary measurements and fit check for the Assigned U.S. or U.S. designated crewmember, including safety assessments and familiarization with the flight equipment.

14.1.h Visa Support

14.1.h.1 Provide visa support, including issuing letters of invitation, for the Assigned U.S. or U.S. designated crewmember, NASA crew support, and management personnel for access to the Russian Federation.

14.1.i Mission/Flight support for Soyuz

14.1.i.1 Services shall be provided during all stages of Soyuz flight including docked operations for overall mission cognizance in accordance with existing practice.

14.1.i.2 Provide for MCC-H requested Soyuz Telemetry in the Russian Telemetry From Moscow (RTFM) stream from MCC-M to MCC-H during Russian Ground Site (RGS) coverage.

14.2 Return of cargo downmass on Soyuz at a rate up to 17 kilograms per Soyuz seat procured. Cargoes should have an average volume density per complement of 500 grams per liter or greater and suitable dimensions as mutually agreed, and certified for Soyuz transportation.

14.2.1 Base services to be provided in support of U.S. cargoes to be returned from ISS

14.2.a Cargo Transportation and Shipping

14.2.a.1 Upon return of cargo to Kazakhstan, provide for the transport of the assigned cargo to NASA in Moscow in a conditioned state (coordinated in advance) based on NASA-provided requirements.

14.2.a.2 Provide for customs clearances and necessary Ministry services to allow for the transport of the returned cargo to the U.S. from Kazakhstan and or Moscow based on NASA-provided documentation.

14.2.b Documentation and Analysis

14.2.b.1 Provide for the integration (modeling) of the descent cargoes prior to return from the ISS, but not earlier than 2 weeks before return. Two months prior to undocking, the return cargo manifest will be provided by the US to Energia. If changes are required after this date, they will only be implemented if mutually agreed.

14.2.c Early de-stow of Soyuz returned cargo at NASA's option

14.2.c.1 Provide early de-stow for NASA cargo at landing as concurred with Roscosmos, but before crew departure from the landing site.

14.2.c.2 Provide transfer of early de-stow cargo to NASA in Moscow, subject to applicable laws. After handover to NASA, Roscosmos is no longer responsible for early de-stow hardware.

14.2.c.3 Provide NASA transportation for early de-stow from landing site to Moscow including customs clearance. NASA will provide documentation as needed.

15.0 Delivery of U.S. cargo to ISS

15.0.1 Delivery of cargo upmass on Soyuz at a rate of up to 50 kilograms per Soyuz seat procured. Cargoes should have an average volume density per complement of 300 grams per liter or greater and suitable dimensions as mutually agreed, and certified for Soyuz transportation.

15.1 Services to be provided in support of delivery of U.S. cargo on Soyuz vehicles. NASA agrees to provide ISS safety certified cargo for launch.

15.1.a Transportation, Customs and Sanitation Clearance for U.S. Cargo.

15.1.a.1 Provide for cargo transportation from Roscosmos facilities or that of their contractors to Baikonur in accordance with ISS documentation including late access cargo.

15.1.a.2 Provide for the customs clearance and required Ministry services in Moscow and Kazakhstan. NASA will provide documentation as needed.

15.1.a.3 Provide for the coordination of sanitary hygiene certifications as required for customs clearance. NASA will provide documentation as needed.

15.1.a.4 Provide travel for up to 2 Russian specialist(s) for not more than 1 week to the US and/or other International Partner facility to support activities relating to cargo bench review and cargo documentation in support of 15.0 as required.

15.1.b Documentation and Analysis

15.1.b.1 Document the manifest of designated Soyuz vehicle in the international coordination protocol and the IDRD.

15.1.b.2 Provide for the integration (modeling) of the U.S. cargo prior launch to the ISS.

15.1.b.3 Certify the integrated U.S. cargo for launch on the Soyuz vehicle for safe flight.

15.1.b.4 The Preliminary ICD for each Soyuz flight will be provided to NASA for joint signature at L-1 month. The Final ICD for each flight will be provided to NASA for joint signature at L+2 weeks.

15.1.b.5 Provide to NASA prior to Soyuz launch detailed photos showing how NASA cargo is packed within the vehicle as well as closeout photos (if technically feasible) of the packing layers shall be provided. Photos of individual items within NASA pre-packs are excluded from photography requirements.

15.1.c Personnel Transportation and Lodging

15.1.c.1 Provide transportation from Moscow to Baikonur for 3 cargo integration personnel assigned to support Soyuz cargo loading, and one additional NASA personnel two times per year to support cargo loading as operationally required, and 3 cargo personnel for launch of Soyuz flights.

15.1.c.2 For personnel as identified in 15.1.c.1, provide meals, lodging in Baikonur at Energia Hotel 1 or Hotel 3 and access to appropriate facilities for cargo integration personnel assigned to support cargo loading and for launch of Soyuz flights, for the duration of their stay.

15.1.c.3 Provide visa support, including issuing letters of invitation, for NASA cargo integration personnel for access to the Russian Federation.

15.1.d Cargo Services in Baikonur

15.1.d.1 Provide for secure, controlled environment storage in Baikonur for U.S. cargo delivered to Baikonur for launch, in accordance with existing practice. Secure environment shall be defined as a locked area that requires keyed (or equivalent) entry and documentation of personnel entering. Controlled environment shall be defined as a standard Baikonur atmospheric pressure and temperature control between 15 to 27 degrees Celsius.

15.1.d.2 Transportation, packing, and handling of NASA cargo in Moscow and Baikonur, and at Baikonur shall be implemented in accordance with mutually agreed procedures.

15.1.e Late access to Soyuz vehicle

15.1.e.1 Provide late access/stowage for NASA cargo at L-1 to 2 days with the ability for late stowage of 1 half CTBs up to 10 kg .

15.1.e.2 Provide transportation for NASA late access cargo from Moscow to Baikonur to include customs clearance, subject to NASA provided documentation.

15.1.e.3 Cargo not launched shall be stored in the NASA office at Baikonur if possible. If storage there is not possible, or if NASA desires the return of the cargo to the U.S., the parties will jointly arrange for the packing and return to the U.S. at NASA's expense.

15.1.f.2 For cargo items to be transported on Soyuz vehicles that require integration hardware, or that require special transportation frames, Roscosmos shall develop and provide the special mounting, fastening and packing systems if this has no impact on the design and schedule of the vehicle. For this reason, NASA and Roscosmos will coordinate and concur on the related interface and accommodation requirements for the cargo at L-3 month's period.

16.0 Disposal of U.S. trash on Russian vehicles -

16.0.1 Disposal of trash on Soyuz vehicles at a rate of approximately 30 kilograms per Soyuz seat procured.

16.0.2. At Soyuz undock minus 2 months, NASA shall identify to Roscosmos the amount of trash to be disposed on the upcoming Soyuz departure.

8.0 Below are the new J-4 milestones:

Line Items/Milestone #	Description	Completion Date	Amount ($M)	Total value for Line Items
00029	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #1 associated services per SOW 14-16)**			47,091,212.06
00029a	Reservation of 1 CY11 Soyuz seat for US designated crew member: CY11-S1	Nov-08	11,772,803.02	
00029b	Review status of work per SOW 14.0 to determine compliance with preparation of services on CY11 Soyuz flight: CY11-S1	Nov-09	11,772,803.02	
00029c	Review status of work per SOW 14.0, and completion of 50% of crew training for US designated crewmember: CY11-S1	Nov-10	14,127,363.62	
00029d	Delivery to ISS of 1 US designated crewmember on CY11 Soyuz: CY11-S1	Nov-11	4,709,121.21	
00029e	Return/Rescue of 1 US designated crew member from CY11 launched Soyuz: CY11-S1	Jun-12	4,709,121.21	
00030	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #2 associated services per SOW 14-16)**			47,091,212.06
00030a	Reservation of 1 CY11 Soyuz seat for US designated crew member: CY11-S1	Nov-08	11,772,803.02	
00030b	Review status of work per SOW 14.0 to determine compliance with preparation of services on CY11 Soyuz flight: CY11-S1	Nov-09	11,772,803.02	
00030c	Review status of work per SOW 14.0, and completion of 50% of crew training for US designated crewmember: CY11-S1	Nov-10	14,127,363.62	
00030d	Delivery to ISS of 1 US designated crewmember on CY11 Soyuz: CY11-S1	Nov-11	4,709,121.21	
00030e	Return/Rescue of 1 US designated crew member from CY11 launched Soyuz: CY11-S1	Jun-12	4,709,121.21	
00031	**Launch, return and rescue of US or US designated crewmember for 1 Soyuz seat (Seat #3 associated services per SOW 14-16)**			47,091,212.06
00030a	Reservation of 1 CY11 Soyuz seat for US designated crew member: CY11-S1	Nov-08	11,772,803.02	
00030b	Review status of work per SOW 14.0 to determine compliance with preparation of services on CY11 Soyuz flight: CY11-S1	Nov-09	11,772,803.02	
00030c	Review status of work per SOW 14.0, and completion of 50% of crew training for US designated crewmember: CY11-S1	Nov-10	14,127,363.62	
00030d	Delivery to ISS of 1 US designated crewmember on CY11 Soyuz: CY11-S1	Nov-11	4,709,121.21	
00030e	Return/Rescue of 1 US designated crew member from CY11 launched Soyuz: CY11-S1	Jun-12	4,709,121.21	

NASA-Roscosmos Protocol
Orlan Suit Telemetry Matching Unit
June 4, 2008

The goal of this project is to provide continuous telemetry data transmission on cosmonaut's health, Orlan space suit, and supplementary hardware during Extravehicular Activity (EVA) without dependence on Russian ground tracking stations coverage during EVA, and for providing ISS crew safety.

The data transmission is planned to be performed with existing systems and interfaces as well as with developing TMU with new interfaces. TMU is installed on RS ISS. Telemetry is transmitted to the Earth via S-band of USOS, until Russian capability to transmit telemetry through a Russian satellite system is available; at such time, Russian systems will be utilized.

The qualification unit procured via the contract between Boeing and RSC-Energia will be provided to Roscosmos as a flight spare once the flight unit is on orbit. Additional spares, if necessary, will be considered upon mutual agreement of the Parties.

The mutual agreements reached within the present protocol are considered to be balanced, and they do not influence the present agreements between the sides including the Protocol of Balance of Contribution and liabilities and annexes to it.

In support of the mutual benefits of the removal of dependence on Russian ground sites during EVA, and the removal of the requirement to sleep shift the ISS crew during Russian Segment EVAs, NASA, Roscosmos, and RSC-Energia agree to the following:

NASA

1. Finance the development and manufacturing of 1 flight unit and 1 qualification unit of TMU devices and sets of cables, in accordance with the contract between Boeing and RSC-Energia.
2. Provide the S-band channel for telemetry data transmission during EVA without compensation from Roscosmos.
3. Work out the requirements for Orlan status telemetry in accordance with the document SSP50097 "SPACE STATION MANNED BASE TO RUSSIAN SEGMENT SOFTWARE INTERFACE CONTROL-DOCUMENT".

Roscosmos

1. As the nominal operational plan, conduct all Orlan EVAs on the normal ISS sleep schedule regardless of Russian ground site coverage, providing that TDRS S-band is capable of delivering telemetry for MCC-Moscow. It is recognized that there occasionally may be situations that would require RS EVAs to be conducted over Russian ground sites;
2. Provide the integration, ground tests, delivery to ISS, and installation and checkout on RS ISS (without compensation from NASA for delivery of upmass to ISS);
3. Upgrade SM onboard computer software and GDC (Ground Debugging Complex);
4. Provide engineering support during operation (on the flight stage), and sustaining engineering and replacement of TMUs as necessary.

RSC-Energia

1. Develop and manufacture the required number of TMU devices, sets of cables and documentation in accordance with the contract between Boeing and RSC-Energia.

APPROVALS

Roscosmos:

Alexey Krasnov 3.6.08

RSC-Energia:

Alexander Derechin

NASA:

Michael T. Suffredini 6/4/08

NASA-Roscosmos Protocol

Joint Station LAN Expansion

October 16, 2008

1. In order to support the future expansion of the Joint Station Local Area Network (JSL) into the new Russian Segment Modules, including MRM 1 and MRM 2, NASA and Russian technical experts have agreed that the use of Ethernet cable, consistent with that used currently on the ISS in both the USOS and the RS for the JSL, is the best approach.

2. To expeditiously acquire the necessary cable, RSC-E is requesting that NASA provide the following:

   A. 300 meters of Tensolite Aerospace Grade 100BASE-T Ethernet Cables NF22P100 for Russian Segment (SM and FGB) external cable manufacturing in November 2008.

   B. 420 meters of Internal cable Tensolite 100-Ohm Quad Cable p/n 23450/0490X-4(LD) to support the internal outfitting of the new RS modules. RSC-E is requesting the release by NASA/Boeing of the remaining 420 meters of the internal cable supplied to RSC-E for the implementation of SSCN 9633/10234.

3. As it was specified in the Protocol dated October 15, 2002, between NASA, RSA and Energia, the three Station Support Computer Laptop configuration will represent the jointly agreed-to SSR configuration in the SM. Station Support Computer Laptop provide the crew maximum flexibility for interoperability within the ISS. In compensation for the provision by NASA of the above cable, Roscosmos agrees to deliver to the ISS as Russian cargo three Next Generation Laptops to be used for SSC 1,2, and 3 on a mutually agreed Progress flight during 2009.

4. NASA will provide a Power and Video Grapple Fixture (PVGF) for MRM1. (This does not include the required unique PVGF cable harness for integration into MRM1, which will be addressed in a separate protocol.)

For Roscosmos:

Alexey Krasnov 11/21/08

For NASA:

Mike Suffredini 11/21/08

NASA-Roscosmos Protocol
24 January, 2008

NASA and Roscosmos agree to the following items:

1. ISS Configuration
    a. Node 3 will be relocated to the port-facing port of Node 1
    b. MRM1 (DCM) will berth to the FGB nadir port
    c. MRM2 (DC2) will direct dock to the SM zenith port.
        i. Roscosmos is no longer pursing the option to berth MRM2 (DC2)
    d. MLM will direct dock to SM nadir port
    e. Roscosmos is assessing need to relocate PDGF to FGB for MRM1 (DCM) berthing operations
        i. Relocation of PVGF on MRM1 may be simpler
        ii. Decision to be made by mid-February 2008
    f. NASA will fly the MLM outfitting hardware on MRM1 (DCM):
        i. ERA spare elbow
        ii. MLM airlock
        iii. MLM radiator
        iv. Portable work station
    g. For planning purposes, beginning with 6 crew operations, Soyuz vehicles will be flown every 2 and 4 months, with approximately 2 months being the minimum separation between flights
    h. For planning purposes, indirect handover will be the nominal plan beginning with the launch of the second Soyuz in the fall of 2009

2. ISS Crew Training
    a. GCTC, RSC Energia, and NASA specialists will work together to assess ways to reduce the cost of training and the crew travel required. Options may include:
        i. Expansion of JSC Soyuz Part Task Trainer capabilities
        ii. Development of online classroom lessons
        iii. Development of a new scheduling and feedback system
        iv. Completion of the bilateral crew training flow integration
    b. The teams will report their findings by early March 2008, with the goal to reduce the training flow for the Soyuz FE1 on 20A increment
    c. Beginning with the ISS 20B crew, all crews will be trained based on 6 crew operations, even though indirect handovers is the nominal plan
    d. Potential compensation will be considered at a later date

3. Urine Processing - Roscosmos will study the following proposal
    a. NASA processes all ISS urine
    b. NASA provides all consumables necessary to process ISS urine
    c. NASA provides water in excess of USOS needs to Roscosmos
    d. NASA will dispose of all waste associated with UPA and WPA

4. TVIS
    a. For nominal operations, USOS crew members are not expected to use TVIS after May 2009 in conjunction with transition to 6 person crew
    b. Roscosmos is considering the use of Russian spare treadmill BD1 or TVIS for 6 crew operations
    c. If Roscosmos chooses to use TVIS, Roscosmos will be responsible for crew time for TVIS maintenance, the purchasing and launching of TVIS spare parts, as well as disposal of TVIS once the Russian treadmill is delivered. NASA will provide sustaining engineering through

delivery of the Russian treadmill. Potential compensation for sustaining engineering will be considered at a later date

d. If Roscosmos chooses not to use TVIS, its disposal will be handled on a shared basis.
e. The parties identified points of contact, Boris Morukov/IMBP and Phil Dempsey/ISSP, to work BD1/TVIS options. They are to report their findings by March 31, 2008

5. Shuttle Condensate - Roscosmos to study the following proposal and respond to NASA prior to March 1, 2008
   a. NASA will provide Shuttle condensate to Roscosmos for processing in the SRV-K, beginning as soon as SRV-K certification is confirmed. Goal is 1/J mission to begin condensate processing
   b. Roscosmos will keep water processed from Shuttle condensate for RS use
   c. Beginning with 6 crew operations, NASA expects to collect approximately 70% of all ISS condensate. NASA will owe Roscosmos water equivalent to the condensate collected above 50% of all ISS condensate
   d. Shuttle condensate provided to Roscosmos will offset the excess ISS condensate collected by NASA until the credit from Shuttle condensate is offset

6. Crew Provisioning
   a. NASA and Roscosmos will consider applying the current practice of crew provisioning during 6 crew operations and will agree on this subject by March 1, 2008. However, upmass for items selected by each Party's crewmembers is that Party's responsibility
   b. The current practice is crewmembers select crew provisioning/crew preference items which are available from both US and Russia and neither side charges for these products

7. MMOD shielding
   a. Roscosmos will assess their capability to provide SM debris wings for launch on Shuttle in 2010
   b. NASA will explore possibility of procuring debris wings from US contractor
   c. Roscosmos is assessing option of including MMOD improvements to Progress and Soyuz vehicles for planned vehicle upgrades
   d. MRM1 and MRM2 shielding is being designed to meet ISS specifications

8. NASA agrees to issue a modification to NAS15-10110 in the amount of $1.9 million. This amount resolves all remaining costs from milestone 0003C28, adds $400K to cover both the training/certification as Flight Engineer 1 of ESA astronauts DeWinne and Eyharts, and resolves all remaining issues for EEE parts

9. Parties agree to hold a telecon by February 1, 2008, to discuss trash disposal under the contract NAS15-10110 with the goal to resolve outstanding issues

10. Roscosmos and NASA will meet in March to respond to the items in this protocol

For NASA:

Michael Suffredini
24/1/08

For Roscosmos:

Alexey Krasnov 24.01.08

NASA-Roscosmos Protocol - 25 April 2008

1. **Expedition 20A**

No later than June 2008 (prior to the MCOP), RSA will determine whether to train the Expedition 20A crew with or without a Space Flight Participant. In the case of no SFP, the Expedition 20A prime crew composition (option 1) will be:

C - Romanenko (O, E, R*)
L - Kornienko (O)
R - J. Williams (E, R)

If the decision is taken to include the SFP, the crew composition (option 2) will be:

C - Experienced Cosmonaut (O, E, R*)
L - J. Williams (O, E, R)
R – SFP

* under review (protects for 20S/Expedition 19B Soyuz launch delay)

C = Soyuz CDR; L = Soyuz FE1; R = Soyuz FE2
O = Orlan specialist; E = EMU specialist; R = SSRMS specialist)

NASA and Roscosmos agree to the following:

1. Regardless of which option is selected, J. Williams' training in Russia will be accomplished in 16 weeks (minimum training on RS systems) + 2 weeks for Orlan certification = 18 weeks.
2. The Fall 2009 SFP will only fly if the 19B Soyuz launches prior to the 20A Soyuz
3. If the SFP is assigned and then removed from flight prior to TBD date, the crew assignments will be as stated in Option 1. If the SFP is removed after this date, J. Williams will remain in the left seat. GCTC will work through the MCOP to define the TBD date by the summer 2008 MCOP.
4. In absence of an SFP, Roskosmos can fill the right seat of a Soyuz by an inexperienced cosmonaut
5. If option 2 is selected and J. Williams or experienced cosmonaut becomes unavailable to fly, the prime crew will be replaced by the Expedition 20A backup crew
6. At the summer 2008 MCOP, the parties will determine the date when the Expedition 20A Soyuz CDR must start EVA training

Expedition 20A backup crew will be assigned by the MCOP.

2. **Urine Processing**

NASA will process all ISS urine, will provide all consumables necessary to process ISS urine, and will dispose of all waste associated with UPA and WPA. In exchange, NASA will provide water from processed urine in excess of USOS needs to Roscosmos.

NASA will provide the expected amount of water and the associated assumptions in the development of that amount. At the end of 2009, the parties will compare the projections with the actual amount in order to evaluate the performance.

3. **Crew Provisioning**

The current practice of having crew members select crew provisioning/crew preference items from both US and Russian inventories at no cost to the partner will be maintained for 6 crew operations. However, upmass for items selected by each Party's crew is that Party's responsibility.

For NASA:

Michael Suffredini 25/4/08

For Roscosmos:

Alexey Krasnov 25.04.08

NASA / Roscosmos Understanding

Provision of services in 2009-2010 in addition to the Balance of Contributions obligations

2 April 2007

1. Roscosmos will provide access to habitation services necessary to provide support for 1 NASA designated crewmember flying in a Russian increment opportunity in 2009. The actual period of time for this service will begin with the return to earth of the Expedition 18 crewmembers by Soyuz and ends with the return of the first Soyuz in the fall of 2009. Such services shall be consistent with habitation services provided in Article 4.C of the 2006 Addendum to the Balance of Contributions. This obligation is in addition to any resources Roscosmos is obligated to provide in the Balance of Contributions and its amendments.

2. NASA will provide Roscosmos 400 kilograms of water, delivered via Shuttle, prior to the end of CY2010. Additionally, NASA will provide Roscosmos with 3 cubic meters of stowage in US controlled volume, for the period of 1 year. These obligations are in addition to any resources NASA is obligated to provide in the Balance of Contributions and its amendments.

3. Delivery to and return from the ISS, for the US or US designated crewmember for this increment opportunity will be arranged by NASA separately. All other resources, including electric power necessary for habitation systems used by the US designated crewmember during this increment opportunity, beyond those specified in Item 1 will be provided by NASA. Crew rescue services will be acquired by NASA. .

4. This Program Managers' understanding will become effective following review and approval of an addendum to the Balance of Contributions agreement through each Party's internal procedures.

From NASA:

Michael Suffredini

From Roscosmos:

Alexy Krasnov

Agreement
on scientific and technical cooperation between
National Aeronautics and Space Administration of the USA (NASA)
and
The State Scientific Center of the Russian Federation - Institute of Bio-medical Problems of The Russian Academy of Sciences (IBMP)
on the project
"Cooperation between NASA and IBMP during implementation of Medical Operations and Baseline Data Collection from NASA designated astronauts"

Preamble

Whereas medical operations and basic data collection is significant for assessment of the data of state of health of NASA designated astronauts before and after space flights, and also taking into account longstanding successful cooperation of specialists of the USA and Russia on space biology and medicine,

NASA and IBMP have come to agreement about mutual support during conduction of medical operations and basic data collection for expeditions to ISS.

IBMP will provide support during medical operations and Basic data collection for NASA designated astronauts before and after flights to ISS in the framework of Intergovernmental agreement in the following way:

1. IBMP provides access to IBMP laboratory facilities to NASA personnel to utilize designated laboratory equipment for analyses of biological and/or environmental samples. NASA in case of necessity will provide IBMP personnel access to designated NASA equipment or facilities in Russia for analyses of biological and/or environmental samples. The Parties will agree in advance on usage of the other Party's equipment and facilities.

2. IBMP provides necessary clearances from the Russian Government for each NASA traveler for environmental and biological sample export from Russia, per the sample return list. NASA will provide all necessary traveling data 20 working days before removal of biological and environmental samples from Russia. Approximate schedule is:

L-45 to 30 days	1 NASA traveler
L-10 days	1 NASA traveler
R+0 to 10 days	3 NASA travelers

3. IBMP provides an IBMP representative to be present in the airport during samples sending with NASA travelers to assist with customs documentation and clearance and security clearance for samples being transported to the border of the Russian Federation.

4. IBMP provides dry ice during the L-45 day pre-launch period, and during the period immediately following Soyuz return, based on operational necessities.

5. IBMP will participate in preflight/postflight telecons and meetings on medical/BDC coordination, and also issues of planning and delivery of samples and materials.

6. NASA will provide IBMP representative a power of attorney for receiving of samples returned at the landing site and information about the returned load.

7. IBMP provides recovery of returned samples at landing site and return to Star City based on environmental conditions established during preflight/postflight telecons.

8. NASA provides IBMP necessary data on the exported samples (types of samples, their volume and amount, environmental conditioning required during transportation, description of the transporting container, etc.) 20 working days before removal of biological and environmental samples from Russia.

For NASA

M.T. Suffredini
Manager,
International Space Station Program

23/07/08 2008

For IBMP

B. V. Morukov
Deputy Director on Science

07 / 23 2008

NASA-Roscosmos Protocol

June 4, 2008

1. In order to maintain the development schedule of the MRM1 (formerly DCM), the Parties agree that the following work will be provided by NASA. It is further agreed that compensation from Roscosmos is required for this work, but the exact amount and form of compensation will be determined at a future date. It is recognized that as the technical specialists work through these issues, there may be additional items that make sense for NASA to provide, for compensation. If these items are identified, they will be covered in a separate Protocol. Additionally, items other than those listed in this Protocol, that do not require compensation, may also be provided. These will be documented using existing ISS processes for bilateral data and hardware exchange (SSP 50136 "BHSEALS", and SSP 50137 "BDEALS").

2. NASA will provide a Power and Video Grapple Fixture (PVGF), a unique PVGF cable harness, test cables (connector savers) to check out the PVGF, and integration assistance necessary to integrate the PVGF onto the MRM1.

3. NASA will provide software and avionics integration to enable berthing of MRM1, with support from Roscosmos, and USOS command and control software reconfiguration necessary to enable:
   a. Routing of power, commands, and telemetry to/from MRM1 while attached to SSRMS;
   b. Automated response to SSRMS safing event (auto-safing);
   c. Testing at the Software Development and Integration lab (SDIL) to verify USOS/RS interface.

4. NASA will provide development of MRM1 thermal models for launch-to-activation (LTA) analyses requested by RSC-Energia. Roscosmos will provide the data necessary for NASA to build the thermal models.

5. NASA will provide the design coupled loads analysis (DCLA) requested by RSC-Energia, and Roscomsos will provide the data necessary.

6. NASA will provide the following Shuttle MRM1 integration hardware:

    a. Flight Releasable Grapple Fixture (FRGF) for MRM1 interface to SRMS;
    b. FRGF attachment hardware (bolts, washers, nuts);
    c. Payload Disconnect Assembly (PDA) for MRM1 interface to Shuttle in order to route power and data (telemetry);
    d. Mating half connectors (ITT Cannon connectors) and AWG8 wire to support the installation of the PDA onto the MRM1 and to connect the ODA simulator to ground test equipment in support of PDA check out.

7. NASA, with support from Roscosmos, will provide software testing in the Shuttle Avionics Instrumentation Laboratory (SAIL) to verify MRM1 1553 interface to Shuttle, based on request from RSC-Energia for a 1553 interface on MRM1 to simplify MRM1 design.

8. Software (NASGRO) to calculate the probability of fracture development in support of development of a fracture control plan and related analyses.

9. NASA has provided the target cargo complement (identified in fax of July 9, 2007, and which will be documented in a cargo interface definition document). This target complement included a listing of the types of bags, number of each type of bag, maximum and average mass for each type of bag, and the total volume for each type of bag, along with the total mass of the cargo complement. NASA will provide 1 unit of each type of stowage bag identified in the fax of July 9, 2007 to RSC-Energia for use in cargo complement analysis, for a period not to exceed 6 months. It is recognized that in order to provide accommodations all 1400 kg of NASA dry cargo, it may be necessary to increase minimally (not to exceed 200 kg) the gross mass limit of the MRM1 integrated module, as stated in contract NAS15-10110. The Parties agree to consider and sign a modification to the contract should some minimal increase in this limit be necessary. In any case, the integrated module will still be required to meet the mass and center of gravity (CG) requirements for the Space Shuttle.

For NASA:

Michael T. Suffredini 6/4/08

For Roscosmos:

4.06.08

Alexey Krasnov

For RSC-Energia:

Alexander Derechin

NASA-Roscosmos Protocol
JAXA On Orbit Crew time
July 23, 2008

1. Recognizing the original Balance of Contributions protocol, dated June 11, 1996, article 11a, that states that after the Government of Japan accrues rights to on-orbit crew time, that allocation will "be drawn equally from the American Segment on-orbit crew time allocation and the Russian Segment on-orbit crew time allocation".

2. Recognizing that the crew time on orbit allocated to JAXA during Increments 17-19 is estimated to total 44 hours, therefore both the USOS and the RS would each be charged approximately 22 hours to accommodate this crew time.

3. It is agreed that the maximum hours to be charged to the RS will be 22 hours to accommodate this JAXA crew time. Roscosmos has no further obligation to provide crew time for JAXA per the Balance of Contributions.

For NASA:

Michael Suffredini
23/07/08

For Roscosmos:

Alexey Krasnov 22.07.08

Protocol
On the Subject of Trash Disposal on ATV-1 and 29P

For the purposes of trash removal on ATV-1 and 29P, the Parties agree to the following:

- The vehicles shall be loaded by the operations organizations from the respective sides as operationally expedient
- Regardless of the actual cargo that is removed by the vehicles, it shall be accounted as if 29P left full of Russian trash and the Russian share of common trash and ATV-1 left full of US trash and the US share of common trash
- No compensation or adjustments to existing debts shall be due either side

For NASA:

Michael T. Suffredini 6/5/08

For Roscosmos:

06/05/08
Alexey Krasnov

NASA - Roscosmos Protocol
8 September 2008

1. Per NASA request, Roscosmos will return 0.5 kg of samples from the "Integrated Immune" experiment on 16S. These samples consist of blood sample sleeves and saliva collection pouch assemblies, require early de-stow, and will be handed over to authorized representative of NASA at the Soyuz, within 48 hours of return to Earth, in accordance with the established procedures.

2. Notwithstanding other obligations, NASA will return Roscosmos additional cargo on a mutually agreed Space Shuttle mission in the amount of 0.5 kg.

3. Per Roscosmos request, NASA delivered 16.3 kg of up mass to ISS for Roscosmos on Space Shuttle flight 1J. This hardware consisted of spares for the Russian Segment ACY.

4. Notwithstanding other obligations, Roscosmos will deliver additional 16.3 kg of up mass for NASA, on a mutually agreed Progress vehicle.

For NASA:		For Roscosmos:	
M. Suffredini	9/11/08 Date	A. Krasnov 26.09.08	Date

NASA/Roscosmos Protocol
April 23, 2009

1. NASA and Roscosmos agree with the following special requirement concerning volume density of NASA trash disposed on Russian vehicles:

   Trash should have an average volume density of 200 grams per liter or greater. In case average trash volume density on a given Progress is found to be less then 200 grams per liter, mass disposed and charged against modification 170 should be calculated as volume of trash disposed multiplied by volume density of 200 grams per liter. In any case, the total volume to be returned in a given year shall not exceed the following:

   - 2009 – volume of 1 Progress
   - 2010 – volume of 2 Progress
   - 2011 – volume of 1 Progress

   This agreement comes into force starting on flight 32P.

2. NASA shall provide storage for IELKs for NASA astronauts to be rotated by Space Shuttles in 2009 and dispose of them using non-recoverable vehicles, such as Russian vehicles, ATV, HTV. If NASA decides for stowage reasons to return IELK's on Shuttle they will be turned over to Roscosmos at KSC without charge for recoverable cargo.

3. Roscosmos agrees to launch approximately 486 kg of NASA upmass on Flight 33P (from the 2009 1.4 MT purchased cargo per Modification 170).

4. Roscosmos agrees to launch approximately 380 kg of NASA upmass on Flight 34P (from the 2009 1.4 MT purchased cargo per Modification 170).

5. The remaining balance of 1.4 MT purchased cargo per Modification 170 will be flown on 35P.

For NASA:

Michael T. Suffredini 4/23/09

For Roscosmos:

Alexey B. Krasnov
04/23/09

<handwritten initials> 4/23/09.

MDS 4/23/09

NASA-Roscosmos Program Manager Understanding
23-Apr-09

Provided/to be provided by NASA:	Provided/to be provided by Roscosmos:
MRM1 integration hardware and support: PVGF, PVGF cable harness, s/w changes to support berthing, modeling and berthing analysis, LTA thermal models, VLA, FRGF and bolts, PDA, ITT Cannon connectors for PDA, SAIL testing, NASGRO software, cargo bags, support to integ electrical testing (per separate protocol)	PDGF on FGB hardware and support: provide and launch FGB PDGF stand, VSC thermal cover and tether restraint, and EVA tool for PDGF stand; RSC-E and KhSC support to FGB PDGF system certification; necessary support and data to NASA for development of training materials, flight procedures, and flight data products for PDGF installation; development of 1553 cable and Russian connectors (per separate protocols)
MRM1 crewtime for MRM1 berthing/robotic activities.	All rights to and responsibility for MRM1 reside with Roscosmos, recognizing that the MRM1 docking port is to be used to provide for Progress and Soyuz vehicles docking only, without additional compensation from either party.
TVIS sustaining engineering beginning December 1, 2009, through December 31, 2011. This includes spares, sustaining engineering expertise on the ground, and training for RS cosmonauts on TVIS maintenance. Does not include upmass/shipping, stowage, or on-orbit crewtime.	Recoverable down mass on Soyuz: 13 kg per Soyuz seat beginning with the return of 18S in the fall of 2009 and continuing through the return of 27S in the fall of 2011 (14 total Soyuz seats)
Stowage in 2007-2008 equal to 3.8 cubic meters	RS cosmonauts crew time to support NASA cargo on Progress, including unloading and packing Progress vehicles 2009-2011 (includes MRM1), not to exceed 100 hrs per each of 5 equivalent vehicles
Total RS stowage in USOS: 1) Jan-June 2009=15 cu m; 2) July '09 - Jun '10=11 cu m; 3) July 2010- December 2011=10 cu m.	Delivery of approximately 19 kg of USOS cargo in 2007-08 beyond modification 166
Crew time for Roscosmos equal to 100 hours during Increments 20-23	FGB Sustaining Engineering/maintenance/spares/trash disposal/operations/ground support/on-orbit crew time; 2014-June 30, 2016. This includes 675 hours on-orbit crew time and 900 kg of spares delivered to ISS & 900 kg of spares disposed. Actual amounts may be greater requiring additional compensation.
Power for equivalent of one Soyuz continuously docked to ISS (0.3 kW) as long as USOS crews are being rotated on Soyuz	Roscosmos will address landing fees for NASA flights to Russia (Moscow) not to exceed 4 flights per year.
MRM1 launch on Space Shuttle. The MRM1 docking port is provided for Progress and Soyuz vehicle docking without additional compensation from either party.	Disposal of up to 4.5 MT of FGB spares through 2013
	Accommodate not more than 32 day slip in purchased increment
Accommodate MRM1 mass exceedance (600 kg above 7900 kg)	Provide additional 150 kg cargo to NASA on Progress (not later than 36P, based on mutual agreement)
Continued sustaining engineering on TVIS June 1-November 30, 2009 (crew time for maintenance, split 50/50 with RS); Assumes 2 USOS + 2 RS crew use TVIS. TVIS will be serviced nominally through the end of May 2009	Share TVIS maintenance crewtime 50/50. June 1 - Nov 30, 2009

NASA/Roscosmos Protocol
Replacement of Russian Segment A31P Laptops
April 23, 2009

NASA and Roscosmos agree to the following:

- Due to the failure of three (3) Russian A31P laptops onboard ISS, Roscosmos has requested NASA to supply onboard A31p laptops as replacement hardware.
- NASA can accommodate this request and will transfer three (3) A31P laptops currently onboard ISS to Roscosmos.
- In return, three (3) T61P laptops will be manifested on 36P or 37P as Russian cargo and will be transferred to NASA once delivered to ISS.

For NASA:

Michael T. Suffredini
4/23/09

For Roscosmos:

Alexey B. Krasnov
04/23/09

NASA-Roscosmos Protocol
Use of ARED by Roman Romanenko
May 29, 2009

1. Roscosmos and NASA agree to Roman Romanenko's use of ARED onboard the ISS during Expeditions 20 and 21. This agreement is based on Roman Romanenko having signed the Informed Consent and having participated in training and pre-flight tests along with his agreement to perform inflight exercise and post-flight tests.

2. Schedule for Roman Romanenko's use of ARED will be per requirements of ARED exercise protocol and the existing on-orbit planning process.

3. Crew time for Roman Romanenko's participation on ARED is the responsibility of Roscosmos.

4. All data collected during the pre-, in- and post-flight exercise and BDC in conjunction with ARED investigations will be shared with both U.S. and Russian flight surgeons and the respective exercise teams. In-flight data for Roman Romanenko will be provided to IBMP as soon as practically possible.

For NASA:

Michael T. Suffredini 6/22/09

For Roscosmos:

Alexey B. Krasnov

IBMP В. Богомолов

NASA/Roscosmos Protocol
Replacement of Russian Segment A31p Laptops
June 3, 2009

NASA and Roscosmos agree to the following:

- Due to the failure of two (2) Russian A31P laptops onboard ISS, Roscosmos has requested NASA to supply onboard A31P laptops as replacement hardware.
- NASA can accommodate this request and will transfer two (2) A31P laptops currently onboard ISS to Roscosmos.
- In return, two (2) T61P laptops will be manifested on 36P, 37P or 38P as Russian cargo and will be transferred to NASA once delivered to ISS.

For NASA: 6/22/09

Michael T. Suffredini

For Roscosmos:

Alexey B. Krasnov

National Aeronautics and Space Administration
Headquarters
Washington, DC 20546-0001

April 23, 2008

Reply to Attn of:

Office of External Relations

Mr. Anatolii Nikolaevich Perminov
Head
Federal Space Agency
42 Shchepkin Street
Moscow, 129857
Russia

Dear Mr. Perminov:

During our one-on-one discussion, you stated the concern and desire of Roscosmos to come to understand the anomalies present on Soyuz TMA-11. It appears at first look that several anomalies repeated from Soyuz TMA-10. I know you have appointed a commission with the director of Keldysh Research Centre as a co-lead with RSC-Energia. This is very good.

During the Space Shuttle return to flight activities, NASA shared with Roscosmos our findings and process for resolution of issues that enabled us to return to flight, as well as subsequent modifications to better resolve the issue of foam loss from the External Tank. It was important for us to have an open dialogue on these matters given our mutual reliance on the Shuttle for International Space Station assembly and re-supply.

Given the similar level of reliance that NASA and the other ISS partners place on the Soyuz TMA system for crew transportation services, I propose that NASA have a member on the Russian commission that is examining the recent Soyuz TMA anomalies. We would select a knowledgeable engineer, able to converse in Russian, and we are prepared to sign any non-disclosure agreement should that be required. We are flexible in how we designate this member, perhaps as an ex-officio member, observer, or some other category if that is more appropriate for your system.

In addition, we propose that our technical specialist participating in the commission be allowed to work closely with counterparts at RSC-Energia to better understand root cause of each of the Soyuz anomalies and the recommended resolution.

Since the Soyuz is a critical transportation system for the ISS partnership, particularly once the Space Shuttle retires, it is in our mutual interest to ensure that we have fully understood and dealt with the root cause of the recent ballistic re-entries.

I look forward to working with you on this important matter.

Sincerely,

William H. Gerstenmaier
Associate Administrator
for Space Operations

National Aeronautics and Space Administration

Headquarters
Washington, DC 20546-0001

October 20, 2008

Reply to Attn of: Space Operations Mission Directorate

Mr. Alexey Borisovich Krasnov
Director, Piloted Space Programs
Federal Space Agency
42 Shchepkin Street
129857 Moscow
Russia

Dear Mr. Krasnov:

In response to your verbal request for Soyuz TMA-12 entry monitoring, NASA will make a best effort to record the Soyuz TMA-12 reentry telemetry signal. NASA did not previously have the capability to record at the requested frequency of 166 Mhz. Therefore we purchased a commercial radio, antenna and pre-amplifier. The system will be tuned to the appropriate frequency and the output routed into a spectrum analyzer for demodulation and then into a recorder. We have assembled the required equipment and will test and calibrate it at Wallops Flight Center in Virginia today, Monday, October 20, 2008. Assuming a successful test, we plan to deploy the unit to Incirlik Air Base in Turkey for recording of the entry on the morning of October 24, 2008 (Kazakh time).

We think the area of interest will be between the de-orbit burn and module separation. Based on this, Incirlik may not be the optimal location for the equipment. We are searching for another ground location to provide appropriate coverage. Any suggestions you can provide would be helpful.

If successful, we will provide the data to you as soon as possible post-entry. We have no ability to decipher the raw signal into telemetry or individual measurements.

As we have stated and are now demonstrating, we stand ready to support in any manner needed. Only through our joint cooperation can we both be successful.

Sincerely,

William H. Gerstenmaier
Associate Administrator
for Space Operations

cc:
Anatoly Perminov, Roscosmos
Vitaly Davydov, Roscosmos
Vitaly Lopota, RSC-Energia
Michael Griffin, NASA
Michael Suffredini, NASA
Albert Sofge, NASA

National Aeronautics and Space Administration

Headquarters
Washington, DC 20546-0001

November 17, 2008

Reply to Attn of: Office of External Relations

Mr. Anatolii Nikolaevich Perminov
Head
Federal Space Agency
42 Shchepkin Street
Moscow, 129857
RUSSIA

Dear Mr. Perminov:

I appreciate your support in the on-going dialog regarding the Soyuz Investigation Commission. The flow of information was critical for a successful Flight Readiness Review prior to the successful launch of Soyuz TMA-13 (ISS Flight 17S). In order to continue that dialog, I plan to travel to Moscow January 26-30, 2009, and would appreciate your endorsement of these plans.

While in Moscow, I would like to review the status of the plasma testing, the testing and results of the returned pyro bolt investigations and the entry data, including the telemetry recordings we provided from Athens, Greece. I would plan to meet with you and your colleagues at Roscosmos, including Messrs Davydov and Krasnov, with Dr. Lopota and others at Energia, with Dr. Koroteev and the Soyuz Investigative Commission and with Mission Control Center – Moscow personnel.

As always, I and my team stand ready to support the on-going investigation in any way possible and to share information and findings to reduce the risk to our crews. I think it is extremely important that you continue the investigation, as you are doing, and that our technical teams continue their dialog to increase our shared understanding of the situation. I know we share crew safety as our highest priority.

Thank you for your continued support.

Sincerely,

William H. Gerstenmaier

William H. Gerstenmaier
Associate Administrator
for Space Operations

National Aeronautics and
Space Administration

Headquarters
Washington, DC 20546-0001

September 7, 2006

Reply to Attn of: Space Operations Mission Directorate

Mr. Anatolii Nikolaevich Perminov
Head
Federal Space Agency
42 Schepkina Street
Moscow 107996
Russia

Dear Mr. Perminov:

Reference my letter to you on September 1, 2006. We have overcome our concerns relative to Atlantis' fuel cell coolant pump. As a result, work is proceeding towards a launch of STS-115/12A on September 8, 2006. In order to increase our likelihood for launch, we would like to extend our launch window to September 9, 2006. If launch were to occur on September 9th, both the Space Shuttle Program and the International Space Station Program have agreed that undocking of STS-115/12A from the International Space Station will occur approximately 9 hours after the launch of Soyuz 13 on September 18, 2006. Discussions between U.S. and Russian operations teams indicate technical support for this plan. I respectfully request your concurrence as well.

Sincerely,

William H. Gerstenmaier

William H. Gerstenmaier
Associate Administrator
for Space Operations

cc:
FSA/A. Krasnov

National Aeronautics and
Space Administration

Headquarters
Washington, DC 20546-0001

June 18, 2007

Reply to Attn of: Office of External Relations

Mr. Alexey Borisovich Krasnov
Director
Piloted Space Programs
Federal Space Agency
42 Shchepkin Street
129857 Moscow
Russia

Dear Mr. Krasnov:

I am writing you to thank you for the outstanding support provided by Energia to resolve the Service Module computer anomaly that occurred during the STS-117 mission. Without the support of Mr. Sevastyanov and the Energia team the outcome of the computer anomaly resolution would not have been favorable. This was an extremely complex technical problem that required close cooperation between the Russian and United States experts to solve this anomaly before it became a crisis. Joint teams also had to be formed to prepare in case the anomaly resolution was not successful. The support to these other teams was outstanding. It is NASA management's opinion that Mr. Sevastyanov's personal involvement and commitment of critical Energia resources played a significant role in the successful and timely resolution of the issue. Only through strong management, technical expertise and data sharing between Energia, Boeing, ESA and NASA were we able to achieve a successful result. Mr. Sevastyanov represented Energia well and provided the critical support needed.

Again, I want to thank you for the outstanding support of Mr. Sevastyanov and the Energia team. Without their technical expertise and support work, the International Space Station would have been halted.

Sincerely,

William H Gerstenmaier

William H. Gerstenmaier
Associate Administrator
for Space Operations

cc:
Dr. Griffin
Mr. Perminov

National Aeronautics and
Space Administration
Lyndon B. Johnson Space Center
2101 NASA Parkway
Houston, Texas 77058-3696

November 30, 2006

Reply to Attn of: OX-06-132

Mr. Alexey Krasnov
Director of Piloted Space Programs Department
Federal Space Agency
42 Schepkina Street
Moscow 107996
RUSSIA

Dear Mr. Krasnov:

We are in receipt of your letter 109/1-10/854 on the subject of "clarification of definition of work, taking into account additional tasks." Modification 149 to Contract 15-10110, signed by both NASA and Roscosmos in December 2005, stipulated that Roscosmos would submit a proposal for definitization by January 30, 2006. Our requirements as documented in Modification 149, have not changed and we have yet to receive a proposal from Roscosmos. Your letter dated March 13, 2006, stated that "Agenda on upgrading production and technical facilities ... will be submitted in the near future." Eight months have elapsed and still we have not received a written proposal.

Regarding your statement that NASA has declined to place an order; NASA cannot place an order with Roscosmos, or any other vendor, without a written proposal. We are ready to confirm our orders for years 2009 through 2011 when we receive a proposal that conforms to the prices agreed to in Modification 149. Should your proposal pricing differ from what was agreed to in Modification 149, which you have verbally stated, then appropriate negotiations can commence after receipt of said proposal.

I look forward to your arrival the week of December 10, 2006, and hope that the proposal requested in Modification 149 will be available upon your arrival. I'm sure you share my concern, that the proposal delay and resulting contract delay may make it difficult for Energia to provide the services necessary to meet the ISS Program requirement for 6 person crew in April 2009.

Sincerely,

Michael T. Suffredini
Manager, International Space Station Program

cc:
OV/Roscosmos Houston Liaison Office
RSC-E/V. V. Ryumin

National Aeronautics and
Space Administration
Lyndon B. Johnson Space Center
2101 NASA Parkway
Houston, Texas 77058-3696

July 30, 2007

Reply to Attn of: OX-07-091

Mr. Alexey Krasnov
Director of Piloted Space Programs Department
Federal Space Agency
42 Schepkina Street
Moscow 107996
RUSSIA

Dear Mr. Krasnov:

In reference to your recent letter dated 07/24/07, the training procured under modification 166 to contract NAS15-10110 is not limited only to that required for qualification as flight engineer 2 (FE2); the requirement is to perform "...theoretical and practical training...to ensure delivery to and return from the International Space Station (ISS) by a Soyuz vehicle and landing in a Soyuz vehicle". With regard to rescue training for shuttle delivered astronauts, there is no provision allowing Roscosmos to charge more for the certification of an astronaut as flight engineer 1 (FE1), nor is there any provision allowing NASA to pay less for certification should training at the FE2 level only be provided.

The intent at the time of signing of modification 166 (and other modifications, for that matter) was to allow the Multilateral Crew Operations Panel (MCOP) to have flexibility in assigning crews, and for the contractual mechanism written to be flexible enough to implement those assignments.

NASA has contracted with Roscosmos for the conduct of this training. Consistent with our discussions the week of July 16, 2007 in Moscow, please continue to provide this training as purchased.

Sincerely,

Michael T. Suffredini
Manager, International Space Station Program

cc:
OV/Roscosmos Houston Liaison Office
RSC-E/V. V. Ryumin

National Aeronautics and
Space Administration
Lyndon B. Johnson Space Center
2101 NASA Parkway
Houston, Texas 77058-3696

August 15, 2007

Reply to Attn of: OX-07-099

Mr. Alexey Krasnov
Director of Piloted Space Programs Department
Federal Space Agency
42 Schepkina Street
Moscow 107996
RUSSIA

Dear Mr. Krasnov:

In my previous letter OX-07-091, dated July 30, 2007, I stated that the intent at the time of signing modification 166 and other modifications to the Roscosmos contract was to allow the Multilateral Crew Operations Panel (MCOP) to have flexibility in assigning crews, and for the contractual mechanisms as written to be flexible enough to implement those assignments without further funding required. My recollection of the negotiations and interpretation of the contractual language confirms this belief.

Having said that, I understand your position that the requirement to upgrade the certification of the ESA crewmember (and backup) to flight engineer 1 certification is not specifically driven by the decision of the MCOP; rather, it is due to the need to plan for contingencies such as Space Shuttle flight slips. I agree that there is additional re-training that you will be providing to enable this upgrade in flight certification this late in the training flow that goes beyond that which may be required under our contract with you.

I propose that we add this item into the mix of other items we have in front of us to resolve from a valuation perspective. My feeling today is the same as it has been in the past—that this is not a large item and should be easily resolved in the context of much larger and more important issues.

I look forward to working through this and other subjects with you as we move towards an on-orbit configuration that is mutually acceptable to all parties. My staff stands ready to meet with you via telecon and/or face-to-face as appropriate to move swiftly towards resolution of these items.

Sincerely,

Michael T. Suffredini
Manager, International Space Station Program

cc:
OV/Roscosmos Houston Liaison Office
RSC-E/V. V. Ryumin

National Aeronautics and
Space Administration
Lyndon B. Johnson Space Center
2101 NASA Parkway
Houston, Texas 77058-3696

Reply to Attn of: OX-07-162

December 20, 2007

Mr. Alexey Krasnov
Director of Piloted Space Programs Department
Federal Space Agency
42 Schepkina Street
Moscow 107996
RUSSIA

Dear Mr. Krasnov:

I would like to propose that we meet in Moscow to discuss the following topics:

1. ISS configuration
    a. Docking Cargo Module status and berthing approach/location
    b. Docking Compartment 2 status and docking approach/location
    c. Multi-purpose Laboratory Module status and docking location
2. 6-Person crew
    a. Treadmill #1 transition to Russian maintenance
    b. Urine processing
3. Soyuz rotation plan beginning in 2009
4. Soyuz crew training in U.S.
5. Technical Assistance Agreement between Roscosmos and United Space Alliance

With the next Heads of Agencies meeting approaching in the spring, it is critical that we reach resolution of these issues and get the International Space Station configuration stabilized before that time. In order to make our time as productive as possible, I would like our technical teams to work together to understand any issues associated with the above topics between now and mid January 2008, so that we can review their findings and make joint management decisions when we meet.

Following our meeting, my team will remain in Moscow to begin discussions with your representatives on NASA's crew and cargo needs post-2011.

From a schedule perspective, I propose to travel January 16, 2008, so as to attend the Automated Transfer Vehicle General Designer's Review on January 18, 2008. Should the GDR move, I'll adjust my travel plans accordingly. However, I will be available for our meetings beginning the week of January 21, 2008, regardless. Please let me know of your availability to support these important meetings.

Sincerely,

Michael T. Suffredini
Manager, International Space Station Program

cc:
OV/Roscosmos Houston Liaison Office
RSC-E/V. V. Ryumin

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
2101 NASA Parkway
Houston, Texas 77058-3696

July 23, 2008

Reply to Attn of OX-08-074

Mr. Alexey Krasnov
Director of Piloted Space Programs Department
Federal Space Agency
42 Schepkina Street
Moscow 107996
RUSSIA

Dear Mr. Krasnov:

In response to our joint discussions, pending an extension of INKSNA relief, the National Aeronautics and Space Administration (NASA) is considering the technical and logistical ramifications of acquiring up to18 seats on Soyuz vehicles between 2011 and 2014. It is understood that the provision of Soyuz commanders in relation to these 6 equivalent Soyuz vehicles may be problematic. NASA is considering allowing astronauts who have previously flown as Soyuz left seat engineer 1 to serve as Soyuz commanders. Our initial analysis of this concept has produced the following requirements for United States On-orbit Segment (USOS) personnel commanding Soyuz spacecrafts:

1. NASA shall be granted access to the Rocket Space Corporation-Energia (RSC-E) Soyuz manufacturing and assembly facilities for the duration of Soyuz production of these equivalent vehicles. This access shall include an on-site office inside the main RSC-E territory with a local telephone and access to the NASA computer and telephone network, and permission to install and maintain, as required, computer and telephone hardware. The office will be manned by a small team of NASA or NASA contractor personnel stationed in Moscow who shall be given semi-permanent RSC-E access badges. This team shall be allowed to visually review the manufacturing progress of the Soyuz vehicle as well as to have access to RSC-E specialists to discuss technical issues on a daily basis. Other NASA personnel, such as USOS astronauts in training for Soyuz flights, NASA Soyuz instructors and NASA International Space Station (ISS) Program management personnel shall be granted site access on an occasional basis.

2. If an in-flight anomaly with any Soyuz should occur during this timeframe, NASA shall be given full and open disclosure of information in order to consider continuation of this concept. To that end, NASA shall have liaison membership on any State or RSC-E Commission that is established to investigate in-flight anomalies with any Soyuz. The NASA representative assigned to the commission shall have full access to all data available to the commission, and shall be able to share these data and consult with other NASA representatives about the issues discussed by the commission prior to the completion of its work. The NASA representative will provide the results of any such discussions to the commission in a timely manner, thus enabling the use of NASA resources, where appropriate, to assist the commission's work. Upon completion of the commission's work, NASA shall be provided official copies of their final report and any associated data.

3. NASA shall be provided a console in the Soyuz flight control room in Mission Control Center-Moscow (MCC-M) for all phases of Soyuz flight when the Soyuz flight control team is on console for flight or simulations. The console shall provide seating space and communication and data interfaces (headsets, access to voice loops and data displays) for two people. One of these will be an interpreter who is certified to the level of "MCC Space-to-Ground" and who shall have the ability to transmit to the USOS Soyuz Commander (CDR) upon concurrence from the Soyuz Flight Director. This interpreter shall participate in all Soyuz complex training of the USOS crew at Gagarin Cosmonaut Training Center (GCTC).

4. At the start of training, an electronic copy of the full set of Soyuz on-board documentation along with technical flow charts (like the example presented when we met in Moscow in April 2008) shall be provided to NASA. NASA realizes this will not be the final on-board documentation and agrees that this full set of documentation shall match the documentation used at GCTC for training the cosmonauts. At approximately, 1 month prior to launch, the final, configuration-controlled electronic copy of the full set of Soyuz on-board documentation shall be provided to NASA.

5. The ISS/Soyuz training curriculum shall be quantified, documented, and provided prior to the start of training, for USOS astronauts designated as Soyuz commanders. Specific Soyuz payload training will not be included. By the end of August 2008, GCTC shall develop a preliminary Soyuz/Russian Segment (RS) training flow for a Soyuz CDR, for experienced USOS astronauts (who have successfully flown in the left seat and are within one year from landing). Results of this assessment will be reported at a joint NASA/Roscosmos telecon the first week in September. A significant reduction in training time will enable NASA to provide additional Soyuz commanders. With the exception of RS emergency training and basic Orlan training if required, all RS training will be deleted for USOS personnel. Soyuz theoretical training will not be required for USOS provided Soyuz CDRs.

6. By the end of August 2008, Roscosmos will provide to NASA the amount (hours) of initial Soyuz theoretical training that can occur at JSC. Crewmembers will be provided consultation then given comprehensive theoretical examinations by GCTC, covering all systems, to verify satisfactory knowledge prior to beginning complex training at GCTC. USOS crew training in GCTC shall be limited to the minimum amount that relies on existing GCTC unique mockups, plus all complex Soyuz simulations. This implies transfer of as much Soyuz theoretical training as possible from GCTC to Johnson Space Center (JSC) using:

   a. distance learning technology
   b. GCTC instructors traveling to JSC to provide any crew training that cannot be completed through distance learning
   c. current, configuration-controlled software model of all dynamic flight phases for JSC Soyuz "stand"
   d. current, configuration-controlled Soyuz training materials, with translation to be performed by NASA and verified by GCTC

7. The current practice of having a NASA instructor work side-by-side with the GCTC Soyuz instructor throughout complex training of the USOS crew at GCTC shall be maintained. This person shall be involved in all aspects of training, including performance evaluation in consultation with the GCTC instructor and formal participation in the Commission for the final and any intermediate examinations.

8. All complex Soyuz simulations at GCTC involving USOS crew on Soyuz vehicles shall involve key members of the MCC-M Soyuz flight control team, including the CPII, who shall have the ability to monitor simulator telemetry, hear simulated space-to-ground communication, and interact via the GCTC Soyuz Instructor with the crew as they would during in-flight operations. The MCC-M team would participate at GCTC or they would be integrated into the simulations from MCC-M.

9. Real-time Soyuz processed telemetry shall be provided to NASA for display in the ISS flight control room in Mission Control Center-Houston. It is acceptable to make available to NASA the same set of data available to the Moscow Support group in Houston.

These requirements represent a significant change to the current concept of Soyuz operations and crew training and will need substantial development between your specialists and ours. I urge you to consider them seriously and give me a written honest evaluation of your ability and willingness to accomplish the changes required to implement them, along with a point of contact for each of the above points.

Sincerely,

Michael T. Suffredini
Manager, International Space Station Program

cc:
OV/Roscosmos Houston Liaison Office

Enclosure 1

Subject: Today's Top Stories (April 28, 2009)
Date: Tue, 28 Apr 2009 06:45:14 -0500
From: "Harrington, J D. (HQ-NB070)" <jharring@nasa.gov>
Attachments: nasacl~1.doc

Today's Quote: "Politics is war without bloodshed while war is politics with bloodshed," Mao Tse-Tung, Chinese Communist politician (1893 - 1976).

Today's Stories: (Compiled from a variety of media sources. The NASA news clips are attached. You can also subscribe to a daily RSS Feed or Email of the NASA News Bulletin by visiting http://www.bulletinnews.com/NASA/subscribe.aspx from your NASA computer.)

1. Editorial Finds Lack Of NASA Administrator "Troubling."
2. Obama Sees Space Race As Model For Achieving Energy Goals
3. Tulsa Museum Applies For Retired Space Shuttle
4. Blogger Recommends Employee Level Report To Improve Safety At NASA
5. Orion Mockup Tested In The Atlantic Ocean
6. Teams Still Interested In Competing In Lunar Lander Challenge
7. Space Shuttle, Soyuz, Will Not Be NASA's Only Method To Reach ISS
8. SpaceX Completes Draco Qualification
9. Work Continues Toward Atlantis Launch
10. AMS Seen As "Crowning Glory" For ISS Research
11. NASA Satellites Help Deal With Earth's Health Issues
12. Swift Discovery Could Pin Down Reionization Era
13. GOES-R Problems Seen As Indication Of Overall Procurement Problems
14. JPL Highlighted As Vacation Destination By Popular Mechanics
15. Researcher Refines Method To Detect Exomoons
16. New Study Argues Against Dinosaur Killing Asteroid Theory
17. NASA Looks To Build Wind Farm In Sandusky, Ohio
18. As Airlines Lobby For NextGen Funding, Congress Debates How To Pay For It

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1. Editorial Finds Lack Of NASA Administrator "Troubling." The Houston Chronicle (4/28, 449K) editorializes, "As President Barack Obama ap hundred days in office tomorrow, a puzzling leadership hole remains at the top of the National Aeronautics and Space Administration." The lack of a nominee is "fueling suspicions by NASA supporters that the new administration is assigning a low priority to future manned exploration." The Chronicle finds the "lack of a permanent administrator... inexplicable and troubling. If President Obama is serious about his commitment to the future of the American space program, he needs to fill that vacuum without further delay.

2. Obama Sees Space Race As Model For Achieving Energy Goals. President Obama told the nation's scientists April 27 that the Cold War space race offers a model for meeting his goals of developing sustainable energy sources while minimizing the effect on global climate. Vowing a return to spending on scientific research comparable to that reached at the peak of space-race spending, Obama told the annual meeting of the National Academies of Science that "there will be no single, Sputnik moment" in the search for clean, renewable energy. Instead, spending will fall across a broad spectrum of technologies, including "solar cells as cheap as paint" and a renewed emphasis on space-based climate monitoring. "We will not just meet but we will exceed the level achieved at the height of the space race," he said. Despite the references to past accomplishments in U.S. space exploration, particularly during the Apollo era, and a generic call for "strengthening our weather forecasting, our Earth observation from space,"Obama did not elaborate on his plans for NASA. The White House has sent mixed signals on the subject in recent weeks, with both a call for continuing the human-exploration plans set in motion by President Bush and a reported $3.5 billion, four-year proposed cut in funding for those efforts. However, White House science adviser John Holdren addressed the topic in passing in an editorial for Science released the same day as Obama's speech. In listing "cross-cutting foundations of success" in meeting science and technology "challenges" under the Obama administration, Holdren included "maintaining and vigorously exploiting a cutting-edge set of capabilities in space, which must be understood not just as grand adventure and focus for expanding our knowledge of how the universe works, but also as a driver of innovation and a linchpin of communications, geopositioning technology, intelligence gathering, and Earth observation." Obama's only reference to NASA was oblique, in a mention of political censoring of Earth-science findings that burning fossil fuel and other human activities contribute to global warming. "The days of science taking a back seat to ideology are over," Obama said to sustained applause from the scientists in the audience.- Frank Morring, Jr. * morring@aviationweek.com

3. Tulsa Museum Applies For Retired Space Shuttle. The AP (4/27) reported, "Officials with the Tulsa Air and Space Museum & Planetarium ha home for one of the three soon-to-be-retired space shuttles." Jim Birdenstine, executive director of the museum, "says the Delta Program that launched America's first satellites into orbit was created in Tulsa and Saturn rockets were built in the city. The bay doors on the Space Shuttle Orbiter were built in Tulsa and mechanics and engineers in the city modified the Boeing 747 to carry space shuttles across the country."

4. Blogger Recommends Employee Level Report To Improve Safety At NASA. In a 1,373 word "UNI-Verse" blog post for iTWire (4/28), William Atkins writes on the recent Florida Today article and Aerospace Safety Advisory Panel (ASAP) report that both highlighted safety concerns with NASA. "In order to weave safety into Project Constellation, and for that matter, into NASA, as a whole, it must start--I think--at the employee level." Atkins focuses with problems at NASA, although he notes that they are universal with any large organization. "NASA and NASA-contractor personnel do have a small say in activities at NASA," and in order to rectify this, NASA's management needs to allow employees to "openly state problems and concerns without risk of reprisal." Atkins suggests "that a comparable ASAP report be issued each year that begins at the employee level, with employee groups, and that eventually winds up reporting on how

employees see safety and efficiency at NASA and its contractor companies."

5. Orion Mockup Tested In The Atlantic Ocean. Space.com
(4/28, Malik) reports, "The life-size mockup of the Orion Crew Exploration Vehicle...is undergoing a series of water landing trials this month in the Atlantic Ocean off the eastern coast of central Florida. They are the first ocean tests of a full-size NASA spacecraft since the Apollo capsule's development in the 1960s." Participants practiced "recovery techniques" as well as the capsule's performance in the water. "The sea trials are the first in which recovery teams attempted to attach a flotation collar around the Orion craft while it bobbed up in down with the ocean waves."

6. Teams Still Interested In Competing In Lunar Lander Challenge. In an article for the Space Review (4/27), Space Review editor Jeff Fous achieved a major milestone for both itself and NASA's Centennial Challenges program when it won first prize in Level One in the Northrop Grumman Lunar Lander Challenge (LLC)," but "lost in the celebrations...is that most of the $2 million in prize money allocated by NASA for the competition is still unclaimed." Seven LLC teams were at this year's Space Access conference and held an impromptu panel. According to Foust, "There's no sign of diminished interest in the LLC" and "these teams have, in general, made good progress in the last year, enough to suggest a real competition...may be taking shape for later this year." Foust, after describing the teams' progress, noted that the competition has changed from a single competition to a competition "season." John Carmack of Armadillo "indicated... that they were planning to go after Level Two as soon as possible. ... Doing it early, he said, allows them to then focus on other activities, although they would be willing to go back and do it again if another team also successfully flies Level Two during the season with better landing accuracy."

7. Space Shuttle, Soyuz, Will Not Be NASA's Only Method To Reach ISS. Popular Mechanics (4/27, Chatsky), in its April 2009 edition, made a Earth orbit besides the space shuttle and Soyuz that could be available for space-station flights" during the period after the shuttle is retired. The article gives a brief description of each spacecraft and the date they were placed into service, such as China's Shenzhou capsule, or would be available.

8. SpaceX Completes Draco Qualification. DRACO QUALIFICATION: Space Exploration Technologies (SpaceX) has completed qualification of its Draco spacecraft thruster and propulsion tank at the company's test site in McGregor, Texas. SpaceX says tests included 42 firings with more than 4,600 pulses of varying lengths and were performed in a vacuum test chamber to simulate the space environment. "The series resulted in a total firing time of over 50 minutes on a single thruster," the company adds. The Dragon spacecraft, which has been selected by NASA as part of its Commercial Resupply Services contract to carry cargo to the International Space Station (ISS) and return cargo to Earth, will use 18 Draco thrusters, each capable of around 90 pounds of thrust, to provide precision control in orbit and while approaching the ISS.- Guy Norris * guy_norris@aviationweek.com

9. Work Continues Toward Atlantis Launch. In the "Flame Trench" blog for Florida Today (4/27, 70K), Todd Halvorson wrote, "NASA is marching through a major payload test today as the agency and its shuttle fleet operators gear up for the planned May 11 launch of shuttle Atlantis." NASA and United Space Alliance workers are "in the midst of a two-day test aimed at verifying electrical connections between shuttle payload elements, their carriers, the orbiter and the flight deck." The tests are expected to be completed by this Thursday's Flight Readiness Review. Halvorson noted, "An end-to-end test of communications links between the cargo, the shuttle, NASA's Launch Control Center and NASA's Tracking and Data Relay Satellite system will follow later this week."

10. AMS Seen As "Crowning Glory" For ISS Research. Discovery News (4/27, Klotz) reported, "The crowning glory of the International Space S with preparing humans to live on the moon or finding a cure for Salmonella. It's a particle detector designed to hunt for an antimatter universe." NASA is planning as an "extra mission" to launch the Alpha Magnetic Spectrometer (AMS) in late 2010, a mission that Congress has authorized the mission, but has "has not yet allocated the funds...to." According to the article, after the mission was originally cancelled in 2003, the "outcry...was sharp, particularly because most of its $1.5-billion price tag was picked up by a huge and still-growing international partnership that is backing the program." Trent Martin, "who is overseeing the project for NASA at the Johnson Space Center," said, "AMS is a fitting experiment for the International Space Station. ... It's very big science. It's international cooperation at its best."

11. NASA Satellites Help Deal With Earth's Health Issues. In the "Space News Examiner" blog for the Examiner.com (4/27), Patricia Phillips wrote, "As panic over a swine flu pandemic builds, silent sentries patrol overhead, a benefit of the space program that often isn't as well-known. ... NASA uses satellites to monitor not only the Earth's environment, but health patterns -- and incoming problems -- as well." NASA's "primary tools" in this area are the Aqua and Terra satellites to monitor disease vectors. "NASA's other tools include the Tropical Rainfall Measuring Mission (TRMM), the Global Precipitation Measurement (GPM) mission and the National Polar-orbiting Operational Environmental Satellite System (NPOESS)." Phillips noted that the information from the satellites is "often provided to health and emergency management officials through the MODIS Rapid Response System at Goddard Space Flight Center. From wildfires to air pollution, NASA can provide images that help health officials provide timely and accurate warnings about airborne diseases."

12. Swift Discovery Could Pin Down Reionization Era. New Scientist (4/28, Courtland) continues reporting on the most distant object ever observed, which was discovered by the Swift spacecraft last Thursday. Swift observed a gamma-ray burst 13.1 billion light years from Earth. The burst is the "earliest object to be discovered from an era called 'reionisation', which occurred within the first billion years after the big bang. At that time, an obscuring fog of neutral hydrogen atoms was being burned off by radiation from the first stars and galaxies." Bloom called this a "watershed" event because it could help determine the timing of reionization. The article noted, "But building up a picture of the early universe will require finding many more distant bursts, and progress in discovering distant bursts has been slow" due to their rarity and the lack of telescopes that are "both sensitive and quick enough to measure very distant, short-lived GRB afterglows." NASA is "considering" funding the Joint Astrophysics Nascent Universe Satellite, which could detect these distance objects. Universe Today (4/27, Atkinson) also covered the story.

13. GOES-R Problems Seen As Indication Of Overall Procurement Problems. In the "Government Inc" blog for the Washington Post (4/27, 652K), Robert O'Harrow continued writing on problems with the GOES-R satellite program. "The price tag for a National Oceanic and Atmospheric Administration program to replace aging satellites has gone up by $670 million $7.67 billion. That rise coincides with a sharp drop in the data products satellites will produce, from 81 to 34, according to a review by the Government Accountability Office." O'Harrow commented, "It's another indication that most everywhere you look in the procurement world there are troubles."

14. JPL Highlighted As Vacation Destination By Popular Mechanics. The AP (4/28) reports, "If your interests run more to science than surfing or sunbathing, you may find yourself shouting 'Eureka!' when you discover the list of geeky getaways in Popular Science magazine's May issue." The magazine lists eight placed it recommends readers visit over the summer. NASA's Jet Propulsion Lab is among the recommendations.

15. Researcher Refines Method To Detect Exomoons. In the Centauri Dreams (4/27) blog, Paul Glister wrote, "Finding moons around extrasolar planets is an invigorating quest." David Kipping of the University College London has been working on a way to detect objects called "transit duration variation (TDV)" events, which measures velocity changes in a planet-moon system over time. In a new paper , Kipping "breaks transit duration variation itse difference between moons in a prograde or retrograde orbit" and "boost the exomoon detection method via TDV by about ten percent in magnitude." Glister noted that a "caveat" with this method is that it is "effective for a planet-moon system in which the plane of the two objects' orbits is aligned with the star-planet orbital plane. ... But it's interesting to note that in Kipping's view, exomoons at low inclination angles should be observable in the lightcurve

during any planet-moon eclipse."

16. New Study Argues Against Dinosaur Killing Asteroid Theory. Bloomberg News (4/27, Britt) reported, "The demise of the dinosaurs probabl occurred 300,000 years after a giant meteor struck what is now Mexico, scientists said, casting doubt on a popular theory that the impact triggered a mass extinction." The team "found sediments linked to the mass extinction that were deposited above the sediments from the time of the asteroid impact. Proponents of the Chicxulub impact theory explain this discrepancy in the sedimentary record with earthquakes and tsunamis resulting from the asteroid impact." The researchers also found that no species went extinct because of the asteroid impact. Gerta Keller of Princeton University "suggests that massive volcanic eruptions at the Deccan Traps in India may be responsible for the extinction. "

17. NASA Looks To Build Wind Farm In Sandusky, Ohio. WUPW-TV Toledo, Ohio (4/27, 9:29 p.m. CT) broadcasted, "NASA is looking at creating a wind farm near Lake Erie at a research center that it already operates. The project would happen right here at the NASA Plum Brook station, which is in Sandusky. NASA says that this entire idea so far is still in the planning stages. But last month the aerospace engineering agency began searching for private developers that were interested in working on a large-scale wind farm project. Officials say the developer will build, own and operate the wind farm. NASA plans to use some of the electricity that's generated, the rest of it will be sold." The AP (4/27) carried the report broadcasted by WUPW-TV.

18. As Airlines Lobby For NextGen Funding, Congress Debates How To Pay For It. Flight International (4/27, Turner) reported, "The total absence of federal dollars pledged to NextGen in US President Barack Obama's recent economic stimulus package is intensifying lobbying efforts by the nation's airlines." There has been "indecision over how to pay for a system that will cost the government up to $20 billion and airlines $20 billion for new equipment and training, with Washington undecided over whether to raise fuel taxes, taxes on tickets or impose take-off fees." ATA's David Castelveter said "the Senate was proposing a $25 fee per flight for anyone using IFR while the House of Representatives had no such provision but was proposing a slight increase in taxes."

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Creativity is all in your mind!

Subject: Shuttle, Station & Constellation News - April 30, 2009
Date: Thu Apr 30 10:40:31 2009 GMT
From: "Herring, Kyle J. (JSC-AP311)" </O=NASA/OU=JSC/CN=RECIPIENTS/CN=264244050>
To: Herring, Kyle J. (JSC-AP311); JSC-DL-SSP

NASA TV: ~5 p.m. CDT (6 Eastern) – STS-125 Flight Readiness Review news conference

Shuttle, Station & Constellation News
Thursday, April 30, 2009

HEADLINES AND LEADS

NASA Shuttle Retirement Postponed ... Maybe

Ed O'Keefe - Washington Post

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Budget Authorizes $2.5 Billion for NASA Shuttle Fleet

Andy Pasztor - Wall Street Journal

House and Senate leaders have agreed to authorize $2.5 billion to keep the U.S. space shuttle fleet flying through 2011, if such an extension is necessary to complete currently planned missions to the international space station. Funding to maintain shuttle operations past the current deadline of December 2010 is part of the nonbinding $3.4 trillion budget blueprint passed by the House and Senate on Wednesday.

House lawmakers in Washington vote to extend space shuttle program

Shelby Spires - Huntsville Times

Moves are being made by space shuttle supporters on Capitol Hill for NASA to stop the beginning of the shutdown of the shuttle program. NASA had been told to start terminating contracts and begin an orderly shutdown of the program starting Friday. Alabama lawmakers have expressed fears that any shuttle extension could drain money from future NASA development projects, like the Ares I rocket being developed in Huntsville.

NASA's long search for a new chief continues on (and on)

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Candidates for NASA's next chief so far can be divided into two categories: those who want the job but can't get political support and those who can get support but don't want the job. In the first column, put retired Air Force Gen. Scott Gration and Steve Isakowitz, the Chief Financial Officer of the Department of Energy and a former top NASA official. Both reportedly wanted the job but were shot down when lawmakers on Capitol Hill nixed their nominations.

NASA may abandon plans for moon base

David Shiga - NewScientist.com

NASA will probably not build an outpost on the moon as originally planned, the agency's acting administrator, Chris Scolese, told lawmakers on Wednesday. His comments also hinted that the agency is open to putting more emphasis on human missions to destinations like Mars or a near-Earth asteroid. NASA has been working towards returning astronauts to the moon by 2020 and building a permanent base there. But some space analysts and advocacy groups like the Planetary Society have urged the agency to cancel plans for a permanent moon base, carry out shorter moon missions instead, and focus on getting astronauts to Mars.

NASA's New Spaceship to Carry Fewer Astronauts

Tariq Malik - Space.com

NASA has cut the crew size for its new Orion spacecraft down from six seats to four in order to keep the space shuttle replacement on track for a March 2015 debut. The space agency made the decision earlier this month in order to meet its commitment to begin operational manned flights on the Orion Crew Exploration Vehicle - NASA's successor for its retiring space shuttles - by 2015.

Constellation versus everything else in NASA

O. Glenn Smith - Orlando Sentinel (Opinion)

(Smith is a former manager of Shuttle Systems Engineering at NASA's Johnson Space Center in Houston)

It is clear that we will not see significant increases in the NASA budget in the foreseeable future. Therefore, it is important that NASA's near-term programs are aimed at things that will be of most benefit to America over the next few years. In the near term, inspiration and real economically valuable results can come from meaningful human flights and accomplishments at the international space station.

Q&A: Alpha Magnetic Spectrometer

Irene Klotz - for BBC News

Samuel Ting, a Nobel Prize-winning physicist from the Massachusetts Institute of Technology (MIT), is the driving force behind a particle detector that is designed to operate on the International Space Station (ISS). The US space agency (Nasa) is still awaiting funding to fly the mission, which was cut from the space shuttles' manifest following the 2003 Columbia accident and the decision to retire the fleet in 2010 once the station was finished.

President Medvedev signs amended bill on lease of Baikonur

Itar-Tass

President Dmitry Medvedev has signed a Federal law on the ratification of a Protocol signed by Russia and Kazakhstan that amends a previous bill on lease of the Baikonur complex initially signed by the governments of the Russian Federation and Kazakhstan on December, 10, 1994. The State Duma passed the amended bill on April 10, and the Federation Council endorsed it on April 22, 2009, the Kremlin press service said.

New astronaut heroes set to join the Hall of Fame

Orlando Sentinel's The Write Stuff

Astronauts George "Pinky" Nelson, William Shepherd and Jim Wetherbee will join an elite group of American space heroes as they are inducted into the U.S. Astronaut Hall of Fame during a public ceremony at Kennedy Space Center Visitor Complex on Saturday, May 2. The event with be hosted by CNN's John Zarela.

'400 Years of the Telescope'

Not heavy on science, the TV special tells of the way technology informs philosophy.

Robert Lloyd - Los Angeles Times

It is the International Year of Astronomy, you more than likely do not know, and the quadricentennial of the invention that revolutionized the science. The birthday special "400 Years of the Telescope" aired Wednesday, and though it is, strictly speaking, 401 years since the first spyglasses appeared, it wasn't until 1609 that Galileo made the improvements that turned it from an instrument of terrestrial convenience to one of celestial investigation. So calculate your azimuths, kids, and let's party!

COMPLETE STORIES

NASA Shuttle Retirement Postponed ... Maybe

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NASA's Congressional supporters appear to have bought some time in their efforts to ease the Space Shuttle program's hard retirement date, as the House and Senate conference agreement on the budget resolution reached this week would fund Shuttle missions beyond September 2010.

The storied Space Shuttle program is set to end at that time to make way for future missions to the Moon and Mars with the Constellation Program. There is wide concern that a hard end date could jeopardize the safety of the eight remaining Shuttle missions and the thousands of government and private-sector jobs tied to NASA.

Without FY 2011 funding, NASA would be unable to continue any missions that did not launch in time. Missions regularly miss their scheduled launch dates since last-minute safety checks often reveal issues that merit a delay.

This week's agreement matches President Obama's fiscal year 2010 budget requests for NASA and then forecasts spending $2.5 billion more in FY 2011, which would allow the agency to fly any of the remaining shuttle missions beyond the current deadline.

"This budget is a significant step towards maintaining safety, minimizing the spaceflight gap, and preserving the highly skilled workforce at Kennedy Space Center and throughout Central Florida," Rep. Suzanne Kosmas (D-Fla.) said in a statement today. "Kennedy Space Center is an economic engine for our community and I will not stand idly by while these jobs are at risk."

Despite Kosmas' good cheer, the budget resolution merely provides a blueprint for lawmakers as the appropriations committees budget for fiscal year 2010 and beyond. While the panels generally follow the conference agreement's guidance, there's no guarantee.

While some wallet-watching lawmakers may be weary of extending the program, but an extension would save thousands of government jobs in Florida, Texas and elsewhere amid the economic downturn.

All of this is happening despite near-radio silence from the Obama administration on the future of NASA. The president has discussed NASA only once, during a meeting with reporters last month. Observers expect the White House to announce Obama's nominee for NASA administrator in the near future.

Budget Authorizes $2.5 Billion for NASA Shuttle Fleet

Andy Pasztor - Wall Street Journal

House and Senate leaders have agreed to authorize $2.5 billion to keep the U.S. space shuttle fleet flying through 2011, if such an extension is necessary to complete currently planned missions to the international space station.

Funding to maintain shuttle operations past the current deadline of December 2010 is part of the nonbinding $3.4 trillion budget blueprint passed by the House and Senate on Wednesday.

Extra budget authority for the shuttles – which was not requested by the White House or interim leaders of the National Aeronautics and Space Administration -- is still subject to future House and Senate appropriations bills. But it's the strongest signal yet that lawmakers want to maintain the option of a one-year delay in phasing out the aging shuttle fleet.

The retirement schedule is controversial because it affects thousands of aerospace industry jobs nationwide, and will partly determine the extent of the gap between the last shuttle mission and the first launch of replacement rockets and manned exploration vehicles NASA is now developing.

House and Senate budget conferees agreed on "the strategic importance of uninterrupted human access to space" and said the extra $2.5 billion is provided "in anticipation that the funding is needed" to safely "complete the construction and equipping" of the space station.

House lawmakers in Washington vote to extend space shuttle program

Shelby Spires - Huntsville Times

Moves are being made by space shuttle supporters on Capitol Hill for NASA to stop the beginning of the shutdown of the shuttle program. NASA had been told to start terminating contracts and begin an orderly shutdown of the program starting Friday.

Alabama lawmakers have expressed fears that any shuttle extension could drain money from future NASA development projects, like the Ares I rocket being developed in Huntsville.

The budget bill passed the U.S. House of Representatives today, it included money to extend the shuttle, and is expected to be taken up by the U.S. Senate this week.

House and Senate conference committee members came to an agreement on the budget resolution. The agreement includes language that removes a provision that a hard deadline for shuttle retirement, which had been set for May 1, or Friday.

U.S. Sen. Richard Shelby, R-Tuscaloosa, and U.S. Rep. Parker Griffith, D-Huntsville, have both expressed reservations over extending the shuttle program if it would mean the Marshall Space Flight Center Ares rocket program would be delayed. Those rockets - Ares I and Ares V - are slated to replace the shuttle and perhaps be used to take astronauts to the moon.

The final budget resolution provides an additional $2.5 billion in fiscal year 2011 for the Shuttle program. The original budget would have slashed shuttle funding to about $100 million from about $4 billion a year.

Rep. Suzanne Kosmas, D- Fla., voted against the original House version citing the lack of flexibility and funding for the Shuttle program past 2010. Kosmas represents Florida's 24th Congressional District, which abuts much Merritt Island the location of Kennedy Space Center and it contains aerospace industry heavy Titusville.

Last week, Kosmas sent a letter to the chairs and ranking members of the House and Senate Budget Committees outlining the risks associated with a hard deadline and urging them to include a Senate provision that would give NASA the flexibility to fly the Shuttle into 2011 if necessary.

NASA's long search for a new chief continues on (and on)

Orlando Sentinel's The Write Stuff

Candidates for NASA's next chief so far can be divided into two categories: those who want the job but can't get political support and those who can get support but don't want the job.

In the first column, put retired Air Force Gen. Scott Gration and Steve Isakowitz, the Chief Financial Officer of the Department of Energy and a former top NASA official. Both reportedly wanted the job but were shot down when lawmakers on Capitol Hill nixed their nominations.

As for the second category, add another military leader: retired Air Force Gen. Lester Lyles who told the Dayton Daily News that he was a top candidate but took his name out of the running. "I felt guilty. They need somebody," Lyles said to the paper. But, he added, "It would have been too big a financial penalty. I didn't want to do that to my family."

White House sources said that much of last week was spent in "serious" interviews with candidates looking to replace former NASA Administrator Michael Griffin, although it's uncertain whether these interviews indicate that President Obama is closer to naming someone or if it's simply part of the vetting process.

So who's left? One name on the list is Lori Garver, a former NASA official who helped the Obama team during the campaign and the transition. And U.S. Sen. Bill Nelson, D-Florida, has been pushing the name of former NASA astronaut Charles Bolden (the two flew aboard the shuttle together in 1986).

But it's unclear whether the White House has a frontrunner anymore.

In the meantime, acting administrator Christopher Scolese visited the Capitol Hill today for a U.S. House hearing on the NASA budget. Much of the conversation centered on how NASA would spend its $1 billion in stimulus money, but many of the participants debated more general questions as the space agency is waiting for both a new leader and a publicly-released budget.

NASA may abandon plans for moon base

David Shiga - NewScientist.com

NASA will probably not build an outpost on the moon as originally planned, the agency's acting administrator, Chris Scolese, told lawmakers on Wednesday. His comments also hinted that the agency is open to putting more emphasis on human missions to destinations like Mars or a near-Earth asteroid.

NASA has been working towards returning astronauts to the moon by 2020 and building a permanent base there. But some space analysts and advocacy groups like the Planetary Society have urged the agency to cancel plans for a permanent moon base, carry out shorter moon missions instead, and focus on getting astronauts to Mars.

Under Scolese's predecessor, Mike Griffin, the agency held firm to its moon base plans. But the comments by Scolese, who will lead NASA until President Barack Obama nominates the next administrator, suggest a shift in the agency's direction. He spoke to the Subcommittee on Commerce, Justice, Science, and Related Agencies of the House Committee on Appropriations.

Scolese was asked repeatedly whether NASA could still make it to the moon by 2020 under the proposed 2010 budget, but failed to give a clear yes or no, and his answers suggested the agency's plans were in flux.

Short trips

"We were looking at an outpost on the moon, as the basis for that [2020] estimate and that one is being revisited," he said. "It will probably be less than an outpost on the moon, but where it fits between sorties, single trips, to the moon to various parts and an outpost is really going to be dependent on the studies that we're going to be doing."

"Recall [that] the Vision [for Space Exploration] was not just to go to the moon as it was in Apollo, it was to utilise space to go on to Mars and to go to other places," he added. "We've demonstrated over the last several years that with multiple flights we can build a very complex system reliably – the space station – involving multiple nations...and we'll need something like that if we're going to go to Mars."

Scolese's further comments hinted that the agency's plans might shift to include a greater emphasis on destinations beyond the moon. "So what I would like to see from NASA over time is an architecture that...will give us flexibility for taking humans beyond low-Earth orbit and allowing us to have options for what we can do at the moon as well as other destinations...[like] Mars or an asteroid...so that there are options on what we do in 2020," he said.

Vague answers

Scolese's vague answers on whether NASA believed it could meet its 2020 moon deadline, as well as similarly unclear answers from Doug Cooke, NASA's associate administrator for exploration systems, left the subcommittee's chair, congressman Alan Mollohan, wondering whether the agency had been given new directions.

"Does the 2010 budget request impact in any way our target – is this so complicated – our target of getting to the moon by 2020?" he asked. "Is there any consideration being given within the organisation to not attempting to meet the 2020 moon [return]...is there any reconsideration of going there? What is going on here?"

Cooke replied: "The direction that we have is to continue to pursue the 2020 date," but added that the agency was still assessing how the 2010 budget might affect that.

Some clarification about any shift in NASA's goals and priorities could come in early May, when the Obama administration's detailed 2010 budget proposal for NASA is set to be released.

NASA's New Spaceship to Carry Fewer Astronauts

Tariq Malik - Space.com

NASA has cut the crew size for its new Orion spacecraft down from six seats to four in order to keep the space shuttle replacement on track for a March 2015 debut.

The space agency made the decision earlier this month in order to meet its commitment to begin operational manned flights on the Orion Crew Exploration Vehicle - NASA's successor for its retiring space shuttles - by 2015. Before the crew reduction, the agency was preparing two parallel Orion designs: a six-person version to ferry crews to the International Space Station, and a four-seater to send astronauts back to the moon by 2020.

"We're not giving up on the six-crew capability of Orion," said Jeff Hanley, NASA's program manager for the Constellation project that includes Orion and its Ares rockets, on Wednesday. "We will need it someday. We don't need it early."

NASA's Orion spacecraft are capsule-based vehicles designed to replace the space agency's three aging space shuttles: Discovery, Atlantis and Endeavour. The orbiters are due to retire at the end of 2010, though Congressional lawmakers have drawn up a budget resolution that could delay mothballing the fleet until at least 2011 if approved.

Hanley said the decision to reduce Orion's crew size for the near-term stemmed from a recent report on ways NASA could accelerate its Constellation program efforts to build the new spaceship, retire the space shuttles and begin operational flights with the new craft in 2015. Cutting the crew size eliminates the extra time and funding needed to design, build and certify two different Orion vehicles - the four-seater and six-seater - at the same time.

"We felt that that was a good program management option to go exercise to simplify the design a little bit," Hanley told reporters in a teleconference today.

Bridging the shuttle gap

NASA already expects a gap of up to five years between the shuttle fleet's retirement and the first operational flight of Orion. During that time, NASA would have to rely on Russia's Soyuz spacecraft to launch astronauts to the station, as well as cargo ships built by Russia, Europe and Japan. The agency is also hoping to use American-built commercial spacecraft, such as the Dragon vehicle and a rocket under development by Space Exploration Technologies, to carry U.S. cargo to the station. Those privately built spacecraft, however, have yet to fly.

Last week, a Congressional Budget Office report questioned NASA's ability to meet its March 2015 target for operational Orion flights without an infusion of billions of dollars in extra funding. But Hanley disagreed, saying Wednesday that there is sufficient funding and congressional support for NASA's plans, but only if the agency draws up a streamlined schedule for testing.

Hanley said his team is considering canceling a second test flight of the Ares I rocket that will launch Orion capsules into space. The first test, Ares I-X, is slated to launch no earlier than late August. Engineers are now studying whether the effort to launch a second planned flight – Ares I-Y – is worth the money and manpower required, or if it should be folded into a full-up Ares I launch or other test.

More space for station

A four-person Orion option will free up some mass and cargo space for more supplies for station-bound missions, Hanley said. But it also means the space station will likely still require a second crew-carrying spacecraft, such as a Russian Soyuz, on hand to provide escape capability for the outpost's full six-person complement. Soyuz spacecraft can ferry three spaceflyers to the space station and stay parked in orbit for about six months. NASA's space shuttles can carry seven astronauts on missions that average just over two weeks in duration.

Soyuz vehicles were already expected to be flying to and from the space station at the time as Orion, NASA officials said.

"The four-seat Orion will still meet all U.S. needs, both for [space station] crew exchange and rescue," NASA spokesperson Katherine Trinidad told SPACE.com. "No additional Soyuz seats are needed as a result of the change in crew size."

The space station is expected to begin full six-person operations in late May, when a second Soyuz vehicle will ferry three new astronauts to the outpost.

"I think it's safe to say that our Russian partners will always want to have their own means to arrive at space station," Hanley said. "Having a diversity in access to the International Space Station is actually a good thing."

Constellation versus everything else in NASA

O. Glenn Smith - Orlando Sentinel (Opinion)

(Smith is a former manager of Shuttle Systems Engineering at NASA's Johnson Space Center in Houston)

It is clear that we will not see significant increases in the NASA budget in the foreseeable future. Therefore, it is important that NASA's near-term programs are aimed at things that will be of most benefit to America over the next few years.

In the near term, inspiration and real economically valuable results can come from meaningful human flights and accomplishments at the international space station. NASA can concentrate on a balanced program of aeronautics, robotic exploration, technology, energy and the environment, preparing for future manned exploration, and do it all within the budget it is likely to get.

It is time to reconsider whether we want to go ahead with the Constellation program to place a base on the moon. Many of us in the space community would be eager to recreate the thrill of Apollo. However, from the public's standpoint, going back to the moon in 2020 would not invoke the same sense of awe and inspiration it did 51 years earlier when it was a seemingly impossible task.

Recent opinion polls show that the public is only lukewarm about spending more than $45 billion and the next 12 to 15 years to go back to the moon.

The moon-base program is an expensive and lengthy diversion from a long-term goal of a human expedition to an asteroid or to Mars. The moon base alone will take considerably more time and money than planned, and will continue to cannibalize all other parts of NASA's limited budget — robotic exploration, science, applications, education, technology development and aeronautics. This is especially so in the near term as the Constellation program faces significant technical problems, budget overruns and schedule slips.

One definition of exploration is finding out what is there. As exemplified by the two magnificent rovers currently on Mars, robotic spacecraft are doing this job today at much less cost than human exploration missions. An enhanced robotic exploration program would enable a lot more true exploration of other places beyond the Earth's orbit, and at no risk to human life.

Regarding technology development for the future, critical systems development and qualifications necessary for lengthy future manned missions beyond Earth's orbit to an asteroid or eventually to Mars can be done better, quicker, cheaper and safer at the international space station. These include recyclable water and food, ion and other advanced propulsion, electric-power generation, better hygiene systems, recyclable environmental systems, in-flight repair techniques and advanced robotics.

The Constellation plan is to close down the shuttle at a time when there is no replacement for America's manned flights to space for at least five years and probably more. After that, when the Ares/Orion starts to operate, there will be major safety issues for several years. It is important that the shuttle remain flying until a new cheaper and safer manned launch system is available and proven. If it is to be launched from Kennedy Space Center, any new launcher, whether it be Ares 5 or another, should be configured to be compatible with parallel operations of the shuttle.

If we end up with no capability for U.S. manned launches for five to eight years, and are forced to buy flights from Russia for our own astronauts, America's image around the world and in the USA would suffer, and many people would begin to question America's leadership in technology. The American people will resent sending American dollars and jobs to Russia when we need those dollars and jobs here.

Inspiration and optimism are more important than ever in these difficult economic times. The NASA space program, at one-half of 1 percent of the federal budget, is truly a bargain for America, and many Americans can say, "The NASA space program is one thing the federal government does that I am proud of."

Q&A: Alpha Magnetic Spectrometer

Irene Klotz - for BBC News

Samuel Ting, a Nobel Prize-winning physicist from the Massachusetts Institute of Technology (MIT), is the driving force behind a particle detector that is designed to operate on the International Space Station (ISS).

The US space agency (Nasa) is still awaiting funding to fly the mission, which was cut from the space shuttles' manifest following the 2003 Columbia accident and the decision to retire the fleet in 2010 once the station was finished.

Professor Ting spoke with reporter Irene Klotz from Geneva, where he is overseeing the final checkout of the Alpha Magnetic Spectrometer at Cern.

IK: How confident are you that the remaining funds for a shuttle mission to fly AMS to the space station will be forthcoming?

ST: I do not know. I have learned in the 15 years working with space experiments that you should only be confident once you are on the space station taking data. Before that time, anything could happen.

So my main job at this moment is to make sure the final phase of the assembly of the detector that nothing goes wrong. The other things are in the hand of God or the hand of Congress.

It is difficult to have a magnet in space because it tends to rotate in Earth's magnetic field, so if you're not careful, the space shuttle or space station will be a satellite with its own style of rotation

IK: Why have you persisted so hard to get this instrument flown? Why is it so important to you to get this to the station?

ST: One, this is a unique experiment because - as you know - all of the knowledge up until now (about) the cosmos has come from measuring light rays from different telescopes in space and on the ground. But in the cosmos, besides light rays, there are particles which carry charge ... antiprotons, protons, helium, antihelium, and so forth.

These have never been measured accurately at high energies. That's because once a particle carries charge, it must have a mass. And once it has a mass, it gets absorbed in Earth's atmosphere, so you have to go to space. Because it carries a charge, you need a magnet. Before (AMS) there's never been a large magnet in space.

It is difficult to have a magnet in space because it tends to rotate in Earth's magnetic field, so if you're not careful, the space shuttle or space station will be a satellite with its own style of rotation. So, in a sense, you walk into new territory in science.

IK: Was this your idea originally to fly a detector in space? Or did Nasa pursue you to propose an experiment for the space station? It's unusual to have a particle physicist involved in the shuttle/station programme.

ST: If you had read the New York Times in, I don't know, 1962 or so, there was an article with the headline "Physicists Discover Antimatter in Complex Form". That was my first experiment. That was the discovery of anti-deutrons which I did together with Leon Lederman, and that is the formation of the anti-proton with the anti-neutron to form complex nuclei.

So, since that time, I have been fascinated about whether there exists a Universe made out of anti-matter. You see, the Universe comes from a Big Bang. Before the Big Bang, it was a vacuum, and nothing exists in a vacuum.

So, at the beginning, if you had an electron, you must also have had a positron (the antimatter counterpart of an electron). If you had a proton, you must have had an anti-proton. In other words, there must have been equal amounts of matter and anti-matter.

It always troubled me: where's the Universe made out of antimatter? That was basically one of the reasons we proposed this experiment - to look at the consequences of the Big Bang.

Another reason, as you know, is that 90% of matter in the world is not observable. And because it cannot be seen, it is called dark matter. So the question is: what is the origin of dark matter?

Those are the two things you can only do on the space station and you need a large magnetic spectrometer to do that. The idea that on the space station you cannot do fundamental science is really not correct. You really can do fundamental science, though... doing experiments in space is somewhat difficult.

IK: Assuming AMS is flown to the space station next year, how long would it take before you would be able to start drawing some conclusions from the experiment?

ST: This doesn't depend on me. This depends on nature. What we will do... the experiment is actually very large. It's a very large magnet, a large detector.

That's why it costs close to $2bn (£1.3bn) to build it. What we want to do is ... in three years, if we still do not see antimatter, this means there's no antimatter to the edge of the observable Universe. In other words, this is a somewhat definitive experiment to see whether an antimatter Universe really exists or not.

IK: You mean in our present location in space and time?

ST: Yeah. We know antimatter doesn't exist in our galaxy, because if it existed it would collide with matter and would produce sharp X-rays. The fact that we don't see these sharp X-rays means it doesn't exist in our galaxy. But the Universe has 100 million galaxies, so you really need to do a very sensitive, very careful search for this.

President Medvedev signs amended bill on lease of Baikonur

Itar-Tass

President Dmitry Medvedev has signed a Federal law on the ratification of a Protocol signed by Russia and Kazakhstan that amends a previous bill on lease of the Baikonur complex initially signed by the governments of the Russian Federation and Kazakhstan on December, 10, 1994.

The State Duma passed the amended bill on April 10, and the Federation Council endorsed it on April 22, 2009, the Kremlin press service said.

The Protocol specified the legal status of Baikonur personnel and their families and guaranteed state protection of human rights and liberties to Russian citizens and their right to state defense and support away from Russia.

Russian citizens on staff of Baikonur cosmodrome, workers of law enforcement bodies and bodies of power of the Russian Federation deployed in Baikonur and their families are under Russian jurisdiction in cases of illegal activities against the Russian Federation and its citizens, servicemen's crimes and other offences committed beyond the Baikonur territory; all other offences fall under Kazakh jurisdiction, the Protocol said.

New astronaut heroes set to join the Hall of Fame

Orlando Sentinel's The Write Stuff

Astronauts George "Pinky" Nelson, William Shepherd and Jim Wetherbee will join an elite group of American space heroes as they are inducted into the U.S. Astronaut Hall of Fame during a public ceremony at Kennedy Space Center Visitor Complex on Saturday, May 2.

The event with be hosted by CNN's John Zarela.

More than 20 Hall of Fame astronauts are scheduled to attend, including Scott Carpenter, Buzz Aldrin, Robert Crippen, Al Worden, and Walt Cunningham.

Nelson was one of only four space shuttle astronauts to fly the Manned Maneuvering Unit untethered in space; William Shepherd was commander of the first crew to live aboard the International Space Station; and Jim Wetherbee was commander of the longest docked shuttle-Mir mission.

'400 Years of the Telescope'

Not heavy on science, the TV special tells of the way technology informs philosophy.

Robert Lloyd - Los Angeles Times

It is the International Year of Astronomy, you more than likely do not know, and the quadricentennial of the invention that revolutionized the science. The birthday special "400 Years of the Telescope" aired Wednesday, and though it is, strictly speaking, 401 years since the first spyglasses appeared, it wasn't until 1609 that Galileo made the improvements that turned it from an instrument of terrestrial convenience to one of celestial investigation. So calculate your azimuths, kids, and let's party!

Made by and featuring people who know and care about telescopes, it is handsomely put together (in "4K resolution digital cinematography," which does sound impressive), but also informed by a kind of gaiety that, given the subject, seems absolutely fitting. (Stars and planets and spiral nebulae -- what's not to like?) It is not particularly heavy on science, past explaining a few simple things about lenses and prisms and changing notions of astral geometry, and various steps in the ongoing refinement of instrument and image.

More to the point, it's a story of the way technology informs philosophy, as Ptolemy's Earth-centered universe gives way to Copernicus' heliocentric arrangement -- that's the one where we rotate around the sun, a system he found "more pleasing to the mind." ("It was a wonderful aesthetic idea," says one of the show's happy talking heads, "and it was right.")

In our own time, pictures of deep space have turned it into something more three-dimensional and colorful, more fluid and alive, than previously envisioned: It is not the old field of white pinhole lights through which the starships of our sci-fi films now sail, but multicolored towers of gas and dust, monuments to cosmic birth and death. It's a whole new universe.

The telescopes themselves, and the buildings that house them, are beautiful in their own right, set on mountaintops around the world, up where the air is crisp and clear, and in space itself, where the air is so clear as to be perfectly absent.

As the instruments get bigger and better, and they keep on building them bigger and better, the view goes deeper into the farthest reaches of everything -- just last week NASA's Swift space observatory picked up an exploding star more than 13 billion light-years away, the farthest and oldest cosmic event yet witnessed -- and we grow that much less wrong about where we are.

END

More detailed space news can be found at:

http://spacetoday.net/
http://www.bulletinnews.com/nasa/

-KjH
Kyle Herring
NASA Public Affairs - Space Shuttle Program

"I'm a little down under, but I'm feeling okay
Got a little lost along the way
I'm just around the corner to the light of day"

Subject: Today's Top Stories (May 6, 2009)
Date: Wed, 6 May 2009 06:38:12 -0500
From: "Harrington, J D. (HQ-NB070)" <jharring@nasa.gov>
Attachments: nasacl~1.doc

Today's Quote: "I am careful not to confuse excellence with perfection. Excellence, I can reach for; perfection is God's business," Michael J. Fox, quoted by Lorne A. Adrain in 'The Most Important Thing I Know', US (Canadian-born) actor (1961 -).

Today's Stories: (Compiled from a variety of media sources. The NASA news clips are attached. You can also subscribe to a daily RSS Feed or Email of the NASA News Bulletin by visiting http://www.bulletinnews.com/NASA/subscribe.aspx from your NASA computer.)

1. Obama Plans To Call For Constellation Review
2. NASA Wins Website Awards
3. Swede Indicted For Breaking Into NASA, Cisco Computers
4. Russia Trying To "Catch Up" To US Space Program
5. Local Stations Mark Anniversary Of Shepard's 1961 Sub-Orbital Flight
6. Canadian Has Large Collection Of Space Memorabilia
7. Students Design Camera For Use At ISS, Future Missions
8. Spaceflight Transition Continues With Michoud Switchover
9. Shuttle Personnel Cleared For Launch Preparations
10. NASA Launches Missile Detection Satellite For MDA
11. Barratt Called A "Real-Life Dr. McCoy."
12. Jacobs Will Take Over Michoud Management In July
13. STS-119 Astronauts To Visit Stennis To Discuss Mission
14. Future ISS Crewmembers Begin Training In Russia
15. Progress Ready To Undock From ISS
16. NASA Considers Rearranging Last Shuttle Flight Manifest
17. NASA Cancels Launch Due To Rainy Weather
18. NASA Selects Instruments For ESA Missions
19. USRA Secures Educational Grant From NASA
20. Scientists Already Adjusting Models To Match Fermi Data
21. Lack Of Solar Activity Seen As Unlikely To Lead To Another Little Ice Age
22. Squyres To Discuss Mars At Science Center
23. Dyson: Scientists Should Look For Plants On Europa
24. Hammel Leads Town's IYA Activities
25. WPost Supports NextGen, High Speed Rail As Cure For Air Congestion

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1. Obama Plans To Call For Constellation Review. The Orlando Sentinel (5/6, Matthews, Block, 221K) reports, "In a major turnaround, the Obama administration intends this week to order a review of the spacecraft program that NASA had hoped would one day replace the space shuttle, the Orlando Sentinel has learned." This follows "months of critical reports" of the Ares I rocket and Orion and is seen as "critical" for Kennedy Space Center workers. The study, which could start this month, will be announced at the same time as Obama's NASA budget plans on Thursday. Vincent Sabathier of the Center for Strategic and International Studies "said the White House had wanted to name a new administrator before announcing the study but that the difficulty in finding a leader and the shuttle's looming retirement forced the administration's hand." According to the article, proponents of the Direct rocket plan "are hopeful their design will get a second look," with TeamVision Corp CEO Steve Metschan "confident that the study will find the Direct design safer and more affordable - and that it will keep more jobs at Kennedy Space Center than Ares I or other rivals." The Los Angeles Times (5/6, 797K) reprints a version of the Orlando Sentinel article.

2. NASA Wins Website Awards. In the "Space News Examiner" blog for the Examiner.com (5/5), Patricia Phillips wrote that NASA, "often criticized for being stodgy in its media approach, won two prestigious 2009 Webby awards. NASA's home portal, nasa dot gov, was voted the People's Choice winner in the Government Website category." The Jet Propulsion Laboratory, "which has consistently provided cutting-edge leadership in media presentation, won Best Science Website for its Cassini portal highlighting the mission to Saturn."

3. Swede Indicted For Breaking Into NASA, Cisco Computers. The AP (5/6) reports, "A federal grand jury has indicted a Swedish man for allegedly hacking into computer networks at Cisco Systems Inc. and NASA." Philip Gabriel Pettersson was charged with five counts of intrusion and trade secret theft. "Sweden won't extradite its citizens to other countries, but it can prosecute citizens on behalf of foreign countries. US prosecutors in San Francisco say they're working with Swedish authorities on the case."

4. Russia Trying To "Catch Up" To US Space Program. The Czech Republic's Transitions Online (5/5, Abdurasulov) reported, "To return to the era of Soviet-US rivalry, it's not really necessary to travel back in time. A visit to this town in southwestern Kazakhstan will do." According to the article, the site and the spacecraft have "changed little" since the Soviet era. "Russia lags behind the US program by several years. The first flight of the new Russian manned

spacecraft is expected in 2018, three years after Orion. But the Kremlin is trying hard to catch up." The article cites the "growing competition" as the reason why some in the US "feel uneasy" with using Soyuz rockets to reach the International Space Station. "But NASA and American astronauts remain confident that political issues will not stop cooperation in space. 'I would remind you that the beginning of cooperation within the Mir-space shuttle program started at the end of the Cold War,' said US astronaut Michael Barratt."

5. Local Stations Mark Anniversary Of Shepard's 1961 Sub-Orbital Flight. KCRA-TV Sacramento (5/5, 5:11 a.m. PT) broadcasted, "It's a big day in history. It was on this day in 1961 that astronaut Alan Shepard became the first American in space. Shepard made a 15 minute flight in the Freedom Seven capsule launched from Cape Canaveral. The sub-orbital flight reached a height of 116 miles into the atmosphere." WPMT-TV Harrisburg, Pennsylvania (5/5, 10:40 p.m. ET) broadcasted, "A look at tonight's classic news clip, May 5, 1961. Astronaut Alan B. Shepard, Jr., became America's first space traveler. He made a 15 minute sub-orbital flight in a capsule launched from Cape Canaveral, Florida."

6. Canadian Has Large Collection Of Space Memorabilia. Canada's Toronto Star (5/6, Dale) reports on Roy Gutzke, who "owns one of the world collections" of space memorabilia, including "American astronauts' handwritten accounts of trips to the moon. Lining the cluttered walls are NASA medals, paintings by astronauts and small Canadian and American flags from various shuttle flights. On his couch is a flight suit worn by Marc Garneau, the first Canadian in space."

7. Students Design Camera For Use At ISS, Future Missions. The Beaumont (TX) Enterprise (5/5, Moore) reported, "A team of Lamar University engineering students spent the last year further developing a camera that, if all goes well, is destined for outer space." The team designed a hyperspectral camera for use at the International Space Station that "could play a role on a manned mission to Mars" since it could be used to "to determine the composition of rocks or other objects and detecting potential life forms. In a pinch, it might detect how much fuel is left in a tank if sensors malfunction or in other such crucial logistical tasks." Team members "said they felt fortunate to attend a university that offers the NASA space grant consortium program, something that adds a tinge of glamour to the task."

8. Spaceflight Transition Continues With Michoud Switchover. Jacobs Technology will take over from Lockheed Martin as support and facilities operations contractor at NASA's Michoud Assembly Facility in New Orleans, marking a major change as the space agency moves toward the post-shuttle era. Lockheed Martin had held the contract along with the prime contract to build the space shuttle external tanks in the government-owned facility. But with the shuttle program coming to an end, NASA won't be buying more of the big aluminum-lithium tanks. Under the three-year contract, Jacobs has the potential to earn $120.49 million in the year that began May 1, $40.11 million in the second year and $42.16 million in the third. Once tank work at the 2.2 million-square-foot facility ends, the plant will shift to manufacturing the Orion crew exploration vehicle and components for the Ares I crew launch vehicle. NASA tells Congress it will cost an additional $4.7 billion to add three shuttle missions to its manifest and continue flying between the planned end of the program after 2010 to late 2012. To fly 13 more missions to maintain U.S. human access to space until the Orion/Ares I stack is ready would require another $14 billion, NASA says. At the end of April, the shuttle program stopped maintaining the option of continuing shuttle operations, triggering a round of contractor work force reductions that will reach about 900 by the end of September as the agency no longer has a need for the parts they manufacture. Of that number, some 400 will be layoffs, another 350 will be jobs trimmed through attrition, and the remainder will be "badge changes" where workers take different jobs in the program, NASA says. Meanwhile, the agency says its March 2015 initial operational capability for the Orion/Ares I stack will not have all of the capability needed for Orion to operate at the International Space Station. That "full operational capability" won't come until 2016, when the Orion will be able to deliver crew to the station and stay there for as long as 180 day as a rescue vehicle.- Frank Morring, Jr. * morring@aviationweek.com

9. Shuttle Personnel Cleared For Launch Preparations. Florida Today (5/5, 70K) reported, "Non-essential personnel will be cleared from launch pad 39A at Kennedy Space Center later today as preparations continue for a...Monday launch of shuttle Atlantis to the Hubble Space Telescope." The personnel will be cleared as "initial pressurization...of two dozen helium and nitrogen tanks that help push fuel to the orbiter's main propulsion and maneuvering system engines" begins. "Pad A will be reopened Wednesday morning for a final charging of replacement batteries being hauled to Hubble, a process that takes about 20 hours."

10. NASA Launches Missile Detection Satellite For MDA. The AP (5/6) reports, "Department of Defense officials say an experimental satellite for the US missile defense program has been launched." A Delta 2 rocket from the Vandenberg Air Force Base launched the payload. "Rick Lehner, a spokesman for the Missile Defense Agency, says the satellite is equipped with experimental sensors designed to detect, track and provide targeting information on missiles."

11. Barratt Called A "Real-Life Dr. McCoy." Space.com (5/5, Malik) profiled astronaut Michael Barratt, who is currently aboard the Interna The article described him as the "closest thing to a real-life Dr. McCoy" because Barratt "literally helped write the textbook on spaceflight medicine...and is the associate editor for space medicine for the journal Aviation, Space and Environmental Medicine." Barratt also is trained to treat any injury at the station. "If an emergency comes up that he may not have the tools for, Barratt said he can always call on a team of doctors in Mission Control."

12. Jacobs Will Take Over Michoud Management In July. The AP (5/6, Sayre) reports, "A company with extensive involvement in the space prog NASA contract to manage and operate the Michoud Assembly Facility." Jacobs Technology received an initial three year contract for $120.5 million to manage the facility. Jacobs will replace Lockheed Martin starting July 1. "Lockheed Martin...will cut about 200 employees from its payroll over a timetable that is being determined, said company spokesman Marion LaNasa. An undetermined number of employees may go to work for Jacobs, while others may seek transfers within Lockheed Martin, LaNasa said." The AP notes, "Lockheed Martin has dominated operations at Michoud as the shuttle tank contractor. But with the shuttle program facing a 2010 end, other contractors will be moving into the facility." The New Orleans Times-Picayune (5/6, King, 178K) notes, "Jacobs has a similar contract at Stennis Space Center near Slidell providing maintenance and facility operations support at that NASA facility."

13. STS-119 Astronauts To Visit Stennis To Discuss Mission. The Hattiesburg (MS) American (5/5) reported, "Astronauts of space shuttle Dis 119 crew will visit NASA's John C. Stennis Space Center today to report on their recent mission to the International Space Station." The astronauts will "share mission highlights with Stennis employees and reporters. ... Immediately following the presentation, Mission Commander Lee Archambault will be available for media interviews. Other crew members scheduled to attend are Pilot Tony Antonelli and Mission Specialists Ricky Arnold and Joe Acaba."

14. Future ISS Crewmembers Begin Training In Russia. WPTV-TV West Palm Beach, Florida (5/5, 12:38 p.m. ET) broadcasted, "The next group of astronauts to take up residence at the International Space Station begins its training in Russia today. The Russian commander along with a Belgian and Canadian astronaut are expected to join the ISS crew at the end of May. The tests include spending the whole day inside a model of the ISS and solving various problems that might emerge during a space flight."

15. Progress Ready To Undock From ISS. Russia's RIA Novosti (5/6) reports, "The Russian Progress M-66 cargo spacecraft will undock on Wednesday from the International Space Station and become a temporary space lab before being 'buried' in the Pacific Ocean, Mission Control said." The spacecraft will conduct experiments for the Plasma-Progress program until May 18. "The Progress M-66 is one of the last cargo spacecraft equipped with analog control systems. The next generation of Progress vehicles will be digitally-controlled. "

16. NASA Considers Rearranging Last Shuttle Flight Manifest. NASA Spaceflight (5/6, Bergin) reports, "As the International Space Station (ISS) continues to build up to a six man crew, managers are looking into adding a Multi-

Purpose Logistics Module (MPLM) permanently on Station at the conclusion to the last logistics mission for the shuttle. Assessments are also taking place on potentially swapping the yet-to-be-baselined STS-134 with STS-133's place in the manifest." Managers noted that the station has "capability and consumables" for the six man crew until October even if JAXA's HTV and the STS-128 mission are delayed. "As part of ongoing discussions relating to the crew size on missions at the end of the current manifest, ISS managers are continuing to work out the best approach on fully utilizing the payload capability of the shuttle." According to the article, because of this, STS-134, which will carry the Alpha Magnetic Spectrometer, could advance in the manifest and STS-133 "would leave its MLPM berthed to the Station."

17. NASA Cancels Launch Due To Rainy Weather. The AP (5/6) reports, "NASA has canceled its planned launch of a satellite designed to detect hidden enemy weapons and inform US troops of their location." The launch of a Minotaur 1 rocket, carrying the TacSat-3 satellite was cancelled due to rainy weather. "A launch date would be announced later." The New York Times (5/6, Chang, 1.06M) website reports, "Liftoff is scheduled for Thursday from a launching pad at Wallops Island in Virginia, after being postponed by weather Tuesday." The article focuses on PharmaSat, a secondary payload on the Minotaur rocket, and nanosatellites in general. These types of satellites "allow NASA to perform simple space experiments more quickly and cheaply than would be possible on the space station or a larger satellite." A future nanosatellite built by the Ames Research Center, "scheduled for launching next year, will look at how well biological building blocks and microbes survive when directly exposed to the radiation, vacuum and other rigors of space." The Washington Post (5/6, Weil, 652K) reports the delay in its weather section. The Hampton Roads Virginian-Pilot (5/6) also covers the story.

18. NASA Selects Instruments For ESA Missions. In the Universe Today (5/4) blog, Nancy Atkinson wrote, "Making good on its promise to work together with other space agencies, NASA has selected two science instruments that will fly on board European Space Agency (ESA) spacecraft, one heading to Mars on the ExoMars rover, the other to Mercury with the BepiColombo orbiter." The selections were made "from eight proposals submitted in December 2008 in response to NASA's new Stand Alone Mission of Opportunity, known as Salmon. ... A key criterion is that science goals, including data archiving and analysis, must be accomplished for less than $35 million."

19. USRA Secures Educational Grant From NASA. Campus Technology (5/5, McCrea) reports, "With an eye on increasing the number of students interested in science, technology and engineering degrees, the Universities Space Research Administration (USRA) has secured $10 million from NASA to manage, enhance, and expand the Education Associates Program (EAP)." The agreement was made with the Ames Research Center. Sheri Klug, program director for the USRA and project administrator for NASA's Education Associates Program (EAP), "said this particular alliance is different from and more flexible than other NASA higher education partnerships. ... 'It's based on demand coming from scientists and engineers, who can turn to the program when they need to advertise an internship or search the applicant pool to find the talent that they need.'" Klug "said the USRA has 'hit the ground running' by setting up a software program that connects scientists, engineers, and students in a seamless fashion."

20. Scientists Already Adjusting Models To Match Fermi Data. Nature News (5/5, Hand) continued reporting on Fermi telescope findings which "herald the birth of a new age of dark matter exploration" even though they contradict the Advanced Thin Ionization Calorimeter (ATIC) experiment. "By Monday, theorists had already readjusted their dark-matter models to be consistent with the new results from Fermi. For many years, models commonly predicted that the energy of dark matter particles centered around 100 GeV. But the new data -- especially Fermi's -- are favouring models that would produce particles at least an order of magnitude heavier, on the scale of teraelectronvolts." According to the article, this "not only means that Fermi...will be crucial in nailing down dark matter, but it also has implications for particle colliders such as the Large Hadron Collider. ... The higher the mass, the harder it will be for the LHC to see them."

21. Lack Of Solar Activity Seen As Unlikely To Lead To Another Little Ice Age. Space.com (5/5, Moskowitz) reported, "Some media reports an suggested that the sun's present lack of activity could lead to another Little Ice Age, but many solar scientists say that's unlikely." NASA solar physicist David Hathaway thought the sun could be heading towards a "grand minimum," that could see no sun spots for decades, but this would not "significantly alter" global warming trends. The last time a grand minimum occurred was during the Little Ice Age. However, "Earth's atmosphere is packed with carbon dioxide and greenhouse gases produced by human activities. The warming effects of these heat-trapping gases will probably dwarf any slight cooling that occurs." According to the article, while "there is good evidence that solar activity does affect climate," the "strength of this effect and the reasons for it are not well understood."

22. Squyres To Discuss Mars At Science Center. In the "Baltimore Science News Examiner" blog for the Examiner.com (5/6), Mary Spiro write, "Answers to your questions about what's new with the Red Planet will be found at the Maryland Science Center on Friday, May 8 during a talk given by geologist Steven Squyres." Squyres is the principle investigator for the Mars rovers. Spiro comments, "Squyres is a fairly engaging speaker and plans to present a traditional lecture, so expect to see lots of images taken by the twin rovers followed by a question and answer session. The content will be aimed at a non-scientific audience."

23. Dyson: Scientists Should Look For Plants On Europa. New Scientist (5/6, Courtland) reports, "Physicist and futurist Freeman Dyson says should search for extraterrestrial life where it is easiest to find. ...' Specifically, he says spacecraft should look for flowers - similar to those found in Earth's Arctic regions - on icy moons and comets in the outer solar system." Dyson suggested that a spacecraft look for these flowers on Europa, whose interior may be hospitable to the plants. "Life could be visible from orbiting spacecraft, however, if it made a home in cracks in Europa's shell that connect the surface to the interior, Dyson said." If these plants were able to "spread to smaller, more distant objects in the solar system's two cometary reservoirs, the Kuiper belt and the Oort cloud, they would be less subject to gravity and could easily grow in size to maximise solar collection, Dyson said."

24. Hammel Leads Town's IYA Activities. The Danbury (CT) News Times (5/6, Tuz) profiles Heidi Hammel, a "senior research scientist and co-director of research at the Space Science Institute in Bolder, Colo., Hammel lives in Ridgefield and telecommutes to the institute." According to the article, Hammel has been "instrumental in Ridgefield's involvement in the 2009 International Year of Science, which celebrates the 400th anniversary of Galileo first using a telescope." Hammel "led the Hubble Space Telescope team that investigated Jupiter's atmospheric response" to the Shoemaker-Levy comet and "is an interdisciplinary scientist for Hubble's successor, the James Webb Space Telescope."

25. WPost Supports NextGen, High Speed Rail As Cure For Air Congestion. The Washington Post (5/6, 652K) editorializes, "A good argument fo Generation Air Transportation System (NextGen) and for high-speed rail can be seen in a graphic of aggregate daily air traffic over the New York area - thick knots of congestion caused, in part, by antiquated air traffic control systems and by folks jamming the skies with relatively short trips." The Post writes that "high-speed rail would give those fliers a reliable alternative," and that a NextGen air traffic control system "would allow more planes to get into and out of the air faster, relieving airport congestion and reducing delays." The Post adds that, "without the one-two punch of a modernized air traffic control system and an interconnected high-speed rail system, Mr. Obama's vision of revolutionized transportation will go unfulfilled."

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Creativity is all in your mind!

Subject: 6 May 2009: Obama Plans To Call For Constellation Review
Date: Wed, 6 May 2009 06:25:18 -0400
From: AIAA Daily Launch <DailyLaunch@AIAA.custombriefings.com>
To: Gerstenmaier, William H. (HQ-CA000)

If you are unable to see the message below, click here to view.

DAILY LAUNCH
TODAY'S NEWS FOR AIAA FROM NEWSPAPERS, TV, RADIO, & JOURNALS

Prepared exclusively for members of AIAA
The World's Forum for Aerospace Leadership

in affiliation with CUSTOM BRIEFINGS

Customized Briefing for William Gerstenmaier May 6, 2009

LEADING THE NEWS

Obama Plans To Call For Constellation Review.

The Orlando Sentinel (5/6, Matthews, Block) reports, "In a major turnaround, the Obama administration intends this week to order a review of the spacecraft program that NASA had hoped would one day replace the space shuttle, the Orlando Sentinel has learned." The study, which could start this month, will be announced at the same time as Obama's NASA budget plans on Thursday. Vincent Sabathier of the Center for Strategic and International Studies "said the White House had wanted to name a new administrator before announcing the study but that the difficulty in finding a leader and the shuttle's looming retirement forced the administration's hand." According to the article, proponents of the Direct rocket plan "are hopeful their design will get a second look."

Florida Today (5/6, Dean) reports Norman Augustine, "a retired chairman and CEO of Lockheed Martin Corp. and former president of the American Institute of Aeronautics and Astronautics, is the likely candidate to lead the study...sources said." A White House Spokesperson "declined to comment Tuesday on the forthcoming Constellation review," but said, "The US human spaceflight program is a very high priority, and the administration believes it is extremely important to ensure that the nation is on a vigorous and sustainable path to achieving its boldest aspirations in space."

In the "Space News" blog for the Huntsville (AL) Times (5/6), Shelby Spires writes, "Rep. Parker Griffith, D-Huntsville, confirmed the White House directed review of Ares, but said the program was still healthy." Griffith said, "The Ares I and V vehicles have been through several studies and reviews and I am confident that any additional study will show that the Ares program is our best option to take our astronauts safely to the space station and beyond." Universe Today (5/5, Atkinson) also covered the story.

FROM AIAA

From the AIAA Digital Avionics Technical Committee - ICNS 2009
Dinner & Keynote Speaker Updates

Dr. Paul G. Kaminski is our dinner speaker on Thursday, May 14th. Dr. Kaminski is Chairman and CEO of Technovation, Inc., a consulting company dedicated to fostering innovation, and to the development and application of advanced technology. He is also a Senior Partner in Global Technology Partners, a consulting firm specializing in business strategy and investments in technology, defense and aerospace-related companies.The title of his speech will be "**Next Gen - Making it all come together with the 4 P's**."

Margaret Jenny will provide the opening day keynote speech on Wednesday, May 13th. Jenny is President of RTCA, Inc. RTCA is a private, not-for-profit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance, and air traffic management (CNS/ATM) system issues. RTCA functions as a Federal Advisory Committee. Its recommendations are used by the Federal Aviation Administration (FAA) as the basis for policy, program, and regulatory decisions and by the private sector as the basis for development, investment and other business decisions.

Online Conference Registration ends Monday, May 11.

Nominate a Colleague for Fellow or Honorary Fellow
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AVIATION AND AERONAUTICS

Washington State May Fine Airline For Dumping Fuel Into Puget Sound.

The AP (5/5) reported, "Washington state's ecology department may fine Asiana Airlines over a plane that dumped fuel over Puget Sound before an emergency landing at Sea-Tac Airport." Curt Hart, a spokesman for the department, said "that some of the jet fuel...reached the water," but that "state action will depend on the investigation by the Federal Aviation Administration and National Transportation Safety Board." He added that "the state does not want to discourage necessary emergency actions."

Eurohawk UAV Prototype Roll Out Planned For October.

Flight International (5/6, Coppinger) reports, "An October roll-out is planned for Germany's Eurohawk high-altitude long-endurance unmanned air vehicle at Northrop Grumman's Palmdale, California facility. But its first flight could be delayed until early 2010." The article reported that "the first flight will be a 48km (25nm) transit from Palmdale to Edwards AFB, where the prototype will undergo system, design and development (SDD) testing." Then, according to EADS, "the SDD Eurohawk [will] fly itself at 45,000ft (13,700m) from 'Edwards AFB to Manching in southern Germany via northern Scotland in mid-2010.'"

Report Predicts Range And Weight Problems For Early 787s.

Aviation Week (5/6, Norris) reports that "while 787 watchers are encouraged by the news that the first aircraft is due to be fueled for the first time on May 5, industry analyst Bernstein Research appears to be less optimistic. In a report published on May 1, it says weight problems on the first production batch could limit range capability by as much as 15%." The report also predicted that "the first delivery to ANA will not be made in the first quarter of 2010 as Boeing currently plans, and that full-rate production of 10 aircraft per month will not be achieved until mid-2013, some six months later than planned." The report cites "three issues: the timeline for certification; the resolution of weight and range issues on the aircraft; and the outlook for ramp-up of production rates."

Boeing Begins Cutting Jobs Amid Aviation Industry Woes.

Aviation Week (5/6, Mecham) reports, "Boeing has reduced its job count by nearly 4,000 positions across most of its employment units since the first of the year, achieving nearly 40% of the total it expects to shed in 2009." The article noted that "the number of jobs at Boeing Commercial Airplanes (BCA) was 65,972 as of April 30, down 1,687 from the Dec. 31 figure, but off only 242 from April 2008." Meanwhile, "employment has actually edged up within the company's other major production unit, Integrated Defense Systems (IDS)," which "stood at 70,023 as of April 30, rising 106 positions from the end of 2008," although "it is down 1,020 from the previous April and 1,437 from last year's high point in June."

Elon Musk Reveals Desire To Build A Supersonic Electric Plane.

TechCrunch.com (5/5, Rao) reported, "Last week, Elon Musk had a candid conversation with VC George Zachary at the Charles River Ventures CEO Summit. One of the most interesting things Musk talked about was his desire to see electric airplanes in the future-and perhaps even one day help develop these green, energy efficient planes himself." During the conversation, Musk said, "technically an electric plane gets more feasible as battery energy improves," noting that "its just a questions of the range." He explained that, "basically, the electrocarrier as it functions for a plane has to be very high and then ultimately, it's how you really use the fact that you have an electric motor driving the plane as opposed to a jet engine."

Cold War Bomber Mistakenly Takes Flight At UK Air Show.

Flight International (5/6, Kaminski-Morrow) reports, "UK air accident specialists are not intending to investigate an unusual incident at an air show during which a Handley Page Victor bomber unexpectedly became airborne during a high-speed taxi demonstration." The aircraft "had been participating in the 3 May event when it became briefly airborne, apparently reaching a height - based on photographic evidence - of at least 20-30ft." The UK's "Air Accidents Investigation Branch says it is 'aware' of the incident, [but] is not conducting an inquiry." The article noted that, "first flown in 1952 the Victor was, alongside the Vulcan and the Vickers Valiant, part of the Royal Air Force's nuclear deterrent 'V-bomber' fleet."

SPACE AND ASTRONAUTICS

NASA Launches Missile Detection Satellite For MDA.

The AP (5/6) reports, "Department of Defense officials say an experimental satellite for the US missile defense program has been launched." A Delta 2 rocket from the Vandenberg Air Force Base launched the payload. "Rick Lehner, a spokesman for the Missile Defense Agency, says the satellite is equipped with experimental sensors designed to detect, track and provide targeting information on missiles."

In the "Flame Trench" blog for Florida Today (5/6), James Dean writes, "NASA's Launch Services Program, which is based at Kennedy Space Center, oversaw the launch." Aviation Week (5/6, Mecham) notes the MDA "turned to NASA for launch assistance because the space agency had...ordered two Delta II launchers at a time when the defense agency had switched to larger Evolved Expendable Launch Vehicles, according to NASA Launch Manager Chuck Dovale." The Lompoc (CA) Record (5/6) also covers the story.

NASA Cancels Launch Due To Rainy Weather.

The AP (5/6) reports, "NASA has canceled its planned launch of a satellite designed to detect hidden enemy weapons and inform US troops of their location." The launch of a Minotaur 1 rocket, carrying the TacSat-3 satellite was cancelled due to rainy weather. "A launch date would be announced later."

The New York Times (5/6, Chang) website reports, "Liftoff is scheduled for Thursday from a launching pad at Wallops Island in Virginia, after being postponed by weather Tuesday." The article focuses on PharmaSat, a secondary payload on the Minotaur rocket, and nanosatellites in general. A future nanosatellite built by the Ames Research Center, "scheduled for launching next year, will look at how well biological building blocks and microbes survive when directly exposed to the radiation, vacuum and other rigors of space." The Washington Post (5/6, Weil) reports the delay in its weather section. The Hampton Roads Virginian-Pilot (5/6) also covers the story.

Progress Ready To Undock From ISS.

Russia's RIA Novosti (5/6) reports, "The Russian Progress M-66 cargo spacecraft will undock on Wednesday from the International Space Station and become a temporary space lab before being 'buried' in the Pacific Ocean, Mission Control said." The spacecraft will conduct experiments for the Plasma-Progress program until May 18. "The Progress M-66 is one of the last cargo spacecraft equipped with analog control systems. The next generation of Progress vehicles will be digitally-controlled."

Soyuz With Progress Arrives At Launch Pad. Kazakhstan Today (5/5) reported, "The rocket carrier Soyuz-U with the cargo transport ship Progress M-02M was delivered to the launch pad in the morning on May, 5th to the cosmodrome Baikonur, 'Kazakhstan Today' agency reports citing Roskosmos press service." The spacecraft is scheduled to launch May 8.

NASA Considers Rearranging Last Shuttle Flight Manifest.

NASA Spaceflight (5/6, Bergin) reports, "As the International Space Station (ISS) continues to build up to a six man crew, managers are looking into adding a Multi-Purpose Logistics Module (MPLM) permanently on Station at the conclusion to the last logistics mission for the shuttle. Assessments are also taking place on potentially swapping the yet-to-be-baselined STS-134 with STS-133's place in the manifest." NASA managers are "continuing to work out the best approach on fully utilizing the payload capability of the shuttle." According to the article, because of this, STS-134, which will carry the Alpha Magnetic Spectrometer, could advance in the manifest and STS-133 "would leave its MLPM berthed to the Station."

Whitehorn: Cost Of Spaceflight Should Be Cut In Half After Five Years.

The Middle East Hotelier (5/5, Greenwood) reports, "Virgin Galactic is considering setting up additional space flight bases in the Gulf, Scotland, Sweden and Australia, the spaceline's president Will Whitehorn has revealed." Whitehorn "said he envisaged the price of the ticket decreasing once the concept became more popular and more spacecraft had been built," predicting, "In five years we will get the price halved [to $100,000]." Whitehorn also thought the first commercial flight will occur "towards the end of next year or in 2011 at the latest."

In the Gizmodo (5/5) blog, Brian Lam interviewed Whitehorn about the history of the company and its passengers. When

Whitehorn was asked, "when's the price coming down to $10,000," he stated, "Once the program gets regularised, and we get enough volume, we will be able to reduce the costs. But we believe after 3 to 5 years, we can get it down to $100,000 from $200,000. We can get it down to $100,000 but don't think we'll get it down to $10,000." Whitehorn also noted that the WhiteKnight 2, when it delivers the space plane, "is also training the next day's travelers in its hull."

JAXA Plans To Use Hayabusa To Refine Asteroid Tracking System.

Japan's Yomiuri Shimbun (5/6) reports, "Hayabusa, a Japan Aerospace Exploration Agency space probe used for research on Itokawa, a near-Earth asteroid, is to be used to develop a system to help predict the orbits of asteroids that could collide with Earth, the agency said." Since the spacecraft will "almost certainly tumble into the atmosphere like an asteroid" when it returns to Earth in June 2010, "it is hoped it can be used to provide some idea of the accuracy of the system used to predict the course along which such a small celestial object can hit Earth." A team from JAXA has developed a new system to track and calculate asteroid trajectories. "The researchers tested the prototype on an asteroid," but "hope that they can improve their calculations further by collecting data on Hayabusa, as it is one object the agency knows will return to Earth."

New Angara Rockets Need More Money Before First Flight.

Flight International (5/6, Coppinger) reports, "Russia's Angara rocket needs a cash injection of billions more roubles to deliver the planned 2011 first flights of its 1.2 and A5 versions." Vladimir Nesterov, director general of the Khrunichev State Research and Production Space Center, which is the prime contracted, stated that there were no "big technical, organisational or production" issues. Instead, "Hardware and testing-related costs, combined with the difficult worldwide financial climate, have been the real challenges." According to the article, "The company's request for funds to complete this project comes after the Russian federal government gave the company Rb8 billion as part of a wider support package for the space industry, not linked to Angara."

Legislation and Policy

Pentagon Procurement Chief Wants Future Combat Systems Contract Reconfigured.

Bloomberg News (5/5, Capaccio) reported, "Boeing Co.'s contract to develop the Army's most expensive weapons system should be revised to tie the company's profit more closely to performance, according to Shay Assad, the Pentagon's director of procurement." Assad said that "Boeing's fixed profit should be cut and its potential bonus increased when the $159 billion Future Combat Systems program is reorganized this year." He explained that the current contract, which "frontloads the payouts so that Boeing could receive as much as 90 percent of the $2.2 billion total by December 2011," wouldn't provide "enough incentive...to insure the contractor would be properly motivated" throughout the life of the project.

Army To Launch Sweeping Review Of Aviation Requirements. Flight Global (5/6, Trimble) reports, "The US Army has launched the first major review of its aviation needs since the previous study led to canceling the Sikorsky/Boeing RAH-66 Comanche." The "Aviation Study-2" will look at "results from the sweeping modernization programmes launched with the Comanche's $14.6 billion budget," according to the Army's Deputy Chief of Staff Lt. Gen. James Thurman. He said "the group will review Aviation 1 study's finding and recommendations," and that "those areas that have been successful will be honed and retained," while "areas that have not been fully executed will be revisited to see if they can be executed and developed, and, if required, cancelled."

WPost Supports NextGen, High Speed Rail As Cure For Air Congestion.

The Washington Post (5/6) editorializes, "A good argument for the Next Generation Air Transportation System (NextGen) and for high-speed rail can be seen in a graphic of aggregate daily air traffic over the New York area – thick knots of congestion caused, in part, by antiquated air traffic control systems and by folks jamming the skies with relatively short trips." The Post writes that "high-speed rail would give those fliers a reliable alternative," and that a NextGen air traffic control system "would allow more planes to get into and out of the air faster, relieving airport congestion and reducing delays." The Post adds that, "without the one-two punch of a modernized air traffic control system and an interconnected high-speed rail system, Mr. Obama's vision of revolutionized transportation will go unfulfilled."

AIAA in the News

AIAA Selects Winners Of International Cooperation Award.

The American Institute of Aeronautics and Astronautics (5/5) announced that it "has selected Dr. John E. Lamar...and Dr. Ing. Dietrich Hummel, of the Institute of Fluid Mechanics, Technical University of Braunschweig...to receive the AIAA International

Cooperation Award for 2009. Drs. Lamar and Hummel will receive the award at the AIAA Aerospace Spotlight Awards Gala on May 13." The pair is being honored "for their outstanding leadership of international workgroups that studied, and improved the understanding of, vortical flow phenomena concerning fighter aircraft and delta wings." Their work "led to a memorandum of agreement allowing NASA and foreign partners to conduct flow field tests in Europe on a NASA test model and four test models contributed by the European partners."

AIAA, ASC Congratulate James H. Starnes, Jr. Award Winners.

The American Institute of Aeronautics and Astronautics (5/5) announced that it "and the American Society for Composites (ASC) congratulate the winners of the inaugural AIAA-ASC James H. Starnes, Jr. Award, Raphael T. Haftka, Distinguished Professor of Mechanical and Aerospace Engineering at the University of Florida, and C. T. (Chin-Teh) Sun, Neil A. Armstrong Distinguished Professor of Aeronautical and Astronautical Engineering at Purdue University." The award is given to "recognize continued significant contribution to, and demonstrated promotion of, the field of structural mechanics over an extended period of time" and will be given on May 6 "as part of the 50th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference."

ALSO IN THE NEWS

Students Design Camera For Use At ISS, Future Missions.

The Beaumont (TX) Enterprise (5/5, Moore) reported, "A team of Lamar University engineering students spent the last year further developing a camera that, if all goes well, is destined for outer space." The team designed a hyperspectral camera for use at the International Space Station that "could play a role on a manned mission to Mars" since it could be used to "to determine the composition of rocks or other objects and detecting potential life forms. In a pinch, it might detect how much fuel is left in a tank if sensors malfunction or in other such crucial logistical tasks." Team members "said they felt fortunate to attend a university that offers the NASA space grant consortium program, something that adds a tinge of glamour to the task."

USRA Secures Educational Grant From NASA.

Campus Technology (5/5, McCrea) reports, "With an eye on increasing the number of students interested in science, technology and engineering degrees, the Universities Space Research Administration (USRA) has secured $10 million from NASA to manage, enhance, and expand the Education Associates Program (EAP)." The agreement was made with the Ames Research Center. Sheri Klug, program director for the USRA and project administrator for NASA's Education Associates Program (EAP), "said this particular alliance is different from and more flexible than other NASA higher education partnerships. ... 'It's based on demand coming from scientists and engineers, who can turn to the program when they need to advertise an internship or search the applicant pool to find the talent that they need.'"

Subject: Today's Top Stories (May 7, 2009)
Date: Thu, 7 May 2009 07:05:03 -0500
From: "Harrington, J D. (HQ-NB070)" <jharring@nasa.gov>
Attachments: nasacl~1.doc

Today's Quote: "Each painting has its own way of evolving...When the painting is finished, the subject reveals itself," William Baziotes.

Today's Stories: (Compiled from a variety of media sources. The NASA news clips are attached. You can also subscribe to a daily RSS Feed or Email of the NASA News Bulletin by visiting http://www.bulletinnews.com/NASA/subscribe.aspx from your NASA computer.)

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1. Upcoming Budget Could Require NASA To Make Program Choices. The Huntsville (AL) Times (5/7, Spires) reports, "The White House is scheduled to release the NASA budget today, but it probably won't give everybody what it wants" because of its "conflicting priorities that pit science research against the space shuttle against the Ares rocket program, developed at Marshall Space Flight Center. Also, the Obama administration is expected to order a cost and progress review of Ares. " The budget is expected to give NASA $19 billion. "The bottom line is that 'NASA needs an extra $4 billion a year to keep doing what it is doing according to Congress' budget office analysis,' said Dr. Scott Pace, director of space policy at George Washington University," and "if the White House and Congress wants to keep (NASA) on the current resource level, then there are choices to be made." Victoria Samson, a space and defense expert with the Secure World Foundation, also believes choices have to made, but cites "leadership" as NASA's "chief problem." Samson said, "There's no NASA administrator right now, and not likely to be one for a while. ... Nobody is in there pulling for NASA that has access to the White House."

2. White Paper Analyzes Griffin's Tenure At NASA. In the Space Politics (5/6) blog, Jeff Foust wrote, "A reader pointed me to a new white paper, Launching a New Mission: Michael Griffin and NASA's Return to the Moon , published late last month by the IBM Center for Business in is written by W. Henry Lambright." The paper is a "chronological overview of Griffin's time at NASA, along with a set of lessons learned at the end. Most of the material should be familiar to people who followed NASA affairs." Foust highlighted on passage "regarding a late 2005 meeting at the White House that featured President Bush, Vice President Cheney, Griffin, and several other key officials about the future of NASA and its budget."

3. NASA Plastic Approved For Use In Heart Device. The Minneapolis Star Tribune (5/7, Moore, 354K) reports, "A 'super plastic' invented by NASA engineers for use in aeronautic and space applications is now being used in a medical device that treats people suffering from heart failure." The material was developed at the Langley Research Center by Rob Bryant to replace metal parts on planes, helicopters, and "space vehicles." The FDA approved the Attain Ability heart lead wire for use in Medtronic's cardiac resynchronization device on Wednesday. "NASA licensed the technology to a Virginia power company, which investigated whether the insulation could prevent intake pipes at power plants from getting clogged with marine life. While that project didn't pan out, other companies such as Medtronic found ways to adapt the technology."

4. Baker Thanks Cytek Workers For Their Efforts. The Olean (NY) Times Herald (5/7, Chapman) reports, "NASA astronaut Ellen Baker gave a talk about her experiences on three missions into orbit aboard the space shuttle" to Cytek employees on Tuesday. "Cytec manufactures components for the space shuttle's external fuel tank for Lockheed Martin and NASA. The visit was in appreciation of the work that is done by employees at Cytec."

5. Students Meet With Arnold At NASA HQ. Maryland's The Gazette (5/7, Holzheimer) reports, "For about a dozen Bowie High School students who are interested in math and science, Friday's field trip was a chance to welcome back one of their own: Richard 'Ricky' Arnold II, a Bowie High graduate who returned from the International Space Station on March 29." The students traveled to NASA headquarters fro the trip. "Arnold will be the commencement speaker at Bowie High's graduation ceremony June 4."

6. NASA Retiree Pleads Guilty On Child Pornography Charges. The WTOP Radio (5/6) website reported, "An 81-year-old, retired NASA scientist government computer to download child pornography." Per Gloersen pled guilty Wednesday to "one misdemeanor count of violating a NASA security regulation." Attorneys on both sides will recommend Gloersen be sentenced to five years probation. "According to the plea, Gloersen still had access to a government computer while retired. He twice infected his computer with a virus while trying to view pornographic files. ... Those images were found during a search of his home in December."

7. NASA History Still Missing After 2002 Moon Rock Heist. In the Gizmodo (5/6) blog, Carmel Hagen detailed how "rogue NASA interns stole m rocks" in 2002. Thad Roberts and Tiffany Fowler stole a safe containing "tainted" lunar rocks that could no longer be used for science. "There is significant frustration among NASA employees regarding the tested rocks. Tainted as they may be, many feel they deserve to be at least on display. ... To Thad Roberts, the problem of the underutilized-but-valuable moon rocks had a simple answer. He told me that if they were useless to science, he saw no harm in stealing them. And the fact he stole the safe, not the more easily taken fresh rocks, seems to back this up." The two were later arrested. "Supposedly, two significant pieces of NASA history went missing during the time of the crime, and have not been recovered: The original video tapes of the 1969 Lunar Landing, and six folders of more mysterious content that were supposedly stored in the safe. Thad claims to have never seen them."

8. Blogger Endorses INSPIRE Program. In the "GeekDad" blog for Wired Magazine (5/6), Brian McLaughlin wrote, "Many parents would have given anything to work for NASA when we were young. A NASA education program seeks to give today's high school students that very opportunity." McLaughlin commented NASA's Interdisciplinary National Science Program Incorporating Research Experience (INSPIRE) program, which is now taking applications, is "a great way to encourage" high school students "that is interested in a career in science or engineering."

9. Textron To Develop Orion Spacecraft's Heat Shield. The Boston Business Journal (5/6, Noblett) reported, "Textron Defense Systems will p National Aeronautics and Space Administration with materials for a heat shield on its next-generation Orion spacecraft, the company announced Wednesday." The company has "spent three years redesigning its heat-deflecting material, Avcoat, used in protecting the original Apollo spacecraft, for the new NASA vehicle."

10. New Internet Protocol Ready To Be Tested At ISS. The Economist (5/6) website reported, "America's space agency, NASA, has been researc Delay (or Disruption)-Tolerant Network protocol, or DTN. The idea is to introduce to space the automatic protocols that enable seamless communication on the terrestrial internet." The system was first tested last November on the EPOXI spacecraft, but "NASA is now poised to install newer versions of this software on the same probe and on the International Space Station." If all goes to plan, all of the systems should be running by September. "Researchers at Ohio University are already distributing a version of what is known as the DTN protocol stack, so that computer programmers can write new programs that will use this new protocol. That will require new e-mail clients, web browsers and file-transfer clients that could be used on the International Space Station or other future manned space missions."

11. Scientists Say Warp Speed Propulsion Technology "Not Impossible." WFXT-TV Boston (5/6, 11:14 p.m. ET) broadcasted, "It is a far out notion that has Trekkies setting their faces to 'stunned.' Some NASA physicists saying that warp speed, the fsster than light travel technology, that was always preceded with a 'beam me up Scotty' on the 1960 show, may be more science future than fiction. Scientists say the notion of space-time displacement is complex but it is not strictly impossible. And some studies have even claimed to have discovered the fundamentals that could make warp speed a reality."

12. Hubble Will Be "New" After Repair Mission. Spaceflight Now (5/6, Harwood), in a 9,011 word article, continued reporting on the upcomin shuttle mission, focusing on the work that will be done to the Hubble space telescope. The article goes into extensive detail on the upgrade and the history behind the mission. "NASA has spent about $10 billion on the Hubble Space Telescope to date, making it one of the most expensive science projects in history. Asked whether it made sense to spend more money on a 20-year-old space telescope, former NASA Administrator Mike Griffin...said it makes all the sense in the world." Griffin noted that after the mission Hubble will be a "new telescope" because of all the system changes, which was echoed by several others quoted in the article. Ed Weiler, associate administrator for space science, said, "What's amazing is, whenever a new telescope comes out on the ground, a press release will always come out that 'oh, this can see a hundred times better than Hubble, or 10 times better.' Yeah, it can, probably, over a very, very tiny field of view. But you don't see Eagle nebulas on the cover of Time Magazine taken from the ground. It's taken from Hubble." Bruce Margon, "former associate director for science at the Space Telescope Science Institute in Baltimore, said shuttle servicing missions and NASA's ability to upgrade the telescope are the keys to the project's success."

13. Logistics Complete For ISS Crew Size Increase. The MIT Technology Review (5/6, Bauser) reported, "On May 29, the crew of the Internati double, from three astronauts to six. In a media briefing held today, NASA said that it has accomplished the necessary tasks ahead of Expedition 20--a Soyuz mission that will carry the second half of the crew, scheduled to launch on May 27." In order to deal with the increase in crew size, "NASA built a comprehensive water recovery system. ... The system has had a few technical difficulties, but according to Dan Hartman, manager of Integration and Operations for the ISS program, it should be operational by next week. A new toilet, crew quarters, galley, and treadmill...have also been developed." Ben Pawlik, Expedition 20's increment manager, said, "The logistics are done, and we have the supplies ready to expand the crew and allow them to stay for an extended period of time."

14. Progress Undocks For ISS. Russia's RIA Novosti (5/7) reports, "Russia's Progress M-66 cargo spacecraft undocked on Wednesday from the International Space Station to become a temporary space lab before being 'buried' in the Pacific Ocean, Mission Control said." Until May 18, "the craft will be used as an orbital laboratory to conduct a series of geophysical experiments under the Plasma-Progress program." China's Xinhua News Agency (5/7) also covers the story.

15. Crew Assigned For Last Atlantis Mission. NASA Spaceflight (5/7, Bergin) reports, "A veteran six person crew has been assigned by NASA for the STS-132 mission to the International Space Station (ISS)." The mission is currently scheduled for May 2010, and "will mark the 32nd and final 'scheduled' flight of space shuttle Atlantis." Ken Ham has been selected as mission commander.

16. Six-Member Crew Will Triple ISS Science Output. The crew of the International Space Station (ISS) is scheduled to double in size when Russia's SoyuzTMA-15 arrives on May 29, marking the first time all of the station-program partners are represented on board. When Canada's Bob Thirsk, Belgian Frank De Winne of the European Space Agency, and Russia's Roman Romanenko join the Expedition 20 crew, they will roughly triple the amount of time available to carry out scientific experiments on the orbiting laboratory. "This is a big transition from what we've had on previous increments, when we've continuously been short of crew time in order to do science," said Ben Pawlik, Expedition 20 increment manager at Mission Control Center-Houston. "On this increment we're faced with the opposite problem. We have a surplus of time." Pawlik said the increment crew -- which will change over the six-month period as some members are replaced-- will have a total of about 600 hours for science, increasing on average from about 20 hours a week for the old three-person crews to as many as 70 hours a week. Initially there won't be all of the scientific hardware and supplies onboard required to use that extra crew time, Pawlik explained, and the crew will be assigned other tasks. Ultimately station managers expect to strike a balance among science, maintenance and the crew time available to handle it. By the end of the increment crew members will have completed assembly of the three-part Japanese Kibo laboratory by adding its external experiment facility, welcomed the first robotic Japanese H-II Transfer Vehicle (HTV) with fresh supplies, and helped set the stage for delivery of the first of two more Russian laboratory modules. Dan Hartman,

integration and operations manager for the ISS program at NASA, said the limiting logistics factor for supporting the larger crew will be food, which is stocked in sufficient quantity to support both the station crew through a missed space shuttle arrival, plus a shuttle crew stranded there by orbiter damage for as long as 70 days. Present supplies won't start causing concern as long as they are replenished by about Oct. 25, he said. Despite a recurrence of bacteria growth in the potable water dispenser on the newly installed water recycling system, flight surgeons are expected to clear the crew to drink the water by the end of next week because the bacteria levels are well below dangerous levels. The system recycles urine, water used for hygiene and the moisture from perspiration and respiration in the cabin atmosphere for reuse by the crew and for oxygen generation. The urine processing assembly, which had to be replaced in March because the original unit didn't work, is out of action again with a "sticky check valve," Hartman said. But that problem should be fixed next week, he said. The Soyuz crew arriving at the end of the month will join Russia's Gennady Padalka, NASA's Mike Barratt and Koichi Wakata of the Japan Aerospace Exploration Agency to make up the first fully international crew on the station. Padalka and Barratt are scheduled to don Russian spacesuits twice next month to set up the Zvezda service module's zenith port to receive a Mini Research Module scheduled for launch on a Proton rocket in November or December.- Frank Morring, Jr. * morring@aviationweek.com

17. Bad Weather Forces TacSat-3 Launch Scrub. The U.S. Air Force will try again the night of May 7 to launch the TacSat-3 satellite for the U.S. Air Force Research Laboratory on a Minotaur 1 vehicle from NASA's Wallop's Flight Facility on Virginia's Eastern Shore. Launch of the $60 million satellite and its trio of experimental payloads -- as well as two piggyback satellites -- was to have come at 8 p.m. EDT May 5, but rain and low clouds barred the liftoff. Mission managers are hoping for better weather for a launch window that opens at 8 p.m. May 7 and extends untilll p.m. TacSat-3 carries an experimental target identification and battle damage assessment sensor; a sea-buoy data-retrieval experiment, and a plug-and-play avionics package that needs flight validation. Also atop the solid-fuel rocket are NASA's PharmaSat microsatellite and CubeSat Technology Demonstration.- Av. Week Staff

18. NASA Involved With ESA's Herschel, Planck Telescopes. In continuing coverage of the upcoming Herschel and Planck telescope launch, iTWire (5/7, Atkins) reports, "The European Space Agency, or ESA, leads both missions with significant participation from NASA." The article primarily focuses on the telescopes' missions, but also notes NASA's involvement more than other articles to date. The related NASA offices are based out of the Jet Propulsion laboratory. NASA said, "JPL contributed mission-enabling technology for two of Herschel's three science instruments and both of Planck's science instruments. The NASA Herschel Science Center... supports the US astronomical community. NASA, US and European Planck scientists will work together to analyze the Planck data."

19. STEREO Spots Major Sunspot. In the "Wired Science" blog for Wired Magazine (5/6), Alexis Madrigal writes, "The sun has a new spot, and long-awaited beginning of the next solar cycle." A "major sunspot" was observed by the STEREO spacecraft yesterday, which Michael Kaiser of the Goddard Space Flight Center's heliophysics division characterized as the "biggest event" over the past year. "Kaiser is sure this sunspot is part of the new cycle because it appeared at about 30 degrees of latitude. This is typical early in the solar cycle when sunspots appear closer to the poles. ... To date, a few minor sunspots have shown up in the higher latitudes, but none with the intensity or size of the new spots."

20. Orange Dwarfs Could Be Best Place To Look For Life. New Scientist (5/7, Shiga) reports, "The universe's best real estate for life may around stars a little less massive than the sun, called orange dwarfs, according to a new analysis. These stars live much longer than sun-like stars, and have safer habitable zones...than those of lighter red dwarf stars." Edward Guinan of Villanova University led the research, which found that orange dwarfs "with masses between 50 and 80% that of the sun, have only a little bit more flare activity than sun-like stars. They would also provide a haven for life for a much longer time - roughly double the 10-billion-year lifetime of a sun-like star." Orange dwarfs are also "three to four times as abundant" as stars similar to the sun. "Gregory Laughlin of the University of California, Santa Cruz, says it should be possible with current technology to find Earth-mass planets in the habitable zones of nearby orange dwarfs."

21. Upcoming Minotaur Launch Might Be Seen Throughout Mid-Atlantic. The Baltimore Sun (5/7, 234K) reports, "Sometime after 8 o'clock Thurs the Air Force hopes to put five small satellites into orbit with a rare launch from Virginia's Eastern Shore. If skies clear, the rocket's climb to orbit could be visible throughout the Mid-Atlantic region." The Minotaur 1 rocket with NASA's PharmaSat and the USAF's TacSat-3 will make a second attempt to launch after weather scrubbed the first try on Tuesday. "If the attempt goes well, it could be visible to millions of people from northern Florida to southern Maine, and as far west as eastern Kentucky, astronomer Joe Rao said." The Salisbury (MD) Daily Times (5/7, Vaughn) notes, "Backup launch days are Friday and Saturday."

22. Lockheed Survives Weather Satellite Contract Challenge. The Denver Post (5/7, Schrader, 211K) reports, "Lockheed Martin Space Systems competitor's challenge in being chosen to build two next-generation weather satellites for the National Oceanic and Atmospheric Administration." On Wednesday, NASA "announced...it had awarded the contract - valued at $1.09 billion if two more satellites are ordered beyond the initial two" to Lockheed, which beat a competing bid by Boeing and Northrop Grumman. "In December, Boeing protested the contract award to Lockheed Martin. The Government Accountability Office decided in Lockheed Martin's favor."

23. Rising Temperatures May Not Lead To Increased Wildfires Risk. USA Today (5/7, Rice, 2.29M) reports, "Although rising global temperatures could lead to much drier trees and forests around the world, that may not necessarily translate to an increased risk for wildfires, according to a new study in this month's issue of Ecological Monographs." While the finding "somewhat contradicts other recent research," Tom Brown of the Lawrence Livermore National Laboratory "found that changes in vegetation trumped past climate changes in determining wildfire frequency, based on research into Alaskan forests." Brown said, "Vegetation can have a profound impact on fire occurrences that are opposite or independent of climate's direct influence on fire."

24. NASA Backs Development Of Renewable Energy Bus Fueling System. Discovery News (5/6, Klotz) reported, "In what may be the ultimate bid energy, a NASA-backed group is designing a wind- and sun-powered fueling system for city buses -- and possibly other machines -- that run on hydrogen." The program, "spearheaded" by the Glenn Research Center, would design a "full-scale demonstration" of the system. Paul Prokopius, an energy consultant and retired NASA fuel cell researcher, "is working with 13 agencies and businesses to parlay $310,000 in seed money into state and federal economic stimulus grants to cover the project's $6 million to $10 million cost." The group hopes to have the system ready by next May. "The station would be built at the Great Lakes Science Center, located in downtown Cleveland on the shore of Lake Erie. The center already has a windmill and solar energy grid that is used for educational purposes and to produce electricity for the museum."

J.D. HARRINGTON

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Creativity is all in your mind!

Subject: RE: MOTHER'S DAY EDITION: Shuttle, Station & Constellation News - May 10, 2009
Date: Sun May 10 14:30:31 2009 GMT
From: "Gerstenmaier, William H. (HQ-CA000)" </O=NASA/OU=JSC/CN=RECIPIENTS/CN=986226466>
To: Herring, Kyle J. (JSC-AP311)

Any Hubble or ISS viewing opportunities from KSC?

Thanks

billg

From: Herring, Kyle J. (JSC-AP311)
Sent: Sunday, May 10, 2009 9:25 AM
To: Herring, Kyle J. (JSC-AP311); JSC-DL-SSP
Cc: Mcconnaughey, Helen V. (MSFC-MP71); Singer, Jody A. (MSFC-MP01); Chapman, John S. (MSFC-MP31); Martin, Jolene J. (KSC-MP04); Wetmore, Michael E. (KSC-AAC00); Ise, Michael R. (MSFC-ER30); Segert, Randall L. (KSC-MK000); Willcoxon, Rita G. (KSC-PH000); Lightfoot, Robert M. (MSFC-DD01); Rigney, Ronald D. (SSC-PA00); Tepool, Ronald E. (MSFC-EE03); Wood, Thomas D. (MSFC-EE02); Williams, Thomas J. (MSFC-ER01); Johnson, M S. (JSC-NA131); JSC-DL-DA8-Personnel; Clem, Kylie S. (JSC-AP311); Stratton, Patricia J. (KSC-USA-90200)[UNITED SPACE ALLIANCE LLC]; 'Barton.K.Gibson@usa-spaceops.com'; Abadie, Marc J. (JSC-DM321); 'Shinpaugh, Earl L.'; Malone, June E. (MSFC-CS20); Buckingham, Bruce (KSC-XAJ00); Curie, Michael (HQ-NB070); Beutel, Allard J. (KSC-XAE00); Ouellette, Fred A. (JSC-ZV111); 'EXT-Sang, Juliette D'; Suffredini, Michael T. (JSC-OA111); Madison, Lynnette B. (JSC-AP311); Martel, Sanda T. (MSFC-CS20)[ASRI]; Martin, David M. (KSC-JP10); Avina, Gabrielle C. (JSC-SD)[WYLE LABS]; Curtis, Kelly D. (JSC-CB)[WYLE LABORATORIES]; Loofboro, Jennifer B. (JSC-SD)[WYLE LABORATORIES]; Davidson, Dennis R. (JSC-MM111); Gerstenmaier, William H. (HQ-CA000); 'william.w.parsons@lmco.com'; Humphries, Kelly O. (JSC-AP311); Sang, Anthony C. (JSC-OB211); Gard, Melissa Y. (JSC-OC311); Contella, Dina E. (JSC-DX321); Meredith, Barry D. (LARC)[ANALYTICAL MECHANICS ASSOCIATES INC]; Stilson, Stephanie S. (KSC-PHA00); Buzzard, Patrick S. (HQ-TA000); 'BOEING - Ed Memi'; Gilbrech, Richard J. (SSC-AA00); Petersen, Daniel D. (JSC-EA421); Henry, H Keith (LARC-H1); Seriale-Grush, Joyce M. (JSC-EA421); Welzyn, Kenneth J. (MSFC-EE02); Sigur, Wandaanne A. (MAF)[Lockheed Martin Space Systems]; Haynes, Dena S. (JSC-EA321); Lanasa, Marion A. (MAF)[Lockheed Martin Space System]; Champion, Robert H. (MSFC-EV01); Michael.j.rein@ulalaunch.com; Oconnor, Bryan (HQ-GA000); Scolese, Christopher J. (HQ-AI000); Honeycutt, John H. (MSFC-MP31); Bond, Timothy A. (JSC-EC611); Weaver, Anita R. (JSC-OZ211); King, Eddie L. (JSC-MG111); IVISON, SANDRA L (JSC-REMOTE); Kerns, Robert V. (LARC-E506); Campos, Leo (JSC-MG)[UNITED SPACE ALLIANCE LLC]; Wadsworth, Harry (MAF)[Lockheed Martin Space System]; Harris, Yolanda B. (MSFC-MP01); Lee, Albert Y. (JSC-OD/USA)[UNITED SPACE ALLIANCE LLC]; 'Wendy.j.locklear@boeing.com'; Navias, Rob (JSC-AP311); Spohr, Robert B. (JSC-DX121); Armstrong, Robert C. (MSFC-JP02); Woodard, Danny R. (MSFC-CS30); Trinidad, Katherine (HQ-NB070); Yembrick, John (HQ-NB070); 'mel.rother@l-3com.com'; Borden, Dawn M. (KSC-PHB20); Herring, Ann O. (JSC-OC)[BARRIOS TECHNOLOGY]; Andrews, David A. (KSC-USA-94353)[UNITED SPACE ALLIANCE LLC]; Beckmeyer, Don H. (SSC-PA20); Cash, Steven F. (MSFC-MP01); Braukus, Michael J. (HQ-NB070); Rai, Amelia E. (JSC-BJ111); Roy, Steven E. (MSFC-CS20); Kanigan, Daniel N. (MSFC-CS20); Impiccini, David J. (JSC-MO)[USAF]; Bihner, William J. (HQ-CK000); Nichols, Stanley R. (HQ-CK000); Whitmeyer, Tom (HQ-CK000); Smith, Karen L. (JSC-NA121); Goldman, Arthur E. {Center Director}(SSC-AA00); Pieczonka, Jessica B. (JSC-AP)[UNITED SPACE ALLIANCE LLC]; Curry, John M. (JSC-ZV311); Rink, Christopher P. (LARC-H1); Fesler, Jeffrey S. (HQ-LM020)[InDyne, Inc]; Krezel, Jonathan (HQ-CK000); Braithwaite, Timothy H. (JSC-OR)[Canadian Space Agency]; Cook, Jerry R. (MSFC-MP21); Brady, Timothy K. (JSC-C102); Petro, Janet E. (KSC-AAA00); Brewer, Angela J. (KSC-PHA00); Van Cise, Edward A. {Ed} (JSC-DX421); Munday, Lisa M. (JSC-OK111); Munday, Stephen R. (JSC-OK111); Morris, Janet L. (JSC-MO)[United Space Alliance LLC]; Tobias, Barry (JSC-DI5)[UNITED SPACE ALLIANCE LLC]; Van Hooser, Katherine P. (MSFC-EE02); Balu, Brian K. (JSC-ZG111); O'Connor, Judy (JSC-CB)[REDE CRITIQUE NSS JV]; Morcone, Jennifer J. (MSFC-CS20); Currie, Nancy J. (JSC-AB111); Ess, Kim Maureen (JSC-MV511); Heflin, James M. (JSC-AB111); Thomas, Candrea K. (KSC-XAE00); Hutcherson, Dana M. (KSC-PHA00); Haney, Dee (JSC-USA)[UNITED SPACE ALLIANCE LLC]; Thomas, Rayelle E. (JSC-ZD111); Anthony, Foster E. (KSC-NEL00); Fullerton, Richard K. (HQ-GC000); Bradley, Linda J. (KSC-USA-91120)[UNITED SPACE ALLIANCE LLC]; Houlihan, John F. (KSC-USA-91130)

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Subject: MOTHER'S DAY EDITION: Shuttle, Station & Constellation News - May 10, 2009

HAPPY MOTHER'S DAY !

NASA TV:
- 9 a.m. CDT (10 Eastern) – Countdown Status Briefing
- Noon CDT (1 Eastern) – Hubble Space Telescope Program Briefing
- 1 p.m. CDT (2 Eastern) – Hubble Science Briefing
- 4 p.m. CDT (5 Eastern) – Rotating Service Structure retracted away from Atlantis

Shuttle, Station & Constellation News
Sunday, May 10, 2009

HEADLINES AND LEADS

Weather outlook good for launch Monday

James Dean - Florida Today

Shuttle Atlantis is cruising toward liftoff from Kennedy Space Center on a fifth and final mission to service the Hubble Space Telescope. "The team is not tracking anything that would prevent an on-time launch Monday," Shuttle Launch Director Mike Leinbach said during a news conference Saturday evening.

NASA's star is getting a tuneup
Upgrades expected to lengthen space telescope's lifespan, improve view of the cosmos

Eric Berger - Houston Chronicle

Most people know the Hubble Space Telescope for its pictures. Oh, the dazzling pictures. Galaxies colliding. Stars being born. Stars dying explosive deaths. Even the first glimpses of planets around other stars.

Astronomers like the pretty pixels, too. But for them, Hubble's observations have proven more glorious for their scientific insight.

NASA clears shuttle for flight to Hubble

Irene Klotz - Reuters

NASA managers have cleared space shuttle Atlantis for launch on Monday on a final mission to refurbish the orbiting Hubble Space Telescope, officials said Saturday. Lift-off is scheduled for 2:01 p.m. (1801 GMT) from the Kennedy Space Center in Florida. Meteorologists predicted an 80 percent chance the weather would be suitable for launch.

The other side of the universe

Robin McKie - The Observer

PHOTO ATTACHED: Remote galaxies never seen before are visible in this image taken using Nasa's Hubble Space Telescope

Myriad galaxies, including some of the cosmos's remotest objects, are caught by the Hubble Space Telescope, providing astronomers with key information about the universe's early history. The newly-released image was one of the last taken before this week's repair mission to the telescope, which orbits Earth, by the space shuttle Atlantis.

'Hubble repair guy' eager to visit an old friend

Eric Berger - Houston Chronicle

Fellow astronauts who will fly with John Grunsfeld aboard space shuttle Atlantis to the Hubble Space Telescope have dubbed him "the Hubble repair guy." That's because this will be Grunsfeld's third trip to the Hubble, where the mission specialist expects to conduct three spacewalks to repair and upgrade the 19-year-old telescope.

NASA Approves Partial Privatization of the Space Program

Taylor Dinerman - FOX News

NASA's critics have long asked: Why does the space agency need to design and build its own rockets and spacecraft?When the Justice Department or the Centers for Disease Control want to send employees somewhere, they don't specify the aircraft types, let alone design the airframes, engines and avionics. They just buy plane tickets. Even the military finds it cheaper to use civilian aircraft for certain missions. So why should space transportation be any different?

Up in the air

With the shuttle program winding down, NASA's future needs resolution

Houston Chronicle

This weekend moviegoers are getting their first look at the reinvented Star Trek, the latest cinematic twist on a 43-year-old iconic TV series and subsequent set of feature films that helped hook several generations of Americans on the allure of manned space exploration. Meanwhile, in real life down here on Earth, NASA's plans to boldly go to the moon (where a handful of astronauts have gone before) and Mars (where humans have never been) face scrutiny and possible delays by a review committee set up by President Barack Obama's administration.

NASA set for dramatic shuttle rescue

Second orbiter ready to launch within days if Atlantis is in trouble

James Oberg - MsNBC.com

As NASA prepares for its final service call to the Hubble Space Telescope, it's also preparing for something never attempted in the history of the shuttle program: a rescue operation so dramatic that Hollywood would be hard-pressed to come up with a more outlandish plot. If the Hubble repair crew due for liftoff on Monday got into the deepest sort of orbital trouble, yet another shuttle would have to be launched into orbit as little as a week later. NASA hasn't launched two piloted spacecraft so close together in more than 40 years. But that's just the first act of the drama.

IndyCar Team Tracking Space Shuttle Atlantis At 2009 Indy 500

PaddockTalk.com

Newman/Haas/Lanigan Racing team members at the Indianapolis Motor Speedway will track the voyage of seven astronauts aboard space shuttle Atlantis beginning May 11 and vice versa. The 11-day mission incorporates five spacewalks to service NASA's Hubble Space Telescope. Liftoff is scheduled for 2:01 p.m. (EDT).

Tour shows a valuable home for 'risky business'
Spaceport gets a look from state, regional officials

Carol Vaughn - Eastern Shore News (Tasley, VA)

WALLOPS ISLAND -- If visitors arriving Wedne-sday for a tour of the Mid-Atlantic Regional Spaceport had questions about what is next for the facility, a 70-foot banner bearing a half-size depiction of Orbital Science Corp.'s Taurus II rocket made the answer clear. The banner hung from a crane at the intersection of Chincoteague and Mill Dam roads near the entrance to the newly created Wallops Research Park, where an estimated 400 people coming to view MARS' launch of a Minotaur I rocket carrying an Air Force satellite could see it as they arrived.

Our views: NASA's brightest star
Final Hubble repair mission sets stage for telescope's grand finale

Florida Today (Editorial)

Ever since humans stood upright and gazed at the night sky, we've been awed by the heavens. And asking the eternal questions: How was the universe born? What makes it tick? Are we alone in its vastness? More than any instrument crafted by man's ingenuity, NASA's Hubble Space Telescope has striven to answer those questions, revolutionizing our understanding of the cosmos and our place in it.

NASA needs mission booster

St. Petersberg Times (Editorial)

President Barack Obama said this spring that NASA was afflicted by "a sense of drift," but the reality is far worse. The nation's space agency has no permanent administrator. It is set to retire the space shuttle, yet its replacement craft has been hard hit by technical and budget problems. The expected five-year gap between the shuttle's end and the return to manned space flight has caused a brain drain in the space industry. Officials on the Space Coast near Kennedy Space Center expect to lose as many as 10,000 jobs in the coming years.

COMPLETE STORIES

Weather outlook good for launch Monday

James Dean - Florida Today

Shuttle Atlantis is cruising toward liftoff from Kennedy Space Center on a fifth and final mission to service the Hubble Space Telescope.

"The team is not tracking anything that would prevent an on-time launch Monday," Shuttle Launch Director Mike Leinbach said during a news conference Saturday evening.

Air Force forecasters expect an 80 percent chance of good weather conditions for the launch, which is planned for 2:01 p.m., 20 minutes into a 62-minute launch window.

If Atlantis is unable to launch Monday, the weather is expected to deteriorate Tuesday and Wednesday to a 60 percent chance of favorable conditions.

Launch pad 39A was cleared for much of Saturday while reactants were loaded into Atlantis so its fuel cells would be able to provide electric power during the planned 11-day flight.

Atlantis mission commander Scott Altman and pilot Gregory Johnson also practiced landings in a Gulfstream jet modified to handle like an orbiter as it returns home.

The rest of the crew includes mission specialists Drew Feustel, Mike Good, John Grunsfeld and Mike Massimino, who are scheduled to perform five spacewalks, and robotics specialist Megan McArthur.

The crew will install two new science instruments into the observatory and attempt complex repairs to two more, plus replace batteries and gyroscopes that should help Hubble thrive for at least five more years.

Shuttle Endeavour, which is standing by on launch pad 39B to fly a rescue mission of the Atlantis crew if necessary, also is in good shape, launch managers said.

Today at the space center, communications networks will be checked out and some crew equipment will be stowed in Atlantis.

The Rotating Service Structure at pad 39A is scheduled to swing open to its launch position about 5 p.m. Fueling of Atlantis' orange external tank is scheduled to begin before dawn Monday.

"Everybody is certainly ready to go and anxious to get this one up, and to watch all the equipment that's going to be put on the Hubble Space Telescope to make this telescope the best it's ever been," NASA Test Director Jeff Spaulding said.

NASA's star is getting a tuneup

Upgrades expected to lengthen space telescope's lifespan, improve view of the cosmos

Eric Berger - Houston Chronicle

Most people know the Hubble Space Telescope for its pictures. Oh, the dazzling pictures. Galaxies colliding. Stars being born. Stars dying explosive deaths. Even the first glimpses of planets around other stars.

Astronomers like the pretty pixels, too. But for them, Hubble's observations have proven more glorious for their scientific insight.

"No area of modern astronomy has not been profoundly changed by the Hubble Space Telescope," said David Leckrone, the Hubble's senior project scientist at NASA's Goddard Spaceflight Center.

Launched in April 1990, the telescope has taken more than half a million pictures of 29,000 celestial objects. Initially subjected to ridicule because of an improperly shaped mirror, the telescope was corrected three years later in space and has undergone three additional servicing missions since its launch. The next one is set to begin Monday, with the liftoff of shuttle Atlantis and the last scheduled fix-it trip to Hubble for the waning shuttle program.

With seven years gone since the last visit by astronauts, scientists liken the telescope to an aging champion athlete with multiple injuries. In this case, however, the surgery should actually make the telescope better by adding capabilities, such as a new spectrograph that will allow Hubble an unparalleled view of the formation and evolution of galaxies.

During the mission, astronauts will make five spacewalks to refurbish and repair hardware and extend the operating life of the telescope for at least five more years, as well as installing new instruments.

"The Hubble Space Telescope will be more powerful and robust than ever before," said Ed Weiler, NASA's science chief.

This visit to Hubble, which orbits Earth at a higher altitude than the space station, almost didn't happen. After the Columbia disaster, a shuttle review board recommended that future missions fly in orbits that would allow them to reach the space station if an emergency arose.

That led NASA Administrator Sean O'Keefe to cancel the planned repair mission in 2004.

Later, in 2006, new NASA Administrator Michael Griffin restored the mission, saying there were risks inherent in all spaceflight attempts and preserving Hubble was worth the elevated risk.

Astronomers like the University of Texas' John Kormendy, who studies supermassive black holes, heartily agree. They are eager to see the mission fly after seeing the 12.5-ton telescope's capabilities slowly diminish in recent years.

Although the Hubble's primary, 8-foot-wide mirror isn't particularly large compared to ground-based telescopes, its perch above the atmosphere affords a crystal clear view of the heavens, giving astronomers the ability to detect the faintest objects and image them in great detail.

Great discoveries

By observing light from the explosive deaths of stars very far from Earth, Hubble made one of the greatest scientific discoveries of the last half century, that the expansion of our universe is actually accelerating rather than slowing under the influence of gravity.

"Realistically, that discovery could not have been made without Hubble," Kormendy said.

The discovery of an accelerating universe has changed the conception physicists and astronomers have of the cosmos and has led them to postulate the existence of an unknown force — dark energy — counteracting gravity to push galaxies apart.

Hubble also captured the first images of a planet around another star; observed the large black holes at the centers of galaxies; and took spectacular "deep field" images of the first galaxies, which formed billions of years ago when the first stars were forming after the big bang.

As with any scientific instrument subjected to so much praise, there's been some hype about the telescope's accomplishments, Kormendy said.

As with any scientific instrument subjected to so much praise, there's been some hype about the telescope's accomplishments, Kormendy said.

"But no matter how much overhyping that has occasionally been done, it is clearly the best research instrument ever in astronomy," he said.

The astronauts who plan to begin flying toward Hubble on Monday say they're well-aware of the astronomical community's interest in seeing them succeed. Careers are on the line for those awaiting use of a telescope for which every minute of observing time is carefully and competitively plotted out.

"It is kind of humbling to think about the Hubble telescope, the impact it has had across the world, and that we're being entrusted to work on it," said Scott Altman, the mission's commander. "It is truly an honor."

NASA clears shuttle for flight to Hubble

Irene Klotz - Reuters

NASA managers have cleared space shuttle Atlantis for launch on Monday on a final mission to refurbish the orbiting Hubble Space Telescope, officials said Saturday.

Lift-off is scheduled for 2:01 p.m. (1801 GMT) from the Kennedy Space Center in Florida. Meteorologists predicted an 80 percent chance the weather would be suitable for launch.

NASA has dispatched shuttle crews four times to repair and upgrade the telescope, which was launched in 1990 with the expectation that it would operate for 10 to 15 years.

"To say we got our money's worth out of Hubble is an understatement," NASA's associate administrator, Ed Weiler, said during a recent news conference previewing the mission.

Hubble has been instrumental in reshaping scientists' understanding of the universe and how it operates. Its discoveries include evidence that space is expanding at an increasingly faster rate and that the process for making planets is very common.

The seven-member Atlantis crew is scheduled to make five back-to-back spacewalks to fix broken equipment on Hubble, install two new science instruments and replace the telescope's gyroscopes, batteries and other gear.

The upgrades should keep Hubble operating for at least five more years, by which time its replacement, the infrared-sensitive James Webb Space Telescope is scheduled to be in orbit.

NASA on Saturday also reviewed launch preparations for shuttle Endeavour, which is poised on a second launch pad in case the Atlantis crew needs to be rescued.

Since the 2003 Columbia disaster, astronauts have been able to seek shelter aboard the International Space Station if their ship was too damaged to fly back through the atmosphere.

Columbia was destroyed as it prepared for landing as a result of a hole in its heat shield caused by a piece of falling foam insulation during liftoff. All seven astronauts aboard were killed.

Hubble orbits too far from the station for the Atlantis crew to get to in case of an emergency, so NASA came up with a plan to have a second shuttle ready to launch on a rescue mission if needed.

The Atlantis astronauts will inspect their ship for damage once they reach orbit and, if no problems are found, Endeavour will be released from service and prepared for a June mission to the space station.

The other side of the universe

Robin McKie - The Observer

Myriad galaxies, including some of the cosmos's remotest objects, are caught by the Hubble Space Telescope, providing astronomers with key information about the universe's early history.

The newly-released image was one of the last taken before this week's repair mission to the telescope, which orbits Earth, by the space shuttle Atlantis.

Repair flights were cancelled after the Columbia disaster but a public outcry forced a Nasa rethink. Engineers say this should extend Hubble's life by five years or more. After that, new robot observatories – requiring no servicing by astronauts – should be in place.

Hubble's glorious, detailed images of the heavens have been extraordinarily popular with the public. By contrast, manned missions have excited little interest, despite their enormous cost. Researchers have been equally unimpressed with their scientific usefulness. The international space station, to be visited by astronauts in a Russian capsule this week, is set to cost around $100bn, for example.

Now President Obama has called for a review of future manned missions – in particular, the US constellation programme, which would involve constructing new rockets to take astronauts back to the moon, and later, to Mars.

The plan was proposed by President George W Bush but critics have questioned the $150bn bill and argued the money would be better spent on unmanned probes. The review's timing, as America prepares to celebrate the 40th anniversary of the Apollo 11 lunar landing, is controversial.

Nevertheless, it is overdue. Returning men to the moon and taking them to Mars was always a dubious scientific enterprise. We should limit our space thrills to images like this one and to the work of robot missions like the Hubble and its successors.

'Hubble repair guy' eager to visit an old friend

Eric Berger - Houston Chronicle

Fellow astronauts who will fly with John Grunsfeld aboard space shuttle Atlantis to the Hubble Space Telescope have dubbed him "the Hubble repair guy."

That's because this will be Grunsfeld's third trip to the Hubble, where the mission specialist expects to conduct three spacewalks to repair and upgrade the 19-year-old telescope.

"I'm almost speechless, I'm so thrilled," he said of the mission, slated to take flight Monday. "For me it's almost like a family reunion."

That the family reunion almost didn't happen is a fact that Grunsfeld, 50, knows all too well.

He was NASA's chief scientist in 2004 when NASA administrator Sean O'Keefe canceled the mission, declaring it unsafe after the space shuttle Columbia tragedy. The Hubble telescope's orbit above the Earth is too far above the international space station for astronauts to seek refuge there in case of an emergency.

"When the mission was canceled I was really quite stunned," Grunsfeld said. "I felt a duty to support the decision of the administration. I decided at that time that rather than to retire in protest, if you will, I would dedicate myself to trying to find a mechanism to service Hubble."

Making plans

The persistence led Grunsfeld and a host of NASA engineers and technicians to devise a plan to meet all the recommendations made by the Columbia Accident Investigation Board. Among the precautions is the availability of space shuttle Endeavour, which now sits on a launch pad in case an emergency rescue is needed.

As Grunsfeld and the mission's three other spacewalkers have practiced in a giant indoor pool near Johnson Space Center, where there's a sunken replica of the Hubble telescope, the veteran has provided invaluable guidance, said Tomas Gonzalez-Torres, lead spacewalk officer for the Hubble mission.

Interest started early

While working with a particular tool, Grunsfeld might note that its behavior in the pool is different, and make suggestions for better results in orbit.

"You simply cannot put a price on the value of the experience he provides," Gonzalez-Torres said. "It's like the MasterCard commercial, his experience is priceless."

Grunsfeld has been interested in astronomy for nearly his entire life, beginning with his childhood in Chicago where he frequently visited the Adler Planetarium.

As he considered a career in astronomy and watched NASA's Gemini and Apollo programs, Grunsfeld said he always felt in the back of his mind that by the time he became a professor it would be routine for astronomers and astrophysicists to go into space to do their work.

When he reached the Massachusetts Institute of Technology as an undergraduate student, in 1978, NASA took its first group of astronauts for the shuttle program. One of them was a postdoctoral student Grunsfeld knew.

"That really opened my eyes to the fact that maybe I really could become an astronaut, too," he said.

By 1995 he had flown his first mission, and later was assigned to Hubble repair duty in 1999 and 2002. Now, seven years later, he looks forward to seeing an old friend for the final time.

"I spent my life studying science," he said. "There's no better privilege I've had than to go into space and service the Hubble. I feel like I've trained my whole life for this mission."

NASA Approves Partial Privatization of the Space Program

Taylor Dinerman - FOX News

NASA's critics have long asked: Why does the space agency need to design and build its own rockets and spacecraft?

When the Justice Department or the Centers for Disease Control want to send employees somewhere, they don't specify the aircraft types, let alone design the airframes, engines and avionics. They just buy plane tickets.

Even the military finds it cheaper to use civilian aircraft for certain missions. So why should space transportation be any different?

NASA's beginning to agree. For the first time, after nearly a half century of building its own rockets and orbiters, it has approved the outsourcing of some of the equipment that enables its manned space missions to private contractors.

Last week, acting NASA Administrator Chris Scolese told a congressional subcommittee that the agency plans to give $150 million in stimulus-package money to private companies that design, build and service their own rockets and crew capsules — spacecraft that could put astronauts in orbit while NASA finishes building the space shuttle's replacements.

On Thursday, the White House ordered a top-to-bottom review of the entire manned space program, one that will be led by former Lockheed Martin CEO Norman Augustine, long considered a friend of private space ventures.

Both developments show that the once-reluctant space agency and the Obama administration are ready to support commercial human spaceflight.

It's a dramatic change, one that could reduce America's dependency on Russia for the next half-decade after the space shuttle program ends, and one that could kick-start a space program that some see as having stalled for 40 years.

"Our government space program has become over-burdened with too many objectives, and not enough cash," says William Watson, executive director of the Space Frontier Foundation, a Houston-based group promoting commercial space activities. Watson said that allowing private companies to handle routine orbital duties could free up NASA to focus on returning to the moon and going to Mars.

Scolese said that $80 million of the stimulus money will be awarded to the company that demonstrates the best "crewed launch demo" — a prototype, based on existing cargo-capsule designs, modified for humans. The agency was careful to note that the competition will be an open one.

Two well-positioned spaceflight companies, SpaceX and Orbital Sciences, are seen as the leading contenders. Each already has a full line of rockets and cargo capsules ready to go, and each company's capsules can be converted to transport astronauts.

Both firms were tight-lipped about their suddenly increased opportunities. Orbital Sciences didn't respond to queries; SpaceX said only that it was "encouraged by NASA's commercial crewed services initiative."

But NASA's savings in cost and time could be significant.

The two leading contractors are building their launch vehicles from scratch. Their designs emphasize very efficient business models and low manufacturing costs. And they operate with at most a few dozen employees at their launch sites, as opposed to the space shuttle program's standing army of almost 15,000 workers.

NASA's hostility toward other American space ventures goes back at least to the early 1990s, when Lockheed Martin developed the DC-X suborbital experimental rocket, financed by the Pentagon's Strategic Defense Initiative Organization (SDIO).

The goal was to get payloads into orbit with a reusable craft that was not the space shuttle, which the Defense Department saw as unreliable and costly.

NASA was hardly enthusiastic about this approach. It believed that it would be many years before such Reusable Launch Vehicles (RLVs) would be ready to fly, and some inside the agency saw it as a threat to its monopoly on human space flight.

In 2000, NASA even objected to the cash-strapped Russian space agency's $20 million deal to send up the first "space tourist," American billionaire Dennis Tito.

But three things happened.

-- The February 2003 Columbia space-shuttle disaster, in which seven astronauts died, forced NASA to rethink its way of doing business. The Columbia Accident Investigation Board's final report "found a NASA blinded by a 'Can Do' attitude, a cultural artifact of the Apollo era that was inappropriate in a Space Shuttle program so strapped by schedule pressures and shortages that space parts had to be cannibalized from one vehicle to launch another."

NASA's tight relationship with a small number of major contractors and its persistent problems integrating political and legal demands with the need to maintain engineering excellence had stressed the agency to the breaking point, the report said.

-- In January 2004, President George W. Bush decided to "reboot" the space program, announcing his "Vision for Space Exploration" to go back to the moon and to eventually send humans to Mars.

-- And in October 2004, engineer Burt Rutan's SpaceShipOne won the $10 million Ansari X Prize. The rocket was the first privately built flying machine ever to reach space.

There was a catch to the Bush plan: As part of the ambitious new program, the 30-year-old space-shuttle program will end next year, saving NASA $3 billion a year to spend on new spacecraft, the first of which is scheduled to fly in late 2015.

But that has created a gap in America's ability to launch astronauts and cargo to the International Space Station (ISS). For at least five years, NASA will depend primarily on Russia to get Americans into space, which doesn't sit well with many space experts and politicians.

As a result, NASA quickly became much friendlier to commercial ventures. In late 2005, then-agency Administrator Michael Griffin announced that NASA was considering buying crew and cargo transportation services to the ISS from private industry.

"We believe," he said, "that when we engage the engine of competition, these services will be provided in a more cost-effective fashion than when the government has to do it," Griffin said.

In 2006, the first round of the Commercial Orbital Transportation Services (COTS) contracts was won by SpaceX corporation of Hawthorne, Calif., which received a contract worth $278 million, and by Rocketplane Kistler of Oklahoma City, which was supposed to get $207 million.

Space Exploration Technologies Corporation, or SpaceX for short, founded by PayPal entrepreneur Elon Musk, was already hard at work on its Falcon series of rockets.

It also had done preliminary design work on a multipurpose capsule called the Dragon, which could be adapted to carry either crew or cargo to the ISS on a Falcon 9.

SpaceX was funded mostly by Musk's personal fortune, but also had a small number of contracts to launch satellites for the Defense Department and from overseas.

Rocketplane Kistler, on the other hand, was an innovative but underfunded enterprise. It promised to build on an earlier RLV program that had failed to get off the ground after a promising start in the late 1990s.

In October 2007, Rocketplane Kistler's NASA contact was terminated due to its failure to meet the agreed-upon financial milestones.

The remaining $170 million from the Rocketplane Kistler disbursement was awarded to Orbital Sciences Corporation of Dulles, Va., for its Taurus 2 launcher and Cygnus capsule combination.

Orbital, one of the few entrepreneurial space firms that have successfully gone from start-up to billion-dollar status, not only builds the Pegasus and Taurus launchers, but also has established a decent reputation building small-to-medium-sized commercial and scientific satellites and space probes.

Most importantly, both SpaceX and Orbital Sciences are well-funded and commercially viable, a crucial factor to NASA.

If a private company shows it's ready to invest its own funds, that's a lot better than people who want to "help spend NASA's money," as Griffin once put it in a different context.

But not everyone in NASA's old guard is pleased with this approach.

"In order to preserve U.S. leadership in space, it would be better to invest in a lifting body lander, a spaceplane that would land on a runway like the Shuttle does now," Apollo 11 astronaut Buzz Aldrin, the second man to walk on the moon, told FoxNews.com. "There is a [NASA] design called the HL-20 that could be launched on an existing reliable rocket and could be ready for a demonstration flight in 2013."

But to the Space Frontier Foundation's Watson, the sky's the limit.

"Let's have an American competition in space — to create good jobs, fuel innovation and close the [spaceflight] gap more quickly," he said. "With private funds matching government investment, we can dramatically leverage taxpayer dollars to produce breakthroughs in a new American industry — commercial orbital human spaceflight."

Up in the air
With the shuttle program winding down, NASA's future needs resolution

Houston Chronicle

This weekend moviegoers are getting their first look at the reinvented Star Trek, the latest cinematic twist on a 43-year-old iconic TV series and subsequent set of feature films that helped hook several generations of Americans on the allure of manned space exploration.

Meanwhile, in real life down here on Earth, NASA's plans to boldly go to the moon (where a handful of astronauts have gone before) and Mars (where humans have never been) face scrutiny and possible delays by a review committee set up by President Barack Obama's administration.

Former Lockheed Martin chief executive Norman Augustine will chair the effort, which aims to produce findings by the end of August. Houston, home to the Johnson Space Center and its 20,000 employees comprising the heart of the U.S. manned spaceflight program, has a lot riding on the outcome of that review.

With the space shuttle fleet to be mothballed after nine more flights, including Monday's scheduled launch of Atlantis to service the Hubble telescope, the U.S. will face years without the capability to launch astronauts to the International Space Station. That will make the formerly dominant U.S. space program dependent on Russia for access to even low Earth orbit for five years or longer. Although congressional critics have called for an extension of shuttle operations, NASA is going forward with layoffs and program cuts to close out shuttle operations.

The review will take a top-to-bottom look at the progress of the Constellation program, which would replace the space shuttle with a new generation of Ares launch rockets and the Orion, an expanded version of the capsule-style craft that carried astronauts to and from the moon. Developmental issues with the Ares I and V have prompted some experts to suggest that existing Atlas and Delta rockets used to launch military satellites could be adapted for the Orion at a substantial savings.

Whether the review actually results in a substantive change in NASA's future plans is uncertain. The space agency has spent $13.6 billion on the Constellation program so far, and will continue the work at a $300 million-a-month clip even while the audit goes forward.

The administration has proposed $18.7 billion for NASA's 2010 budget, a 5 percent increase over current spending levels. The allocation for Constellation actually got a boost, at least in the short term.

Obama has yet to select a new NASA administrator, leaving agency veteran Christopher Scolese as acting chief.

At a budget briefing, Scolese, who will choose the ten-member review panel in consultation with the White House, signaled his own preference for the manned exploration program. "Clearly if we are on the wrong path, we should change," said Scolese. "If you are asking me if I think we're on the wrong path, no, I don't."

It's a positive sign that funding for work on the new launch system will continue during the review. Obama needs to name a permanent NASA chief who can forcefully articulate the agency's future flight plans.

The United States must maintain a leading role in the exploration of space by manned and unmanned vehicles, for economic, scientific and national security reasons.

The Houston area has watched its residents walk on the moon. The fact that the space program has been allowed to muddle into a precarious situation where America will lack the capacity to even launch astronauts into orbit for a period of years is not only shameful, but dangerous to the national interest. It must be remedied as soon as possible.

NASA set for dramatic shuttle rescue

Second orbiter ready to launch within days if Atlantis is in trouble

James Oberg - MsNBC.com

As NASA prepares for its final service call to the Hubble Space Telescope, it's also preparing for something never attempted in the history of the shuttle program: a rescue operation so dramatic that Hollywood would be hard-pressed to come up with a more outlandish plot.

If the Hubble repair crew due for liftoff on Monday got into the deepest sort of orbital trouble, yet another shuttle would have to be launched into orbit as little as a week later. NASA hasn't launched two piloted spacecraft so close together in more than 40 years. But that's just the first act of the drama.

The rescue shuttle, Endeavour, would have to pull within about two dozen yards of the stranded shuttle Atlantis, and then help Atlantis' crew members make their way across a lifeline to refuge. Then Endeavour, full to capacity, would have to leave Hubble as well as Atlantis behind and return home — but not before Atlantis' controls are set for a self-destruct sequence.

The rescue mission, known as STS-400, would be NASA's last resort for saving the lives of Atlantis' astronauts in case of emergency. If Atlantis suffers irreparable damage to its thermal protection system — perhaps during ascent, perhaps from a space debris impact, perhaps from other less likely but not impossible hazards — it would no longer be able to return safely to Earth.

Because Atlantis is in an orbit different from that of the international space station, it wouldn't be able to reach that safe haven, even though the station will periodically zoom below the shuttle. The only hope for survival would be STS-400's arrival.

STS-400 would be arguably the most perilous journey ever planned for space travelers. And no matter what the outcome, the mission would probably bring the 28-year space shuttle program to an early end.

Doubled-up shuttles

The possibility of a rescue mission is the reason why Endeavour and Atlantis are both sitting on launch pads at NASA's Kennedy Space Center — a double vision that's been seen only a handful of times in the past and almost certainly will never be seen again.

Two crews are on alert for launch: The seven astronauts for the final Hubble servicing mission, known as STS-125, and the four astronauts for the STS-400 rescue mission. When STS-125 launches, the countdown for STS-400 will be at L-minus-7 days and counting. As STS-125 proceeds, the STS-400 countdown continues to L-minus-3 days, and then enters a "hold" just before fueling.

In a perfect world, the STS-400 team would just mark time until Atlantis heads back to Earth, after which Endeavour would be put back into preparation for a flight to the space station in mid-June. But if STS-400 is needed — and the need might not be discovered until the final few days of the STS-125 mission — the countdown would resume, and Endeavour would launch three days later. A day after that, using an abbreviated rendezvous path, it would be hovering back to back, 75 feet (23 meters) from Atlantis.
Already on board are the extra spacesuits and other equipment needed to ferry STS-125's seven astronauts across the gap into Endeavour. That could take two days, maybe three. Just before he left, Atlantis commander Scott Altman would configure the shuttle's flight deck so that ground controllers could bring it down safely into the ocean by remote control. Then it would be time to check the rescue ship itself for damage, do any necessary repair work and head back to Earth.

The rescue operation will almost certainly never be needed. But if it is needed, all the preparations and all the training must already have been performed. There just won't be time to throw it together on the spot.

Preparing for possibilities

In the wake of 2003's Columbia catastrophe, NASA has always designated one shuttle crew to rescue another crew in the event of an emergency, so the concept itself is no big deal. But on every previous shuttle mission, and on all remaining shuttle missions after this one, a stranded crew could hold out aboard the international space station. There, air and food and power supplies give them a good chance of lasting 70 or 80 days before needing a pickup.

Consequently, the designated rescue vehicle did not need to be standing by for quick launch. Usually it was not even "stacked" to its external tank and solid-rocket boosters. If the mission ever needed to be called up, ground processing teams could go to double shifts and prepare it in time.

Not this time. Like the doomed Columbia, Atlantis will be following an orbital path that makes reaching the shelter of the space station impossible. The only supplies the crew can use to extend their lives and await rescue are those that they bring along with them.

So for this mission only, the potential urgency of the situation requires the rescue ship to be ready to go within a few days of a launch decision. The last time NASA had two different manned space vehicles in a similar situation was the dual flight of Gemini 7 and Gemini 6 in December 1965.

Off-and-on Hubble mission

After the loss of Columbia, NASA looked into whether the next-in-line shuttle mission — then about two months in the future — could have been rushed into space within two weeks. It would have been practically impossible, they concluded, and extremely risky to the second vehicle and its crew.

So when a rescue capability was decreed mandatory for subsequent shuttle mission, the lone non-station mission — the Hubble repair — was left without a plausible safety net and thus was canceled.

Engineers at the Kennedy Space Center didn't give up on a rescue plan, however. If they couldn't rush the regularly scheduled next flight to launch, perhaps they could give special treatment to the next mission hardware that would allow it — this one time only — to be pre-positioned. First they convinced themselves it could be done, and then they convinced NASA Administrator Mike Griffin. The Hubble mission was back on the schedule.

"We'd had plenty of time to work out all the details needed for processing two vehicles," said Angie Brewer, flow director for Atlantis' STS-125 mission. "The main thing was to be smart with the resources, and to schedule tests so they didn't conflict with tests for the other vehicle."

Atlantis and Endeavour have different processing teams in separate wings of the Orbiter Processing Facility at Kennedy Space Center. They followed the standard countdown plans on schedule. Resources that they shared, such as special testing and servicing facilities and teams, had to be "deconflicted," in NASA jargon. But there was adequate time to lay out a schedule for that, and it all worked out.

"They worked smart and had a plan in advance," said Candrea Thomas, a spokeswoman at NASA's Kennedy Space Center. "There was no more overtime than usual."

Orbital drawbacks

The reasons why Atlantis' crew can't reach safe haven at the space station — or, for that matter, why Columbia's astronauts couldn't have done so even if they knew that their ship was mortally wounded — have not always been explained well. But the principles are fairly straightforward. Understanding them opens up an appreciation of some benefits of the different orbits, as well as the inconveniences they can cause.

Shuttles, like other satellites orbiting above the atmosphere, stay in orbit by virtue of their tremendous speed: about 25,000 feet per second (17,000 mph or 27,000 kilometers per hour). Gravity still pulls them toward Earth's center — they still "fall down." But they are moving forward so fast that Earth's curvature drops the ground out from under them. They fly over the horizon and just keep falling.

Changing the direction of the satellite's flight path requires sideways thrust. The "orbital plane" can be shifted by using rocket power. It's just very costly, because the added velocity is usually so tiny compared with the inherent velocity of the orbiting object.

A boost of 1 foot per second to the side results in an orbit that diverges about 400 feet from the previous flight path. To turn the orbit by as much as one degree (about 70 miles) requires an impulse of about 800 feet per second, which is more than enough to return to Earth, or fly hundreds of miles higher.

So when one object orbits at an angle of 28 degrees to the equator (which is typical for a due-east shuttle launch from Kennedy Space Center), and another object is orbiting at 52 degrees (where the space station flies), even the best case demands a plane change of 24 degrees. and hence a thrust almost as powerful as the original blastoff from Earth's surface.

Neither Columbia in 2003 (in a slightly higher orbital inclination) nor Atlantis in 2009 has anywhere near the rocket power to make that "left turn in space" and match orbits with the space station — no matter how often their paths criss-cross one over the other. It's almost close enough to wave, but never to shake hands.

Orbital advantages

But where orbital planes taketh away, they also giveth. If it's required, STS-400 would get a valuable bonus for its rescue mission. Blasting off from Earth, from a point that is being carried eastwards by Earth's rotation, it is much easier to reach a Hubble-type orbit.

First of all, the shuttle can take full advantage of the "kick in the pants" it starts out with by launching directly into the direction of Earth's rotation. Secondly, there's a longer launch opportunity because the flight paths for STS-400 and STS-125 stay closer together for a longer time. The "launch window" for liftoff to the station is usually only four or five minutes, but the corresponding window for a launch to Hubble (and Atlantis, if a rescue is needed) is almost an hour long.

Some days a countdown can be terminated by a serious technical flaw, or meteorological messiness. But other countdowns can be (and have been) scrubbed because of a brief snag — say, a thundercloud, or an intruding pleasure boat in an offshore impact zone, or a software data set that needs to be quickly reloaded. Such problems couldn't be fixed in five minutes, but could have been in 50 minutes.

So the rules of orbital mechanics are what make the STS-400 rescue mission necessary. But the same rules make the mission a little easier than they might otherwise have been.

IndyCar Team Tracking Space Shuttle Atlantis At 2009 Indy 500

PaddockTalk.com

Newman/Haas/Lanigan Racing team members at the Indianapolis Motor Speedway will track the voyage of seven astronauts aboard space shuttle Atlantis beginning May 11 and vice versa.

The 11-day mission incorporates five spacewalks to service NASA's Hubble Space Telescope. Liftoff is scheduled for 2:01 p.m. (EDT).

The tie-in began two years ago when three STS-125 astronauts - mission commander Scott Altman and mission specialists/spacewalkers Andrew Feustel and Mike Massimino - provided a behind-the-scenes tour of the Johnson Space Center in Houston for NHLR team members. The team hosted the astronauts and their families at the Champ Car race that weekend. NHLR senior engineer Craig Hampson has remained in contact with the crew. The tour included mission control, the neutral buoyancy facility and the flight simulator.

"We all proved miserable at landing the shuttle with the exception of our chief mechanic, who brought his young son of the video game generation," Hampson said. "He put it right down on the runway no problem." In practice this week, the Nos. 02 and 06 cars of Graham Rahal and Robert Doornbos are carrying the mission logo at the Indianapolis Motor Speedway. Wrote Altman in a recent e-mail to Hampson: "Hopefully, we'll be back in time to watch the race and root for your team."

"It's great that they're finally able to go up and that it corresponds with our big month of May," Hampson said. "As a team, we're following it really closely and excited for them. If they had gone up earlier, there was a hope they would be able to come to the race. Hopefully, we'll see them sometime during the year at a race."

Astronauts will install two new instruments, repair two inactive ones and perform the component replacements that will keep the telescope functioning into at least 2014.

"The mission is really complicated," Hampson said, "plus trying to do it with a space suit on and gloves on and in space where every action has an equal and opposite reaction. They had to come up with a lot of unique tools and processes to fix things that were never expected to have to be fixed in space. It's going to be a real challenge."

Tour shows a valuable home for 'risky business'

Spaceport gets a look from state, regional officials

Carol Vaughn - Eastern Shore News (Tasley, VA)

WALLOPS ISLAND -- If visitors arriving Wedne-sday for a tour of the Mid-Atlantic Regional Spaceport had questions about what is next for the facility, a 70-foot banner bearing a half-size depiction of Orbital Science Corp.'s Taurus II rocket made the answer clear.

The banner hung from a crane at the intersection of Chincoteague and Mill Dam roads near the entrance to the newly created Wallops Research Park, where an estimated 400 people coming to view MARS' launch of a Minotaur I rocket carrying an Air Force satellite could see it as they arrived.

The spaceport is preparing for the Taurus II's demonstration mission late in 2010, including the addition of $50 million in new infrastructure on Wallops Island.

Billie Reed, executive director of the Virginia Commercial Space Flight Authority, led the two-hour bus tour of NASA Wallops Flight Facility and the spaceport for about 50 guests, including state and local officials those in charge of the spaceport hope will look favorably on additional funding for future operations there. They include U. S. Sen. Jim Webb's representative Charles Stanton, state Sen. Ralph Northam, who represents Virginia's Eastern Shore, Sen. John Watkins, who is on the state Senate Finance Committee and Delegate Lynwood Lewis.

"It's an exciting time. Things are, as they say, really beginning to take off," Reed told the crowd.

The event happened as spaceport personnel waited for a break in the weather to launch their third Minotaur rocket from the facility, and as major improvements are under way there in preparation for the 2010 demonstration mission of the Taurus II rocket, which is designed to carry up to 8,000 pounds of cargo per flight.

NASA, in December, awarded Orbital a $1.9 billion contract for eight missions to supply the International Space Station after the space shuttle program ends. The Dulles company last summer chose MARS as its base of operations for its $45 million space launch vehicle program.

Tour highlights included a stop at the control room where spaceport launches are coordinated and where live video of the Minotaur rocket sitting on pad B could be seen. The rocket was to have launched late Tuesday, but bad weather delayed the launch until later in the week.

Reed cited NASA Wallops Flight Facility's history of successful space missions. "We've gone to orbital here now from Wallops 29 times," Reed told the guests after they viewed footage on the control room's big screen of the successful TacSat-2 launch -- the spaceport's first -- in December 2006.

MARS is in a unique location in the United States to be able to launch rockets to carry cargo to the space station's orbit, Reed said.

"It's in the middle of our sweet spot," he said.

The group then toured a new NASA payload processing facility where the Maximum Launch Abort System Flight Test Vehicle is currently being assembled. The 80-foot by 40-foot facility with its 70-foot tall bay, built in 2003, is an example of what is needed at Wallops to keep the Shore competitive in the space industry, Reed said.

The vehicle being assembled there will test technology designed to ensure the safety of future astronauts during early flight for NASA's Constellation manned space flight program. It is scheduled to launch later this month.

The tour bus later drove onto seven-mile long Wallops Island, past the Minotaur on its pad at the island's southern end and also past additional sites to the north where a launch pad for the liquid-fueled Taurus rocket and a $12 million horizontal integration facility with room to assemble two of the rockets simultaneously will soon be built.

In addition to the new infrastructure being built on the island in preparation for the Taurus project, Orbital is undergoing a $45 million expansion of its northern Virginia campus, Reed said.

The island also houses $75 million of Navy infrastructure on its northern end.

Virginia Commercial Space Flight Authority Board Chairman Vincent C. Boles, who rode along on Wednesday's tour, said the spaceport's biggest challenge now is the "aggressive timetable" for the Orbital missions.

Boles is general manager of the Advanced Technology Division of The Aerospace Corp. in Chantilly and has 30 years experience in the aerospace industry.

"We've made the big crossroads. Getting that first launch up was a big milestone," Boles said. Now, with the NASA-Orbital contract, the authority's business model, which called for measured growth, "all of the sudden became real."

"We're going to be going through the evolution of what I call the emerging authority," in order to maintain support for the spaceport's current work and prepare for more in the future.

"It's risky business; It's non-forgiving," Boles said of the commercial space business, adding, "You don't get do-overs."

Our views: NASA's brightest star

Final Hubble repair mission sets stage for telescope's grand finale

Florida Today (Editorial)

Ever since humans stood upright and gazed at the night sky, we've been awed by the heavens.

And asking the eternal questions:

How was the universe born? What makes it tick? Are we alone in its vastness?

More than any instrument crafted by man's ingenuity, NASA's Hubble Space Telescope has striven to answer those questions, revolutionizing our understanding of the cosmos and our place in it.

Now, the instrument is poised for a grand finale of observation as shuttle Atlantis' crew prepares for liftoff Monday from Kennedy Space Center on the fifth and final Hubble repair mission that will allow the telescope to look deeper into space than ever before.

In work akin to orbital brain surgery, spacewalking astronauts will install a new camera, sensors, gyroscopes and batteries that will allow Hubble to function through at least 2014, after which it will flame out in a funeral plunge through the atmosphere.

But before then — providing the operation goes well — Hubble should unleash more historic discoveries, cementing its place as NASA's brightest star and alongside the Apollo moon landings as among humanity's greatest scientific achievements.

Nearsighted start

While Hubble is a household name now, it had a star-crossed beginning.

The brainchild of astronomer Lyman Spitzer in 1946, NASA got behind the idea in the 1970s and billed the initial $1.5 billion project as a "time machine" that could peer back to the earliest moments of the universe's existence. Its launch was delayed by the shuttle Challenger accident, and when shuttle Discovery ferried it into orbit in 1990, the unthinkable happened:

A flaw in what was supposed to be the most perfect mirror made had left Hubble a near-sighted wreck, its pictures a fuzzy blur. NASA became the butt of late-night jokes on TV and was crucified in Congress.

It took a life-saving repair flight in 1993 — where astronauts installed corrective optics similar to eyeglasses to restore the telescope's vision — to put Hubble on the fast track to posterity.

Building on the accomplishments of Newton, Galileo and Einstein, it wasted no time turning science fiction into science fact and altering our fundamental understanding of how the universe works.

Stunning discoveries

Among its stunning discoveries:

- Hubble has nailed down the age of the universe at about 13.7 billion years, and with it the Big Bang, the moment when scientists believe the cosmos was born in an explosion that created all matter and, ultimately, us.

- It has proven the existence of black holes and confirmed the monsters — which gobble up everything that comes their way — form the centers of galaxies, including our Milky Way.

- It has looked into clouds of interstellar gas where stars are born, examined quasars and supernova, and studied the chemical makeup of planets in other solar systems to see if they might have the ingredients for life.

In doing this and much more — and displaying its pictorial prowess on the Web — Hubble has captured the public's imagination in a way never thought possible, becoming a cultural icon.

That's perhaps best shown in what is arguably its most famous picture, called the Hubble Deep Field.

Peering into a tiny speck of the sky, the telescope provided the deepest, most detailed visible view of the universe, uncovering a bewildering assortment of at least 1,500 galaxies at various stages of evolution.

The photo is even more remarkable when you consider the view represents the typical distribution of galaxies in space, and so a universe infinitely filled with stars and planets.

Most noble quest

Outfitted with new gear, Hubble will continue its galactic photo shoot while also focusing its instruments on something else: The hunt for dark matter, which is thought to comprise about 70 percent of the universe but about which scientists know almost nothing.

Theory suggests it plays a role in the formation, rotation and evolution of galaxies, which makes Hubble's upcoming hunt a detective story of the highest order.

Centuries from now, Hubble will be cited as a turning point in unlocking the ancient mysteries of the universe and opening our minds to new worlds of knowledge.

It has been a most noble quest that, we're happy to say, still has a long way to go.

NASA needs mission booster

St. Petersberg Times (Editorial)

President Barack Obama said this spring that NASA was afflicted by "a sense of drift," but the reality is far worse. The nation's space agency has no permanent administrator. It is set to retire the space shuttle, yet its replacement craft has been hard hit by technical and budget problems.

The expected five-year gap between the shuttle's end and the return to manned space flight has caused a brain drain in the space industry. Officials on the Space Coast near Kennedy Space Center expect to lose as many as 10,000 jobs in the coming years.

Meanwhile, the Obama administration announced last week that an independent panel would take a "fresh look" at NASA's space flight program. This is a poor time for the president to contribute to the same "sense of drift" he bemoaned in March.

The space agency needs a new sense of purpose and strong leadership to carry it out. But in Washington, the Obama White House continues to fiddle, while in Florida leaders have failed to rally around a high-tech industry that could chart a new course for the state. The embattled president of Space Florida resigned last week, and U.S. Sen. Bill Nelson said Friday that agency should "clean house."

The president's $18.7 billion budget for NASA retains the plan to fly nine more missions before retiring the space shuttle in 2010. But the commitment to NASA seems to end there. The next-generation Constellation rocket project calls for a return to orbit by 2015 and moon-and-beyond flight by 2020. The review that Obama ordered last week should clarify by August whether the return of manned flight — and the budget commitments to make it possible — are, in this recession, a presidential priority.

The end of shuttle flights, even if they extend into 2011, will have devastating effects on Florida. The Cocoa Beach Area Chamber of Commerce estimates that job losses at Kennedy could cost another 18,000 jobs across the region. The layoffs will only compound the fall in property values as many aerospace workers try to relocate or seek retraining for other jobs.

The state needs to develop a space policy as the White House reassesses its own plans for NASA. The industry has too much history in Florida and too much promise for the state's economy to tie it solely to the whims of this administration's vision for space exploration.

Florida should find incentives to keep the industry's technical base and to compete for commercial space ventures. At the least, Florida can remain on the cutting edge until the Obama administration sorts out whether, how and when to return to flight.

END

More detailed space news can be found at:

http://spacetoday.net/
http://www.bulletinnews.com/nasa/

-KjH
Kyle Herring
NASA Public Affairs - Space Shuttle Program

"The Skulls met the Pythons
Down at the First Street station
Alliances have been made in alleyways
All across the nation"

Enclosure 2

Mcconnell, Stephen (HQ-NB040)

From: Suffredini, Michael T. (JSC-OA111)
Sent: Wednesday, May 20, 2009 12:43 AM
To: Read, Michael E. (JSC-OX111); Gerstenmaier, William H. (HQ-CA000); Shireman, Kirk A. (JSC-OA111)
Subject: RE: For concurrence: Soyuz contract release & RTQ

I concur.

From: Read, Michael E. (JSC-OX111)
Sent: Tuesday, May 19, 2009 5:07 PM
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We helped edit the background paper and the RTQs.

Mike

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To: Read, Michael E. (JSC-OX111)
Sent: Tue May 19 16:43:50 2009
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Yes, from my perspective they are accurate and complete, and ready for usage upon receipt of a signed contract modification from Roscosmos...which is expected any day.

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Cordero, Jessica A. (JSC-AP111)

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Sent: Wednesday, May 13, 2009 12:18 PM
To: Ruiz, Marianne D. (JSC-BG111); Skowron, Gail L. (JSC-BG111); Autry, Katherine K. (JSC-BG111)
Cc: Suffredini, Michael T. (JSC-OA111); Jennings, Kelly J. (JSC-BG111)
Subject: RE: Russian Contract Mod

Except that the addition under "Status" should read "...beyond those already contracted through the fall of *2011*"...not 2012.

Mike Read

Manager, Russian Integration Office

International Space Station Program

NASA/Johnson Space Center

281-244-7656 (Office)

713-470-8258 (Blackberry)

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<< File: Soyuz Contract 051309 1130 EST.doc >>

Jeff

Harold V. Jefferson

Sr. Procurement Analyst

300 E Street S.W. , Suite 5O82

Washington, DC 20546-0001

202.358.0409 Voice

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Enclosure 3

RTQ: 09-12 **5/28/09**

SUBJECT: CONTRACT FOR RUSSIAN SOYUZ SERVICES

BACKGROUND: Since the procurement of seats in a Soyuz vehicle requires an advance commitment of approximately three years, in early 2009, NASA and Roscosmos have been discussing procurement of additional Soyuz crew transportation and related services after the existing contract commitment. The latest procurement covers six seats for crew rotations in 2012-2013. The previous procurement covered three seats in a fall 2011 launch (spring 2012 landing).

A Continuing Resolution signed by President Bush on Sept. 30, 2008 included the extension of an exception to the Iran, North Korea and Syria Nonproliferation Act (INKSNA) that allows NASA to negotiate these agreements for Soyuz services with Roscosmos.

How many additional Soyuz trips were under discussion this year?
Modification 1 of the synopsis entitled "Procurement of Crew Transportation and Rescue Services from Roscosmos," published on April 16, 2009, clarified that a minimum of three seats to a maximum of 24 seats could have been procured. This May 2009 contract modification will provide for six U.S. Operating Segment (USOS) crew member rotations in calendar years 2012 and 2013.

What was the value of the previous contract?
The full value of the December 2008 contract extension, providing for services for three Soyuz seats in 2011, was approximately $141 million. The original contract was signed Dec. 16, 1993. The basic contract was awarded for $400 million.

What is the value of the additional Soyuz services in this latest modification?
There have been 195 modifications issued to date and this May 2009 contract extension is Modification 196. The value of Modification 196 is $306 million, which includes all necessary training and preparation for launch, crew rescue, and landing of a long-duration mission for six individual station crew members. The contract modification also provides for crew post-flight rehabilitation, medical exams and services. Under the contract modification, the Soyuz flights will carry limited cargo to and from the station and dispose of trash. The cargo allowed per person is approximately 110 pounds (50 kilograms) launched to the station, approximately 37 pounds (17 kilograms) returned to Earth, and trash disposal of approximately 66 pounds (30 kilograms).

What is the cost per seat for the six additional seats, and how does that compare to what NASA was paying Russia for Soyuz support from the 2008 contract extension?
NASA is purchasing comprehensive Soyuz support including all necessary training and preparation for launch, crew rescue and landing for an entire long-duration mission, as well as some limited crew cargo delivery to and from the station. These services amount to approximately$51 million for each crew rotation purchased in 2012- 2013. The average cost for each crew rotation purchased in 2008 and flown in 2011-2012 was $47.1 million. The increase covers a general rise in the cost of providing the services.

How does the price per seat compare to what spaceflight participants pay?
NASA is not part of the negotiations between Roscosmos and spaceflight participants. We do not have the information to comment on the terms and conditions of these flights.

Why doesn't the contract extend Progress cargo shipments past 2011?
NASA does not plan to purchase Russian Progress cargo services beyond the existing services contracted through 2011. On Dec. 23, 2008, NASA awarded two International Space Station Commercial Resupply Services contracts to companies that will deliver cargo to the International Space Station after the retirement of the space shuttle. One was awarded to Orbital Sciences Corp. of Dulles Va., and another was awarded to Space Exploration Technologies (SpaceX) of Hawthorne, Calif. NASA ordered eight flights valued at $1.88 billion from Orbital and 12 flights valued at $1.59 billion from SpaceX. The maximum potential value of each contract is $3.1 billion. Based on known requirements, the value of both contracts is projected at $3.5 billion total.

Each contract calls for the delivery of a minimum of 20 metric tons of unpressurized or pressurized cargo to the space station, as well as the return or disposal of cargo from the orbiting complex. NASA will monitor the progress each company makes toward the fulfillment of these services.

If U.S. commercial cargo capabilities are not available as early as planned, NASA will rely on pre-positioned critical spares, delivered by the shuttle before its retirement, for replacement of hardware and components. Space station operations may be affected if on-orbit components fail at a higher rate than predicted. The cargo up-mass capability of the European Automated Transfer Vehicles (ATV) and Japanese H-II Transfer Vehicles (HTV) will keep the station safe until U.S. cargo capabilities are available, but they may not ensure high productivity operations.

Europe plans to fly four more ATVs between 2010 and 2013, and Japan plans to fly seven HTVs in 2009-2015 under the current schedule.

NASA plans to minimize the risk to continued station viability and promote the development of a competitive, low-Earth orbit space economy, which will grow as both government and non-government users increase the demand for on-orbit services.

Where will the money come from?
Funding will come out of the "ISS Crew and Cargo Services" budget line that already has been included in the NASA budget.

Why doesn't NASA use the money from this contract instead to support COTS-D?
In the near term, NASA must secure crew transportation from an experienced and qualified provider that has a demonstrated capability, in order to ensure a continued U.S. presence aboard the station. The Russian Soyuz is a proven, reliable vehicle operated by one of the station's international partners. NASA will consider other sources for the transportation of crew to ISS when that capability has been successfully demonstrated.

In the future, NASA is open to competitively procuring U.S. commercial crew transportation services. However, it is essential that commercial cargo services be demonstrated first, in order to meet the requirements of the resupply contracts already awarded and ensure continued operations and maintenance of the station.

NASA will integrate U.S. commercial crew transportation vehicles into the station's logistics rotation when that capability is demonstrated. NASA has proposed to Congress that they apply a portion of Recovery Act funds for Exploration Systems through its Commercial Crew and Cargo Program as initial steps to stimulate efforts within the private sector to develop and demonstrate technologies that enable commercial human spaceflight capabilities.

What was the reason NASA modified the pre-solicitation regarding Soyuz seats?
NASA was going to buy a minimum of 18, the modification brought it down to three.

Modifications to pre-solicitations are not uncommon. The parties determined that contracting for a full year of Soyuz seats provided for the initial immediate crew rotation needs of the USOS and gave NASA the opportunity to evaluate other potential crew rotation providers in the future. For this modification, NASA chose to procure six seats since it is highly unlikely a proven capability other than Soyuz will be available in the next six months.

Why is NASA contracting more than the minimum of three Soyuz seats, as defined in the modified synopsis?
As stated by our partner and Soyuz services provider, Roscosmos, there is a three-year lead time required to manufacture a Soyuz vehicle, which necessitates having a contract in place for three Soyuz seats in the fall of 2012 by the fall of 2009. Currently, there is no proven domestic capability to deliver cargo to the space station on non-human rated vehicles which is expected to occur prior to demonstration of crew capability. In order to ensure a continuous U.S. crew presence on board the station in the fall of 2012, it is unlikely that a human rated capability could be guaranteed in the next six months (by the fall of 2009). Therefore, Soyuz services through the fall 2012 launches were procured.

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Enclosure 4

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May 28, 2009

CONTRACT RELEASE: C09-24

NASA EXTENDS CONTRACT WITH RUSSIAN FEDERAL SPACE AGENCY

WASHINGTON -- NASA has signed a $306 million modification to the current International Space Station contract with the Russian Federal Space Agency for crew transportation and related services in 2012 and 2013.

The firm-fixed price modification covers comprehensive Soyuz support, including all necessary training and preparation for launch, crew rescue, and landing of a long-duration mission for six individual station crew members.

Space station crew members will launch on four Soyuz vehicles: two in spring 2012 and two in fall 2012. Their landings are scheduled for fall 2012 and spring 2013, respectively. The contract modification also provides for crew post-flight rehabilitation, medical exams and services.

Under the contract modification, the Soyuz flights will carry limited cargo to and from the station, and dispose of trash. The cargo allowed per person is approximately 110 pounds launched to the station, approximately 37 pounds returned to Earth, and trash disposal of approximately 66 pounds.

For more information about NASA and agency programs, visit:

http://www.nasa.gov

-end-

Summary of Discussions
NASA-CNSA Science Working Group
June 30-July 1, 2008

Summary
On June 30 and July 1, 2008, delegations led by the U.S. National Aeronautics and Space Administration (NASA) and the China National Space Administration (CNSA) met in Beijing, China. The Chinese delegation also included representatives from the China Meteorological Administration (CMA), the National Satellite Meteorological Center (NSMC), the National Satellite Ocean Application Service (NSOAS) and the Chinese Academy of Sciences (CAS). This was the first formal bilateral meeting of the NASA-CNSA Earth and Space Science Working Groups. As only background information and general topics were discussed at this first meeting, the two Working Groups met in combined session; future Working Group meetings will likely consist of separate Earth science and space science sessions.

The discussions were exploratory in nature and focused on providing general background information about current and future science programs and plans at NASA and CNSA. The two groups also discussed areas of potential mutual interest in Earth science and space science. A complete delegation list is at Attachment 1.

Discussion Topics

Background and International Relations
On June, 30, Mr. Michael O'Brien, Assistant Administrator for External Relations, delivered a non-paper on behalf of the U.S. Government to Mr. Luo Ge, Vice Administrator of CNSA, who agreed to transfer the document to appropriate Chinese authorities. Mr. O'Brien then provided an overview of NASA's current overall plans in space exploration. He also gave a summary of the manner in which NASA participates in international cooperative activities. Mr. Wang Keran, Director General, Foreign Affairs Department provided a similar briefing on CNSA activities.

Earth Observation Science Facilities Tour
On June 30, CNSA officials arranged a visit of the NASA delegation to the CMA Satellite Center (CMA/NSMC) and the China Center for Earth Resources Satellite Data Application (CRESDA). At CMA/NSMC the NASA delegation was given a tour of the system operations facility and two briefings on the Chinese Feng Yun (FY) satellite series. At CRESDA, the NASA delegation heard presentations on the Huan Jing (HJ) satellite series and about the China-Brazil Earth Resources Satellite.

Space Science
On July 1, Dr. Marc Allen, Assistant Associate Administrator for Strategy, Policy and International, Science Mission Directorate (SMD), gave an overview of SMD and reviewed NASA's method for making decisions on science missions. Dr. Paul Hertz, SMD Chief Scientist, followed with a presentation on NASA's current and future space science missions and potential areas of collaboration.

Following questions from the Chinese delegation regarding NASA's programs, Dr. Wang Chi, Deputy Director of Chinese Center for Space Science and Applied Research (CSSAR), gave a background presentation on Chinese space science activities and future plans. Dr. Hao Xifan, Deputy Director General, Lunar Exploration Program Center (CLEP) of CNSA, then gave a presentation on the current status of Chang'e-1 and plans for future lunar robotic missions.

Earth Science

On July 1, Dr. Michael Freilich, Director, Earth Science Division, SMD, provided a summary of NASA's current missions and future plans in Earth observation and Earth science.

Dr. Tang Junwu from NSOAS presented information about China's ocean observing satellites. Dr. Yu Tao, from CNSA's Demonstration Center for Spaceborne Remote Sensing followed and presented information about the status of and applications arising from China's remote sensing activities.

Summary of Next Steps

On July 1, Mr. Luo and Mr. O'Brien summarized the activities of the meeting and discussed possible next steps. The delegations agreed to the following general activities and potential future discussion topics:

- Mr. O'Brien and Mr. Luo will remain the working group points of contact. Eventually, technical leaders for the two working groups will be determined based on the subject areas chosen;

- NASA will consider a reciprocal visit of the working groups to the United States to further refine selected topics before the end of CY 2008;

- NASA and CNSA will begin discussion within respective governments on the possibility of drafting a U.S.-China Framework Agreement on Civil Space Cooperation;

- Candidate topics for further discussion should be narrowed before the next meeting, by mutual agreement;

- Candidate Earth Science topics for future discussion include:
  - U.S. researcher access to global measurements from the Chinese satellites in the Hai Yang (HY)-1 and HY-2 ocean dynamics series
  - Data exchanges related to aerosol robotic network ground stations that monitor spectral aerosol optical depth, aerosol inversion products, and water in diverse aerosol regimes
  - Discussions and activities related to existing geodetic networks/solid Earth processes; and

- Candidate Space Science topics for future discussion include:
  - Data exchanges related to robotic lunar and planetary, astrophysics, and heliophysics missions

- Collaborative research and data analyses involving NASA and CNSA sponsored scientists
- Invitation to CNSA to join NASA and other potential international partners in studying a proposed International Lunar Network, a NASA-led international initiative to create a network of science instruments on the lunar surface in the 2012-2016 timeframe.

The meeting concluded with a discussion between Mr. O'Brien and Dr. Sun Laiyan, Administrator of CNSA. Dr. Sun agreed with the next steps that were discussed during the meeting. Dr. Sun and Mr. O'Brien also agreed that each agency would clear the suggested next steps within their respective governments.

Attachment 1

Delegation

United States
NASA

- Mr. Michael O'Brien, Assistant Administrator, Office of External Relations
- Dr. Marc Allen, Assistant Associate Administrator for Strategy, Policy and International, Science Mission Directorate
- Dr. Michael Freilich, Director, Earth Science Division, Science Mission Directorate
- Dr. Paul Hertz, Chief Scientist, Science Mission Directorate
- Mr. Justin Tilman, NASA Representative to Asia
- Mr. Chris Blackerby, International Programs Specialist, Office of External Relations

U.S. Embassy, Beijing

- Dr. Virginia Curran, Second Secretary Environment, Science, Technology and Health, U.S. Embassy, Beijing
- Mr. Christopher Green, Second Secretary, Environment, Science, Technology and Health, U.S. Embassy, Beijing

China
CNSA

- Mr. Luo Ge, Vice Administrator
- Dr. Zhang Wei, Director General, Foreign Affairs Department
- Mr. Wang Keran, Deputy Director General, Foreign Affairs Department
- Mr. Xu Yansong, Division Director, Foreign Affairs Department
- Dr. Wang Cheng, Deputy Division Director of Satellite Applications
- Dr. Hao Xifan, Deputy Director General, Lunar Exploration Program Center (CLEP)
- Dr. Zang Zhenqun, Deputy Division Director of System Engineering Department
- Dr. Huang Jianchun, Lunar Exploration Program Center
- Dr. Liu Janzhong, Lunar Exploration Program Center

CAS

- Prof. Wang Chi, Deputy Director General, CSSAR
- Dr. Gu Xingfa, Director of Institute of Remote Sensing Applications
- Dr. Yu Tao, Vice Director of Institute of Remote Sensing Applications
- Dr. Meng Qingyan, Institute of Remote Sensing Applications

NSMC

- Dr. Lu Naiquan, Vice Director of National Satellite Meteorological Center

NSOAS

- Dr. Tang Junwu, Leading Scientist, National Satellite Oceanic and Vice Director of National Satellite Ocean Application Service

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

October 26, 2006

Dr. Yuan Jiajun
President
Chinese Academy of Space Technology
82 Zhichun Road, Haidian District
100086 Beijing
People's Republic of China

Dear Dr. Yuan:

Thank you for your hospitality during my recent visit to China. My visit to the Chinese Academy of Space Technology was both informative and enjoyable.

I would like to thank you and your colleagues for your time and efforts. It was a pleasure to have met you.

Sincerely,

Michael D. Griffin
Administrator

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

October 26, 2006

Dr. Wu Ji
Director
Chinese Academy of Sciences
1 Nanertiao Road, Zhongguancun, Haidian District
100080 Beijing
People's Republic of China

Dear Dr. Wu:

Thank you for your hospitality during my recent visit to China. My visit to the Center for Space Science and Applied Research was informative and enjoyable.

I would like to thank you and your colleagues for your time and efforts. It was a pleasure to have met you.

Sincerely,

Michael D. Griffin
Administrator

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

October 26, 2006

Dr. Laiyan Sun
Administrator
China National Space Administration
8A Fucheng Road, Haidian District
100037 Beijing
People's Republic of China

Dear Dr. Laiyan:

Thank you for your support and the support of your colleagues.

Please convey my gratitude to your staff, including Mr. Xu Yansong and Mr. Wang Kerans of the China National Space Administration Foreign Affairs Department.

It was a pleasure to have met you and I look forward to a continued dialogue between our organizations.

Sincerely,

Michael D. Griffin
Administrator

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

October 26, 2006

Dr. Guo Huadong
Vice Secretary General
Chinese Academy of Sciences
52 Sanlihe Road
100864 Beijing
People's Republic of China

Dear Dr. Guo:

Thank you for your hospitality during my recent visit to China. My visits to the various Chinese Academy of Sciences facilities were both informative and enjoyable.

I would like to thank you and your colleagues for your time and efforts. It was a pleasure to have met you.

Sincerely,

Michael D. Griffin
Administrator

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

October 26, 2006

Professor Jiang Mianheng
Vice President
Chinese Academy of Sciences
52 Sanlihe Road
100864 Beijing
People's Republic of China

Dear Professor Jiang:

Thank you for your hospitality during my recent visit to China. My visits to the various Chinese Academy of Sciences (CAS) facilities were both informative and enjoyable.

I also appreciated the opportunity to interact with China's future space science and technology leaders during the lecture to the graduate students of CAS. I thank you and your colleagues for your time and efforts. It was a pleasure to have met you.

Sincerely,

Michael D. Griffin
Administrator

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

October 26, 2006

Dr. Zheng Guoguang
Vice Administrator
China Meteorological Administration
46 Nandajie Road, Zhongguancun, Haidian District
100081 Beijing
People's Republic of China

Dear Dr. Zheng:

Thank you for your hospitality during my recent visit to China. My visit to the China Meteorological Administration and the National Satellite Meteorological Center was informative and enjoyable.

I thank you and your colleagues for your time and efforts. It was a pleasure to have met you.

Sincerely,

Michael D. Griffin
Administrator

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

October 26, 2006

The Honorable Xu Guanhua
Minister
Ministry of Science and Technology
15B Fuxing Road, Haidian District
100862 Beijing
People's Republic of China

Dear Minister Xu:

Thank you for your hospitality during my recent visit to China. My visit to the Ministry of Science and Technology was informative and enjoyable.

I thank you and your colleagues for your time and efforts. It was a pleasure to have met you.

Sincerely,

Michael D. Griffin
Administrator

National Aeronautics and
Space Administration

Office of the Administrator
Washington, DC 20546-0001

October 26, 2006

Dr. Shen Xuemin
Deputy Director
Shanghai Institute of Technical Physics
500 Yutian Road
200083 Shanghai
People's Republic of China

Dear Dr. Shen:

Thank you for your hospitality during my recent visit to China. My visit to the Shanghai Institute of Technical Physics, Chinese Academy of Sciences were both informative and enjoyable.

I thank you and your colleagues for your time and efforts. It was a pleasure to have met you.

Sincerely,

Michael D. Griffin
Administrator

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

October 26, 2006

Mr. Han Zheng
Acting Party Secretary and Mayor of Shanghai
1418 West Nanjing Road
200040 Shanghai
People's Republic of China

Dear Mr. Han:

Thank you for your hospitality during my recent visit to China. My visit to Shanghai was informative and enjoyable.

I enjoyed learning about the impressive city of Shanghai during the lunch that you were so kind to host. It was a pleasure to have met you.

Sincerely,

Michael D. Griffin
Administrator

National Aeronautics and
Space Administration

Office of the Administrator
Washington, DC 20546-0001

October 26, 2006

Dr. Jinghua Cao
Deputy Director
International Cooperation Bureau
Chinese Academy of Sciences
52 Sanlihe Road
100864 Beijing
People's Republic of China

Dear Dr. Cao:

I would like to take this opportunity to acknowledge the hospitality that my delegation and I received during our recent visit to China. My visits to the various Chinese Academy of Sciences facilities were informative and enjoyable.

I thank you and your colleagues for your time and efforts. It was a pleasure to have met you.

Sincerely,

Michael D. Griffin
Administrator

National Aeronautics and
Space Administration

Headquarters
Washington, DC 20546-0001

May 9, 2006

Reply to Attn of: Office of External Relations

Mr. Luo Ge
Vice Administrator
China National Space Administration
8A, Fucheng Road
Haidian District
Beijing, 100037
People's Republic of China

Dear Mr. Luo:

Thank you again for visiting NASA and meeting with me on April 3, 2006. I enjoyed seeing you again and appreciated the opportunity to continue our dialog regarding developments in our respective civil space programs.

During our meeting, I was particularly pleased to receive your Administrator's invitation for the NASA Administrator to visit China. The NASA Administrator is pleased to accept that invitation and is currently considering a visit to China sometime during the September 21-27, 2006, timeframe.

The NASA Administrator's overall objectives for his visit to China are to better understand Chinese civil space capabilities and interests through facility tours and meetings, as well as to exchange information regarding opportunities for working together in Earth science research and lunar exploration. As such, he would be particularly interested in visiting spacecraft development, test, and launch facilities, including the Jiuquan launch facility, as well as Earth science and lunar exploration research institutes.

As we discussed, NASA is looking forward to receiving your specific suggestions for site visits and meetings. Mr. Peter Ahlf is the NASA Point of Contact in my office for making the associated arrangements. He can be contacted by telephone at +1 202-358-0708 and by email at peter.r.ahlf@nasa.gov.

I look forward to our continued coordination on this matter and to the opportunity to see you again in China.

Sincerely,

for

Michael F. O'Brien
Assistant Administrator
for External Relations

国家航天局

CHINA NATIONAL SPACE ADMINISTRATION

To:

Dr. Mike Griffin

Administrator

NASA

Fax: +1-202-358-4329

Dear Mr. Griffin,

On behalf of China National Space Administration, I would like to extend my invitation to you for an official visit to China in September of 2006.

This is the continuation of my visit to NASA in December 2004 and following our extensive exchange on number of occasions for lunar exploration, human spaceflight, earth science and remote sensing etc. Your trip will be considered as an implementation step between our two Presidents' proposal on space cooperation.

Enclosed is a proposed agenda, more details will be available in the coming weeks. Please let me know if there are any thing else that we could facilitate during your visit to China.

I look forward to hearing from you and I await for your names of delegation.

Sincerely yours,

孙来燕

Sun Laiyan

Administrator

CNSA

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A/2006-00845

000058

National Aeronautics and
Space Administration
Headquarters
Washington, DC 20546-0001

August 8, 2006

Reply to Attn of: Office of External Relations

Dr. Sun Laiyan
Administrator
China National Space Administration
8A, Fucheng Road
Haidian District
Beijing 100037
People's Republic of China

Dear Dr. Sun:

Thank you for your recent letter inviting the NASA Administrator to visit China in September 2006. I am pleased to accept your invitation on his behalf. Dr. Griffin looks forward to getting better acquainted with civil space officials in China, touring aerospace facilities, and discussing potential areas of mutual interest with you.

The NASA delegation plans to arrive in China on September 22, 2006, and to depart on September 28, 2006. I appreciate the efforts of your staff and the progress made to date in planning this trip.

I look forward to meeting with you in September.

Sincerely,

M F O'Brien

Michael F. O'Brien
Assistant Administrator
for External Relations

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08/11/2006 12:51 202-358-4329 EXTERNAL RELATIONS PAGE 01/01

NASA Administrator Trip to China
Summary

- Based on agreement between President Hu and President Bush in April 2006, the NASA Administrator visited Beijing and Shanghai China on September 23-28, 2006. The NASA delegation was hosted by Dr. Sun Laiyan, Administrator of the China National Space Administration (CNSA).

- The NASA delegation included Administrator Mike Griffin, Associate Administrator for Space Operations Bill Gerstenmaier, Assistant Administrator for External Relations Mike O'Brien, Deputy Assistant Administrator for Public Affairs Dean Acosta, and Astronaut Shannon Lucid.

- NASA participated in meetings with the following:

  - CNSA: discussed respective program plans and objectives, as well as mutual interest in further discussions regarding potential cooperation in scientific data exchange, lunar exploration, and space debris tracking and mitigation.
  - The Chinese Academy of Space Technology (CAST): reviewed CAST programs and facilities for development, integration and testing of remote sensing, space science, lunar, and human spacecraft
  - The Chinese Academy of Sciences (CAS): received an overview of CAS programs throughout China and presented a public diplomacy lecture on NASA programs to CAS graduate students
  - The Center for Space Science and Applied Research (CSSAR), CAS: reviewed programs and facilities for development of remote sensing, lunar, and human spacecraft scientific payloads, as well as facilities for science data management and applications
  - The Shanghai Institute of Technical Physics (SITP) and the Shanghai Astronomical Observatory (SHAO), CAS: received an overview of SITP satellite payload development programs and SHAO observation capabilities; discussed SHAO interest in scientific cooperation
  - The China Meteorological Administration (CMA) National Satellite Meteorological Center (NSMC): reviewed programs and facilities for downlink and applications of Chinese meteorological satellite data
  - The Minster for Science and Technology (MOST): discussed respective programs and mutual interest in further discussions regarding potential science collaboration
  - The Acting Communist Party Secretary in Shanghai and Mayor of Shanghai: received an overview of Shanghai city development achievements and plans.

- The NASA delegation did not meet with any Chinese human spaceflight program officials.

- NASA met its trip objectives of getting better acquainted with Chinese space officials, as well discussing areas of mutual interest and concern. With the exception of China's human spaceflight program, Chinese officials were open and forthcoming about their programs and interests, and expressed a strong interest in cooperation with NASA.

- China has developed broad and impressive capabilities in remote sensing, and space science, including plans for China's first lunar orbiter mission in April 2007. It was not possible to assess Chinese capabilities in human spaceflight since the NASA delegation was not allowed to visit facilities related to human space flight.

- NASA welcomes China's emergence as a peaceful space-faring nation. The trip was a first, positive step towards closer relations between the United States and China in civil space activities. Given the purpose of the trip, no specific proposals for cooperation were discussed, and no agreements were signed.

- CNSA proposed that NASA and CNSA establish working groups to discuss opportunities for collaboration in earth and space science, lunar exploration, and space debris tracking and mitigation. CNSA also proposed that the two agencies conduct yearly meetings to review these activities and suggested that CNSA Administrator Sun is considering a visit to the United States in spring 2007. Cooperation in human spaceflight was not discussed.

- NASA responded with interest to CNSA's proposals, but noted that further coordination within the U.S. government would be required prior establishment of working groups and discussion of specific cooperative projects.

- Note: The Minister of Science and Technology asked if China could participate in the ISS Program. The Administrator responded that no such invitation was contemplated by the ISS partnership, noting at length the absolute requirement for openness and transparency among all ISS partners regarding human space flight activities.

- [redacted]

(b)(5)

- [redacted] NASA plans to conduct follow-on discussions with CNSA regarding respective interests in science cooperation. This will involve a visit to China by a NASA delegation including the Associate Administrator for the Science Mission Directorate in the late 2006 or early 2007 timeframe.

(b)(5)

- Meanwhile, NASA will continue current multilateral discussions that include China in exploration strategy development, spectrum management, and orbital debris management.

U.S. Civil Space Cooperation with China

Background

- NASA's bilateral interactions with China have been very limited.

- Following the meeting between President Bush and President Hu in April 2006, the NASA Administrator visited China in late September 2006 to:

  meet Chinese civil space officials;
  visit Chinese aerospace facilities;
  understand Chinese plans for space exploration;
  encourage greater Chinese transparency; and
  exchange views on areas of potential mutual interest and concern.

- Chinese officials were forthcoming about their scientific programs and objectives, and interested in civil space cooperation with NASA.

- However, the Administrator was not allowed to visit Chinese human space flight facilities.

Current Cooperation

- NASA has one agreement with the Chinese Academy of Science to study the dynamic processes of the Earth's interior.

Potential Future Cooperation

b5
- [redacted]

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- [redacted]

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[redacted]

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.

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 State Department's Circular 175 process for

8/21/08

Proposed Anomaly for NASA in Initial FY 2009 Continuing Resolution
Extension of NASA Exception to INKSNA

Anomaly:

"P.L. 106-178, 50 USC 1701 note is amended in subsection 7(1)(B) by striking 'January 1, 2012' and inserting in lieu thereof 'July 1, 2016'".

Date Required:

This provision is urgently required in the initial Continuing Resolution on 1 October 2008

Rationale:

This amendment extends the exception to the Iran, North Korea and Syria Nonproliferation Act (P.L. 106-178, 50 U.S.C. 1701 note, "INKSNA"), which prohibits "extraordinary payments" both "in cash" and "in kind" by the U.S. Government (whether directly or via contractors) to the Russian Government, Roscosmos and entities under its authority for the International Space Station (ISS) or relating to human spaceflight activities from January 1, 2012 to July 1, 2016. In 2005, Congress provided an exception for ISS purchases and barters through December 31, 2011—the projected date at that time when NASA's new crew transportation system was to come online. With the exception granted in 2005, NASA is paying Russia for space vehicles for crew transport, rescue, and cargo supplies between 2006 and 2011.

NASA and the U.S. commercial sector are aggressively developing new domestic U.S. crew transportation capabilities that will remove the dependency on Russian vehicles. However, NASA's current projected date to bring U.S. crew transportation and rescue capabilities online is now 2016, when the U.S. Orion Crew Exploration Vehicle will have reached Full Operational Capability, and U.S. commercial providers of crew transportation and rescue services are not expected to have demonstrated the equivalent capability to meet ISS mission needs before 2016.

This extension is necessary to ensure continued U.S. access to and presence onboard the ISS, including crew transportation and rescue, cargo resupply services from U.S. commercial providers, and Russian-unique equipment and capabilities (e.g. sustaining engineering and spares). After 2011 and until U.S. capabilities are available, the U.S. has no other means to meet these requirements and sustain the ISS. The U.S. has made a major investment in, and been the leader of, the ISS, and must be able to meet U.S. obligations under the ISS Agreements, retain U.S. leadership of the ISS, and ultimately space, and sustain ISS for post-Shuttle operations and utilization until alternative U.S. capabilities are available.

While the current legislative exception does not expire until 2011, this extension is urgently needed now to negotiate contracts for production of more Russian Soyuz vehicles, which will take approximately 36 months to develop. The current contract for Soyuz services expires in the fall of 2011. In order for the U.S. to have a contract in place providing for Soyuz services beginning with the crew rotation in the fall of 2011 until the spring of 2012, legislative authority must be in place three years prior to that.

This extension maintains the core nonproliferation goals of INKSNA and ensures that U.S. commercial providers can use Russian hardware when providing domestic crew and cargo services to the ISS. This extension also is consistent with Section 301 of H.R. 6574, the United States-Russian Federation Nuclear Cooperation Agreement Act of 2008, as reported by the House Committee on Foreign Affairs on July 23, 2008, and with the intent of S. 3103, the International Space Station Payments Act of 2008, as introduced on behalf of the Administration by Senators Biden and Lugar on June 9, 2008.

NASA Administrator Trip to China
Main Messages

- As agreed by President Hu and President Bush in April 2006, the NASA Administrator is visiting China on an invitation from Dr. Laiyan Sun, Administrator of the China National Space Administration (CNSA).

- The purpose of the trip:
  Get better acquainted with Chinese civil space officials.
  Visit Chinese aerospace facilities.
  Understand Chinese plans for space exploration.
  Encourage greater Chinese transparency and mutual understanding on civil space matters.
  Conduct an exchange of views on areas of potential mutual interest and concern.

- General messages:
  NASA welcomes China's emergence as a peaceful, space-faring nation.
  NASA applauds China's achievements and contributions in Earth science research and human spaceflight.

- Given the purpose of the Administrator's trip, it is premature to speculate on potential NASA cooperation with Chinese aerospace entities.

- Specific messages in this regard:
  Any future cooperation should be mutually beneficial and consistent with all existing U.S. laws and regulations regarding U.S. activities with China.
  Specific questions regarding U.S. policy toward China will be directed to the Department of State.
  We would like to understand Chinese plans for space exploration and Earth science research
  We are interested in hearing Chinese views on other areas of potential mutual interest.

- Other areas for potential discussion:
  Regarding Earth science research, China has developed robust capabilities and NASA appreciates the role of Chinese scientists in a number of multilateral working groups devoted to this type of research.
  NASA also recognizes the partnership between NOAA and Chinese entities in exchange of data and information, work on understanding the ocean's role in climate, and study of living marine resources and polar sciences.

- Following his visit to China, the NASA Administrator will report the results to the President.

RTQ: 06-XXX **8/30/06**

SUBJECT: CHINA TRIP (DRAFT)

Background: The NASA administrator will be visiting China from September 22 through September 28, 2006.

When is the NASA administrator going to China?

Dr. Griffin is scheduled to visit China from September 22 through September 28, 2006.

What will he do there?

As agreed by President Hu and President Bush in April 2006, in the area of trying to deepen the relationship between our two nations, the NASA Administrator is scheduled to visit China for the very first time. The purpose of this initial NASA Administrator visit to China is to:

- Get better acquainted with Chinese civil space officials;
- Visit Chinese aerospace facilities;
- Understand Chinese plans for space exploration;
- Encourage greater Chinese transparency and mutual understanding on civil space matters;
- Exchange views on areas of potential mutual interest and concern.

What specific facilities will the Administrator visit?

CNSA has organized visits to:

- the Chinese Academy of Space Technology (CAST), where space hardware is developed;
- the Chinese Academy of Science (CAS) to view payload development facilities in Beijing and Shanghai;
- the National Satellite Meteorological Center in Beijing to see satellite operations facilities; and
- the Jiuquan Launch Facility, the site of China's human space flight launches.

He will also meet with several key science and technology sector officials in Beijing and Shanghai.

What is NASA's assessment of the Chinese space program?

NASA welcomes China's emergence as a peaceful, space-faring nation. We applaud China's achievements in Earth science research and human spaceflight. NASA notes in particular China's contributions to the global effort to understand the Earth and its processes, as well as China becoming the third nation to launch humans into space.

How did this trip come about?

As agreed by President Hu and President Bush in April 2006, the NASA Administrator is visiting China on an invitation from Dr. Laiyan Sun, Administrator of the China National Space Administration (CNSA).

Will NASA and China agree to any new aerospace cooperation as a result of this trip? From NASA's perspective, what might areas of potential mutual interest be? In other words, what kind of cooperation could NASA envision with China?

Given the introductory nature of the Administrator's trip, it would be premature to speculate on potential NASA cooperation with Chinese aerospace entities that could result from this visit.

It's important to note that any potential cooperation with China would need to be mutually beneficial and consistent with all existing U.S. laws and regulations regarding U.S. activities with China.

NASA looks forward to discussing Earth science research, and other areas of potential mutual interest, including those already under discussion in multilateral forums such as data sharing, spectrum management for lunar operations, and orbital debris mitigation.

Specific questions regarding U.S. policy toward China should be directed to the Department of State.

Does NASA currently cooperate with China?

NASA's cooperation with China currently consists of limited, low-level, project-specific Earth Science cooperation, involving geodynamics/plate tectonics research and joint participation in certain multilateral coordination groups, such as the Committee on Earth Observation Satellites.

Does NASA plan to cooperate with China in the context of the Vision for Space Exploration?

To date, NASA has no specific plans to cooperate with China on the Vision for U.S. Space Exploration. However, as directed by the President, NASA has been actively seeking opportunities for international involvement in the Vision. As part of this NASA initiative, China has been participating in a multilateral effort among 13 countries to develop a global exploration strategy.

What are NASA's specific interests regarding the Chinese lunar program?

China and several other nations have publicly announced plans for lunar robotic activities. NASA would be interested in understanding China's plans for space exploration.

Any potential cooperation would be consistent with all existing U.S. laws and regulations regarding U.S. activities with China.

Is NASA planning to cooperate with China in any scientific programs?

NASA currently has no specific plans for scientific cooperation with China. In the field of Earth science research, China has developed robust capabilities and NASA appreciates the role of Chinese scientists in a number of multilateral working groups devoted to this type of research.

NASA is also aware of the productive partnership that currently exists between the National Oceanic and Atmospheric Administration and Chinese entities in the exchange of Earth science data and information, work on understanding the ocean's role in climate, and study of living marine resources and polar sciences.

What about human spaceflight? Could China become part of the International Space Station program?

Adding any additional partners to the International Space Station program would require a formal decision by the U.S. government and consultation and agreement among the governments of all the International Space Station partners. We currently have no plans or ongoing discussions in the U.S. government or with our international partners to pursue any Chinese participation in this program.

China has so far launched two crewed missions in its Shenzhou spacecraft. Would NASA consider allowing an astronaut to fly on a Chinese spacecraft, like astronauts now routinely do on Russian Soyuz, or allowing a Shenzhou to dock with the space station or space shuttle?

While NASA applauds China's significant achievements in human space flight, NASA currently has no plans for cooperation with China in human spaceflight related activities.

Why not? Isn't NASA seeking additional forms of transportation for crew and cargo to the International Space Station? Couldn't the Chinese Shenzhou spacecraft dock to the space station and provide the up- and downmass NASA needs?

China's human space flight program is currently in development including its capability to conduct on-orbit rendezvous and docking. China has announced its first test of a rendezvous capability sometime following its next crewed flight planned for late 2008. While we applaud China's initial accomplishments, technical discussions of its participation in the International Space Station program are premature given the required development work and the timeframe for station utilization.

After the retirement of the space shuttle in 2010, transportation needs for the International Space Station can be successfully met with a combination of spacecraft: the U.S. Crew Exploration Vehicle, Russian Soyuz and Progress, European ATV, and Japanese HTV. In addition, the U.S. is pursuing commercial transportation to low-Earth orbit.

Is NASA competing for space dominance with China, given its recent human space flight achievements? In other words, is this a new space race?

No, NASA's focus is to implement the Vision for U.S. Space Exploration outlined by President Bush in January 2004. In announcing the Vision, President Bush said , "The vision I outline today is a journey, not a race, and I call on other nations to join us on this journey, in a spirit of cooperation and friendship."

After the trip, what next?

Following his visit to China, the NASA Administrator will report the results to the President. It is premature to speculate on any potential civil space engagement.

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What are NASA's views regarding U.S. government sanctions on the China Great Wall Industry Cooperation?

Specific questions regarding these U.S. government sanctions should be referred to the U.S. Treasury Department or the U.S. Department of State.

Does the NASA Administrator's visit indicate that the United States and NASA take China seriously as a space power?

Questions regarding U.S. government foreign-policy perspectives with China should be addressed by the U.S. Department of State.

That said, Chinese accomplishments in space speak for themselves.

NASA welcomes China's emergence as a peaceful, space-faring nation. We applaud China's achievements in Earth science research and human spaceflight.

The Rocket Team

Michael D. Griffin
Administrator
National Aeronautics and Space Administration

The 19th Annual Von Braun Dinner
Huntsville, AL
22 October 2007

Good evening. Miles, thank you for being here tonight and for introducing me. Last summer, just prior to a Space Shuttle launch, I sat down for an interview with CNN just as one of your producers informed me that they had to cut away from their coverage of the mission. There was breaking news of vital national interest from Los Angeles: Paris Hilton was going to jail.

That was the moment when I realized how tough the NASA Administrator's job really is. There is no way I can compete for the American people's attention against Paris Hilton. But I guess there is also a good side to this; my face will never grace the cover of *People* magazine.

But seriously, CNN as a network and you in particular, Miles, have done a wonderful job of informing and educating the American public about the who, what, where, when and – most importantly – the whys of our nation's journeys in space, and we thank you for that.

Space exploration is a complex story, a rich story, full of drama and despair, pride and pathos. It is a story we need to tell our children and grandchildren, lest they forget why it is we explore what John F. Kennedy referred to as the "New Frontier" of space. There are many distractions in modern life, and I believe it is necessary for us to discuss openly with the public the principles that led us as a nation to embrace space exploration, five decades ago.

I recently read an interview with actor Bill Pullman, who is famous among those of us who watch science fiction movies for being the president who beat the aliens in the movie *Independence Day.* Pullman wrote and produced a new play about the International Space Station Expedition 6 crew, Ken Bowersox, Don Pettit, and Nikolai Budarin, and their trials and tribulations aboard the ISS following the loss of the Space Shuttle *Columbia.* When Pullman was asked the question about how he first learned of the *Columbia*'s loss, he responded quite simply and insightfully: "It was a Saturday morning, and I think I was in the car driving. I had to go run to get milk and I heard the radio report. I remember pulling off to the side of the road and listening to it. It was stunning to me. I was aware that I hadn't kept up on it. I wasn't somebody who was aware that they had even gone up. Suddenly I became hugely interested."

Probably everyone in this room remembers that Saturday morning of February 1st, 2003. I know Dave King does. He spent the next several months in Texas and Louisiana leading the debris recovery and investigation efforts for *Columbia.* Many of us that morning were probably going about our lives in a manner similar to Bill Pullman when we were pulled in by the television or radio with the news. We called and emailed our family and friends in the space business, and most importantly, we rolled up our sleeves and went to work finding the cause of the accident, fixing it, and continuing the journey.

All of you here know that there are galvanizing moments in our lives, moments we remember forever, moments when we hold our breath in the realization that the events unfolding before us will forever change the course of our lives. These are the events for which we remember precisely where we were and what we were doing, what we saw and what we felt, when we first heard. For the rest of our lives, we return to them in quiet introspection, thinking about how the world changed in those moments. Those who are older can recall many such. For the oldest among us, there is still Pearl Harbor, and later Hiroshima.

For those a bit younger, the assassinations of John and Robert Kennedy, and Martin Luther King, Jr. might be the first. Younger still, and there is the fall of the Berlin Wall or September 11th. Not one of us ever, ever forgets such things. And, for those here tonight, there are many more such milestones even closer to home. Sputnik. Yuri Gagarin. John Glenn. The Apollo Fire. "The Eagle has landed" and, "one small step..." Challenger. Columbia.

These are the things, too often crises, which shape the course of human events. Thus, tonight I will pose for you a question which I hope will stir some debate: Why does it take a crisis to capture our attention?

This is a simple question without a simple answer. However, I do believe that it is fundamental to some of the problems we face in explaining the importance of space exploration to the American public, or to our children. There are many distractions in our lives, distractions that make it difficult to distinguish between what is urgent and what is important. It is easy to become complacent about or even apathetic toward the signals that, too often in the clarity of hindsight, show that another crisis looms, that action should be taken.

Crises can take many and various forms, and always – always – in the investigation that occurs after an accident or a tragedy, we find that there were warning signs, that there were people who connected the dots but were not heeded. Churchill was right about Hitler years before Hitler proved him so. And as Admiral Gehman said of the Space Shuttle *Columbia*, "The machine was talking, but why was nobody hearing, how were the signals missed?"

Even worse, with the passage of time we seem to forget the lessons learned from those crises which occurred many years ago. Time heals the wounds, the fear, the pain we felt when the galvanizing moment occurred. We move on. And slowly, our complacency grows back. The great engineering educator and author, Henry Petroski, writes about this facet of humans and their organizations in his book, *Design Paradigms:*

Case Histories of Error and Judgment in Engineering. He cites a trend, two centuries old, of major bridge disasters occurring about every three decades. Younger engineers who did not experience the community-wide trauma of such an event do not fear it, do not believe it can happen to them, and do not embrace its lessons as deeply as those who were there. The cycle thus begins anew.

As managers, we must understand this aspect of human nature, and fight against it. We must inspire and reward perseverance and persistence to the task before us. We must check, re-check, and check again to hear what our machines and our people are saying. All of us – from assembly-line technicians through young and mid-career engineers to Center Directors and Associate Administrators within NASA – have the responsibility to speak up if we believe that something is amiss with their part of the complex machine. Other people may disagree with any given concern, or may simply see things differently; in fact, it is guaranteed that they will. And no decision can be made that doesn't leave at least one group feeling as if their concern has been set aside. But it is still everyone's responsibility to offer their own judgment on a controversial issue. The final decision cannot be made better by the lack of debate. In this way, sometimes a crisis can be averted.

This takes me to last week's Flight Readiness Review for STS-120. We should all applaud the folks from NASA Engineering and Safety Center who brought forward their concerns with regard to the integrity of the Shuttle *Discovery* wing leading edge. We have a new inspection technique that, if nothing else, demonstrates that we don't know as much about the reinforced carbon-carbon (RCC) panels that comprise the wing leading edge as we thought we did. This realization brings with it the concern as to whether several of the panels had adequate margin for flight. We had a good, healthy engineering discussion, culminating in a majority, but not unanimous, decision that we have an acceptable level of risk to launch the Space Shuttle. The bottom line is, I don't think we're seeing new behavior in the RCC panels. I think we're seeing how the panels we've always flown look, "acceptable reasons" – why those of us in the space business make the sacrifices we do to pursue the dream and the challenge of spaceflight. Some of you may have been there or perhaps have read the speech, which later appeared in *Air and Space* magazine. I've been enormously surprised by the outpouring of positive feedback I've received in regard to that speech, far more than for any other speech I have ever given. With those thoughts, I must have touched a sensitive nerve that the analytical side of my brain did not know was there. The real reasons which drive those of us who are in this business are, I think, more visceral, or even spiritual, than can be expressed by means of any tangible rationale.

While NASA's budget is about half a cent out of every federal budget dollar, spaceflight in all its forms is a strategic capability for this nation. We must understand the real reasons why that is so, we must explain those values to our children, to their children, to the public, and to the nation's leadership, lest it just slip away.

Thus, maybe the reasons why the American public is not aware of what we're doing in space, of what we're trying to accomplish, is that we're not explaining it well enough. Maybe the scientists and engineers in this room need the help of folks like Miles O'Brien, Neil Tyson, Homer Hickam, Tom Hanks, Bill Pullman and many, many others who are far more charismatic than I will ever be, and who know how to weave the fabric of such a story. For those of us in the space business, this is our story, a complex story full of richness, daring, drama, comedy, and pathos. While I don't pretend to know all the different ways to tell it, or maybe any of them, I do know it cannot be condensed down to a bumper sticker slogan. But it can be distilled. "This cause of exploration and discovery is not an option we choose," as President Bush put it in his eulogy to the *Columbia* astronauts. "It is a desire written in the human heart. We are that part of creation which seeks to understand all creation. We find the best among us, send them forth into unmapped darkness, and pray they will return. They go in peace for all mankind, and all mankind is in their debt."

A few weeks ago, many television news shows and newspapers recognized the 50th anniversary of the launch of the first man-made satellite, the Russian *Sputnik*. Some commentators noted the galvanizing reaction of this event on the American public and our national leadership around the question of whether we were falling behind in recognized leadership in the world, falling behind the Soviet Union in technological competitiveness, and how this reaction was primarily a media-driven frenzy. That is the power of the American media then as now. America at the forefront of the frontier is a concept deeply embedded in our national psyche. People who tell stories for a living know this better than I do. Space was the New Frontier, as the junior senator from Massachusetts and future president would say. He was the first of our national leaders to recognize the strategic importance of the new medium, the new arena of space.

President John F. Kennedy also understood what it meant for nations to ignore the tell-tale signs of a looming crisis, failing to connect the dots. His thesis at Harvard in 1940, *Why England Slept*, compared the failure of the British government to take steps to prevent the rise of Nazism in Europe with allusions to how America was also ignoring its own looming crisis, and could be pulled into another world war. Like Churchill, Kennedy spoke up about his concerns, just as I have asked every NASA employee to speak up if they have concerns. In Kennedy's case, when he spoke in his famous speech on May 25th, 1961, about the need to "take longer strides", the Congress and the American people listened.

In my own small way, I have recently given vent to my thought that the pace of China's space program may be faster than our own. Later this week, China plans to launch its first satellite to the moon. I also believe that, if they so choose, the Chinese have the economic and technical wherewithal to send their taikonauts to the moon before the United States plans to return our own. If this happens, we in the United States will not like our position in the world of that time. I am speaking when inspected via a new technique. But I will say here, I simply could not be happier with the manner in which the NESC folks pursued, and brought forth, this concern.

In the space business, we live up to a creed of excellence, or die from the lack of it, and we make our entire society better for the acceptance of that challenge. We are not perfect; we do not have perfect knowledge of our machines or the environment in which they will be operating. Our machines are no more perfect than we ourselves. A quote that I love goes like this: "Excellence is the result of caring more than others think wise, risking more than others think safe, dreaming more than others think practical, and expecting more than others think possible." My hope is that we inspire our people to work – and work hard – toward the goals of the missions placed before us, as our forebears did. That's what it takes. This *is* rocket science.

NASA is a high-performance organization, working on large, complex engineering systems on their way to Mercury, Mars, Pluto, and with the Dawn mission, the asteroid belt between Mars and Jupiter. Weather permitting, my hope is that tomorrow or later this week we will launch Space Shuttle *Discovery*, commanded by Colonel Pam Melroy ,to ISS on the STS-120 mission. This Shuttle mission will deliver the Italian-built *Harmony* module to connect the European and Japanese laboratory modules which will be flown on the next two missions.

But, we will only launch after checking, re-checking, and checking again. Tonight, as I speak, hundreds of technicians and flight controllers are working toward that launch. Tonight, here at Marshall, payload operators are working on experiments onboard the ISS. Tonight, the Expedition 16 crew commanded by Peggy Whitson will soon wake to begin preparing for Discovery's arrival. On November 2nd, we will celebrate seven years of continuous manned spaceflight operations aboard the Space Station. Many, many people said that such a goal could never be reached, but as Meriwether Lewis wrote in his journal, "we continued on."

In discussing the great things we have accomplished and seek yet to do, I need to return to my original question: why does it take a crisis to get the American people's attention? It is frustrating sometimes for those of us in the space business to realize that many people in the American public are not aware, or do not care, about the things we are accomplishing, often for the first time in history.

We saw this for the first time with the lunar missions that followed Apollo 11, except most famously the harrowing Apollo 13. Some people lost interest – lost interest! – in seeing a precious few of their fellow Americans begin the exploration of an entirely new and unknown world. Today, it can be frustrating when some young people actually question whether we ever really landed on the Moon. However, it has been almost 35 years, and enough time has passed that many Americans forget the importance of these events in their time. In a way, it's a lot like Petroski's observations concerning the three-decade cycle in major bridge collapses. New generations sometimes need to relearn the lessons so painfully gathered by their fathers.

Perhaps, that is what prompted the *Columbia* Accident Investigation Board to observe: "The U.S. civilian space effort has moved forward for more than 30 years without a guiding vision." That was a damning statement, citing as it did a lack of leadership in space policy, a strategic interest for the United States, reaching to the highest levels of our nation for over a generation.

Earlier this year, Mike Coats asked me to speak at a dinner in Houston. It was "budget season" in D.C., and I didn't have time to write a speech, or even to seek help from any of my colleagues, who might have been willing to furnish a draft for editing. I was simply out of time when the dinner arrived, and so I stood up to speak with nothing more than the benefit of a few notes I made on a napkin during dinner. Thus, I spoke more from the heart and less from my analytical side than is customary for me. I discussed the "real reasons" – as compared to the out now because I hope to avert the situation our nation faced fifty years ago with the launch of *Sputnik*.

Even at the age of eight, I was as attuned to events following the launch of *Sputnik* as closely as was possible by watching television and reading *The Baltimore Sun*. The newspapers were full of both soul-searching analysis and rampant second-guessing. We questioned our military plans, our civilian research programs, and our educational systems, and made changes in all those areas and more. America's readiness – or more properly our lack of readiness – to explore and exploit the space frontier decided a presidential election. *Sputnik* changed everything.

I was in Russia a few weeks ago toasting the 50th anniversary of this accomplishment with my Russian counterpart, Anatoly Perminov. Times have changed. NASA is now paying the Russian Space Agency several hundred million dollars over the next several years for the *Soyuz* and *Progress* vehicles necessary to support the International Space Station. Partly for that reason, we need the help of the rocket team here at Marshall and our industry partners to develop the next-generation Ares rockets as expeditiously as possible. I would rather we spent NASA's funds within the American space industry, first with U.S. commercial systems to support the Station, and then the *Orion* crew vehicle and *Ares* rockets. This is both important and urgent, and we need to work with the same sense of purpose as our forbears to build these new systems.

While we engineers like to talk about the machines which propel us into space, in a democracy it is really the American people who ignite our Nation's space program. Fortunately for those who care about space, one of the most charismatic men in history was the first director of Marshall, Wernher von Braun, whose memory we honor here tonight. Chris Scolese brought to my attention a wonderful book, *The Rocket Team*, about the life and times of von Braun and the team he built. I commend it to your attention.

There's no need for me to recount to this group the story of the von Braun team and how they built the V-2, Redstone, Jupiter, and, finally, the Saturn V. Many of you know far more than I do about these accomplishments. Von Braun's charisma, technical acumen, and leadership in the field of space exploration are legendary.

But do you know what Huntsville was like before von Braun settled here to work in the spring of 1950? The population of Huntsville was 16,000, and the city fathers proudly advertised it as "The Watercress Capital of the World". Von Braun changed Huntsville, the nation, and the world in the course of his pioneering efforts in space exploration. Von Braun and other legendary engineers and managers like Glynn Lunney, George Mueller, George Low, and Chris Kraft turned President Kennedy's vision into a reality. I've said before, and will do so again here, that James Webb was NASA's greatest administrator for the manner in which he kept those people and their programs pointed in the right direction during the 1960s. Today, young engineers in this audience are following in their footsteps, and pursuing a vision for space exploration which, I hope, will be sustainable over the next fifty years.

Look around the room. You are the people whose accomplishments future NASA administrators will toast 50 years from now. You are the ones who will be building the *Ares I* crew launch vehicle and the *Ares V* heavy-lift launch vehicle to propel our nation back to the moon. But it will only happen if we all work just as hard as they did. *You* are the new Rocket Team. But not only must we be able to build rockets, we must also re-ignite the passion for space exploration that Von Braun conveyed to his team, and to the nation. This is now our story to tell.

Only a few months before he died, von Braun wrote the following: "While the members of this magnificent team changed with time, the fundamental characteristics of the team itself never did. It always has been characterized by enthusiasm, professionalism, skill, imagination, a sense of perfectionism, and dedication to rocketry and space exploration. How can the story of such people and of the exciting programs with which they are involved ever end?"

So, let us resolve that it will not – not ever – end.

Thank you.

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

① Refer to orig. Agency

November 13, 2007

MEMORANDUM FOR THE CHIEF OF STAFF

CC: DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET
ASSISTANT TO THE PRESIDENT FOR NATIONAL SECURITY AFFAIRS
COUNSELOR TO THE PRESIDENT
CHIEF OF STAFF, OFFICE OF THE VICE PRESIDENT
DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY

② No action from OSTP

FROM: MICHAEL D. GRIFFIN
ADMINISTRATOR

SUBJECT: Chinese Lunar Capabilities

The purpose of this memorandum is to outline recent progress and expected developments in the Chinese manned spaceflight program, to note the implications of these developments, and to suggest a path forward.

Chinese space officials have openly discussed plans to conduct spacewalking demonstrations next year, orbital rendezvous and docking operations by 2010, and a robotic lunar landing mission by 2012. Based upon a careful review of open source information concerning the capabilities of the *Shenzhou* crew vehicle and the planned *Long March V* rocket, it is my considered judgment that China will have the technical and budgetary wherewithal to conduct a manned mission to the surface of the moon before the United States plans to return.

While the initial Chinese mission(s) to the moon would not have the long-term sustainability of our own plans for lunar return, China would demonstrably be on the moon before the United States can return. The bare fact of this accomplishment will have an enormous, and not fully predictable, effect on global perceptions of U.S. leadership in the world.

The next decade will be a period in which U.S. primacy in space will already be in question. After Shuttle retirement in 2010, and prior to deployment of *Orion/Ares* in 2015, we will be paying roughly $200 million per year, on average, to Russia to transport American astronauts and cargo to and from the International Space Station. Even this scenario assumes legislative relief from the Iran-Syria Nonproliferation Act to buy *Soyuz* and *Progress* flights after 2011, a request for which must be made to the Congress by early 2008. Without such legislative relief, it is entirely possible that there will be *no* U.S. presence in space in 2012-15.

Thus, a Chinese landing on the moon prior to our own return will create a stark perception that the U.S. lags behind not only Russia, but also China, in space. Already, largely in recognition of China's space accomplishments to date, a number of nations are establishing new cooperative relationships with China for space related activities. I believe this to be a matter of strategic importance for the United States.

China is prosecuting a fully indigenous program of human spaceflight development. They have adapted the design of the Russian *Soyuz* vehicle to create their own *Shenzhou*, which is more spacious, more capable, and better suited for long duration space missions than its Russian antecedent. China plans to conduct its first spacewalks and orbital rendezvous operations in 2008 and 2010, and to build a small space station in the next few years. All of this has been openly announced. Their accomplishments so far give me no cause to doubt their ability to carry out these plans.

With the first manned *Shenzhou* flight in October 2003 China surpassed by itself the accomplishments of all six U.S. *Mercury* missions in the early 1960s. The second *Shenzhou* flight in 2005 demonstrated most of the accomplishments of the first three U.S. *Gemini* missions in 1965. They will soon demonstrate the rendezvous and docking capabilities pioneered by the U.S. in the *Gemini* program in 1966, by docking a *Shenzhou* spacecraft with another *Shenzhou*, or with an orbital module left by a prior mission. With such demonstrations completed, the Chinese *Shenzhou* will be fully as capable of transporting cargo or crew to the International Space Station as is the Russian *Soyuz* upon which we presently depend.

These examples illustrate a fundamental difference between the development of the Chinese human spaceflight program, and that of the U.S. and Russia. Because China can follow established technical paths, they do not have to verify the basic feasibility of their approach. They need only to demonstrate that their systems work as designed to accomplish tasks which are by now well understood. Thus, each step in space can take them to a new capability plateau, eclipsing the equivalent of several pioneering but tentative steps in an earlier era. The United States required twenty-one human spaceflights to reach the moon in the 1960s. China will not need so many.

The second major initiative for which the Chinese have demonstrated significant progress is the development of the *Long March V* launch vehicle. They have conducted several rocket engine tests over the past two years, and plan to conduct demonstration flights in 2008-11. The Chinese have advertised its capability as 25 metric tons (mT) to low Earth orbit (LEO), rivaling or surpassing the largest expendable launch vehicles available today, which have a capacity of approximately 20 metric tons, or slightly greater. I believe that China's concerted, methodical approach to the *Long March V* development, along with recent construction of a new launch facility on Hainan Island, puts them on track to bring the *Long March V* online by 2012-13, their stated intention. NASA's *Ares I* rocket, which will have similar capabilities, will not be fully functional until March 2015, according to current plans.

Third, China has developed and demonstrated a dual launch processing capability. This capability, together with the 25 mT-to-LEO capacity of the *Long March V*, allows China to reach the "tipping point" critical to executing a manned mission to the Earth's moon. As one possible approach, this can be done by means of two dual-launch sequences.

The first *Long March V* would place, in Earth orbit, a lunar lander similar in size and mass to the Apollo Lunar Module, about 14 mT, together with a lunar orbit injection (LOI) stage weighing 6 mT. With a second *Long March V* launch, the lander and LOI stage would be joined in Earth orbit by a 25 mT Trans-Lunar Injection (TLI) stage. The two payloads would rendezvous and dock automatically, as the Russian *Soyuz* and *Progress* vehicles do at the International Space Station today. After docking, the TLI stage would send the combined payload to the moon. Injection into lunar orbit would be accomplished by the LOI stage, leaving the lander poised to wait for a few weeks, or even months if necessary, for the second launch sequence.

The second pair of *Long March V* launches would place in Earth orbit a crewed *Shenzhou* vehicle and LOI stage with one launch, and a TLI stage with the other. As in the earlier sequence, the *Shenzhou* would rendezvous and dock with the TLI stage, which would send the combined stack to the moon. The LOI stage would decelerate the *Shenzhou* into lunar orbit, where it would then dock with the waiting lander. The *Shenzhou* would differ from today's Earth-orbital version in two respects. It would require larger propellant tanks to allow it to depart lunar orbit for the return to Earth, and it might require a thicker heat shield to withstand atmospheric entry upon return from the moon. Neither of these modifications presents a significant challenge. The lunar version of *Shenzhou* would weigh about 11 mT, considerably less than the 14 mT lunar lander, so the delivery of a lunar-capable *Shenzhou* to lunar orbit presents no difficulty.

After rendezvous, the *Shenzhou* crew would transfer to the lander, land on the moon's surface, remain for several days, depart, rendezvous again with the Shenzhou, and return to Earth. (Parameters and assumptions for this scenario are summarized in the attached Technical Notes.)

What is fundamentally different about the dual-launch capability that the Chinese have demonstrated, and could well develop for the *Long March V*, is that it enables human lunar missions without requiring a 120 mT-class vehicle like the Apollo-era *Saturn V*, or our planned Shuttle-derived *Ares V*. This technique is not particularly cost-effective and is not easily scaled to a sustainable operation, but it does offer a path to "boots on the moon" without the development of a heavy-lift launch vehicle. In my opinion, U.S. analysis of existing and planned Chinese (and Russian) spaceflight capability and intentions has so far failed to take this possibility into account.

Apart from the lunar lander itself, this approach requires for its implementation only modest developments beyond the existing *Shenzhou* and the *Long March V* vehicles. The new elements for a lunar mission are the TLI and LOI stages, which would be essentially the same aside from the size of the propellant tanks employed, and which would utilize the upper-stage engines from the *Long March V*, with modest improvements. This is a minor developmental excursion from *Long March V* technology.

The key unknown in this scenario is therefore the question of China's intention to develop a human lunar lander. In this regard, I note that China recently launched its first robotic lunar orbiter mission, and has announced plans for a robotic lander by 2012. The developments in communications, tracking, guidance, navigation, and control required to execute robotic lunar orbital and lander missions are identical to those for a manned system, irrespective of whether or not the lander itself is scaleable to human missions. Inasmuch as the design parameters of the Apollo lunar lander are widely known and well within today's state of the art, the development of a similar vehicle by the Chinese should not present a significant problem.

Pending development of a Chinese manned lunar lander, a fly-by or orbital mission around the moon could easily be executed with the *Shenzhou* spacecraft and a single pair of *Long March V* launches, as outlined above. Indeed, as a matter of prudent engineering development, I would fully expect China to execute such a mission prior to a lunar landing. This would be completely analogous to the inspirational *Apollo 8* mission during the Christmas season of 1968.

China clearly recognizes the value of space activities as a driver for innovation, a source of national pride, and an enhancement to its stature in the world. As such, they are likely to continue their robust space activities with or without cooperation with the U.S. and other nations. Many of the demonstration flights of the *Shenzhou* and *Long March V* will come at a time when NASA is still developing the *Orion* and *Ares I*, and while we are paying hundreds of millions of dollars to Russia to fly our astronauts. Again, I am concerned that this scenario, for which I believe China to have the required technical and budgetary wherewithal, will cause many to conclude that the United States is no longer the real or perceived leader in space. I raise these issues because I believe it is important to understand the possibilities for competition as well as collaboration with near-peers. We can neither collaborate nor compete without capabilities of our own to put on the table. Thus, it is critical to provide sufficient funding to NASA to implement the Constellation program as currently planned.

In addition to the budget I have requested to keep the *Orion* and *Ares I* on-track for a 2014 initial operational capability, I recommend that we engage China in such a way as to curb the tendency toward rivalry in space with the United States. In February of this year I provided the President with a modest plan for initial NASA engagement with China, focused primarily on cooperative scientific space research. In parallel with the immediate implementation of this plan, I recommend that the Administration form an interagency team through the Space Policy Coordinating Committee to coordinate proposals for enhanced civil space cooperation with China, with the goal of influencing China's space plans in a manner that is consistent with our own plans as documented in the Vision for U.S. Space Exploration. Clearly, a decision to proceed with any enhanced cooperation must be based upon principles of transparency, reciprocity, and mutual benefit. Such cooperation would also provide the USG with insight into their human spaceflight capabilities and plans. While Chinese leaders have themselves raised the issue of potential partnership in the International Space Station program, this requires careful consideration and should not be the subject of near-term discussions, because of the likely adverse reaction it will produce from our current partners.

I would be happy to discuss these issues at your convenience.

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Technical Notes

<u>Mission Parameters</u>		
Translunar Injection ΔV (km/s)	3.1	
Lunar Orbit Injection ΔV (km/s)	1.0	
<u>Trans-Lunar Injection</u>		
TLI Stage Gross Mass (mT)	25.0	*Long March V* payload to LEO
TLI Stage Mass Fraction	0.9	U.S. Centaur upper stage > 0.9
TLI Stage Empty Mass (mT)	2.5	
TLI Propellant Mass (mT)	22.5	
Specific Impulse (I_{sp}, seconds)	450	Modest improvement of YF-75
Net Payload to TLI (mT)	20	
<u>Lunar Orbit Injection</u>		
Lunar Lander Mass (mT)	14	Apollo Lunar Module Mass
LOI Stage Gross Mass (mT)	6.0	
LOI Stage Mass Fraction	0.83	Conservative assumption
LOI Stage Empty Mass (mT)	1.0	
LOI Stage Propellant Mass (mT)	5.0	
LOI Injection Stage I_{sp} (seconds)	450	Same as TLI Stage
<u>Lunar Shenzhou</u>		
Earth Orbital Shenzhou Mass (mT)	8.0	
Lunar Departure ΔV (km/s)	1.0	
Lunar Departure Propellant Mass (mT)	2.7	Hypergolic propellants, 310 s I_{sp}
Additional Propellant Tank Mass (mT)	0.3	10% of propellant mass
Total Lunar Shenzhou Mass (mT)	11.0	Less than 14 mT lunar lander

HOLD FOR RELEASE
UNTIL PRESENTED
BY WITNESS
November 15, 2007

Statement of
Michael D. Griffin
Administrator
National Aeronautics and Space Administration
before the
Subcommittee on Space, Aeronautics, and Related Sciences
Committee on Commerce, Science and Transportation
United States Senate

Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to appear today to discuss the status of space transportation in support of the International Space Station (ISS). I would like to give you an update on our plans to ensure that space transportation capabilities remain available through the completion of ISS assembly and during the ISS post-assembly period after the Space Shuttle fleet has been retired in 2010. These capabilities are essential to successfully complete, operate and maintain the ISS, ensure productive utilization of this valuable national asset, and meet U.S. obligations to our international partners, including Canada, Europe, Japan, and Russia.

For the remainder of this decade, the Space Shuttle fleet will remain a highly capable and reliable system for assembling and servicing the ISS. In concert with the consistent performance of our Russian partner's Soyuz and Progress vehicles, and the emerging cargo transfer vehicles from our European and Japanese partners, the ISS will have adequate support for the remaining assembly period. The use of the Shuttle to deliver ISS components, essential spares and external stowage platforms is critical during this period.

Looking to the post-assembly period, the Shuttle's successor, the Orion Crew Exploration Vehicle, is on track to achieve Initial Operational Capability (IOC) in early 2015. The Constellation Program, of which Orion and its Ares I Crew Launch Vehicle are key components, has already made significant strides in the development and testing of system components.

The next decade, 2011 to 2020, will be an exciting period in the space transportation industry. There are many initiatives underway in both the public and private sectors to field new vehicles to serve the next generation of space exploration and development. It is important that NASA closely monitor the progress of individual development projects and actively manage risk so as not to jeopardize the viability of the ISS due to an inability to service it on a timely basis. Flexibility will be important to our success.

The capability to transfer crew to and from the ISS, and to ensure a safe and expedient return in the event of an emergency, is relatively limited in the near term. On the other hand, capabilities to transport cargo and crew should become more diverse in the next decade, and thus will involve detailed trades among cost, schedule, performance, and risk. NASA's policy is to employ U.S. commercial services for both cargo and crew exchange at the earliest available opportunity, while minimizing the technical risks of interrupting the U.S. crew presence on orbit, or having to leave the ISS in a state of disrepair because failed components cannot be replaced.

The Space Shuttle Legacy

The ISS was designed to employ the Space Shuttle fleet for assembly and ongoing servicing. With a capacity for launch and return of up to 16 metrics tons (Mt) of non-pressurized cargo and four Mt of pressurized cargo, the Space Shuttle's supply and return capability far exceeds that of all other domestic and foreign vehicles. In addition, the Space Shuttle provides ISS crew exchange, while also transporting the construction crew needed to conduct complex assembly operations in space. The Shuttle's robotic arm is essential to these tasks, as are the Shuttle-based capabilities for conducting extravehicular activities. When necessary, the Space Shuttle can be employed for ISS attitude control and re-boost. For these reasons, the ISS was designed to be assembled and maintained based on the Space Shuttle's capabilities. The transition from Shuttle-based space transportation to a mixed fleet of U.S. commercial spacecraft and international partner assets is challenging due to this design heritage, but NASA is committed to developing options to satisfy the requirements of the ISS after the retirement of the Shuttle.

Retirement of the Space Shuttle is on schedule for 2010. We are confident that we can complete the remaining 10 baseline and two contingency Shuttle missions to the ISS, and the servicing mission to the Hubble Space Telescope, within this timeframe. In the second half of 2006, NASA successfully completed three Space Shuttle missions which continued ISS assembly with the addition of the P3, P4, and P5 truss segments. In June 2007, ISS-13A (STS-117) added the S3 and S4 truss segments, boosting available power on the ISS to 42 kilowatts. All of these new systems continue to operate as designed, with the exception of the starboard solar array rotary joint. We need to determine the source of the contamination within the joint, but all of the rotational elements are replaceable and there is a high probability of repair. Analysis completed to date shows this problem will not impact the next assembly flight ISS-1E (STS-122). STS-120 landed safely at Kennedy Space Center on November 7, 2007, after having delivered the Node (Harmony) safely to the ISS. The Harmony will now be moved to its permanent location at the end of the U.S. laboratory. This activity will involve three spacewalks and two major robotic maneuvers. Harmony will be ready for ingress and final activation around November 24. Pending successful activation and relocation of Harmony, the Shuttle and ISS teams are set to complete four flights this year. This is remarkable considering that 2007 started with an external tank sustaining 2,000 hail damage hits and a three-month delay to flights.

The next ISS assembly flight 1E (STS-122) is scheduled to launch the European *Columbus* laboratory in early December 2007. With this flight, we will turn our attention to integrating the long-awaited elements of our international partners. It will be followed next year by deployment of the Japanese *Kibo* laboratory complex, and the Canadian *Dextre*, a special purpose dexterous manipulator for the ISS external robotics system. With the addition of these features, the ISS will emerge as a prominent example of the benefits of cooperation in science and technology for peaceful purposes. The ISS will house three premier research laboratories, one from the U.S., one from Europe, and one from Japan. Future missions will enable us to increase the ISS permanent crew size from three to six and deliver critical system spares to the Station. A crew of six is essential to maintain the completed ISS and to operate its laboratories at a high rate of productivity. Pre-positioning spares gives us the ability to ensure a prudent margin on systems performance, while allowing the U.S. commercial transportation capability to mature. This strategy was also one of the principal recommendations found in the February 2007 *Final Report of the ISS Independent Safety Task Force.*

The Space Shuttle will retire at the end of Fiscal Year 2010. After 2010, there is no mission requirement for the unique capabilities of the Space Shuttle. Flying the Space Shuttle past 2010 would carry significant risks, particularly to our efforts to build and purchase new transportation systems that are less complex, less expensive to operate, and better suited to serving both ISS utilization and exploration missions to the Moon, Mars, and beyond. Already, Shuttle facilities are being closed or transferred to exploration, Shuttle contracts are being phased out, and Shuttle engineers are designing exploration hardware. If we were to take the costly step of reversing those changes to keep the Space Shuttle flying past 2010, at a cost of $2.5 billion to $4.0 billion per year, using the same facilities that Constellation needs to develop, test, and begin operating Ares I and Orion, we would only exacerbate the gap in U.S human spaceflight and put at risk our Nation's preeminence in space exploration. NASA is committed to a transition and retirement process that is efficient, innovative, and that minimizes the gap in U.S. human spaceflight to the greatest extent possible. In support of this effort, we have modified the Space Program Operations Contract (SPOC) to create a strong bridge between Shuttle and Constellation operations.

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Orion Crew Exploration Vehicle and Ares I Crew Launch Vehicle

NASA's Constellation program, which includes the Orion Crew Exploration Vehicle and the Ares I Crew Launch Vehicle projects, has made great strides this past year. The program has tested hardware, logged wind tunnel hours, conducted rocket firings, and hired contractors for almost all program elements. Constellation has an integrated schedule and is meeting its early milestones. The Ares I has passed its system design review and is on track for preliminary design review, with test flights slated for 2009. All major elements of Orion and Ares I will be under contract by the end of 2007, bringing the program closer to the IOC of Orion in March 2015 and full operating capability about one year later.

The Orion will translate the hopes and aspirations of explorers the world over into an operational system for the next generation in human space exploration. It is the first element in an evolving architecture that will one day carry people back to the Moon, on to Mars and beyond. The Orion will also have the capability to exchange crews on the

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ISS and serve as an emergency crew return vehicle. In this role, which it will serve if U.S. commercial services are unavailable, it will have a capacity for up to six crew members and a stay time on orbit of up to 210 days. Its associated service module will have a limited capacity for some pressurized dry cargo transfer.

International Space Station: Post-Assembly Transportation Requirements

Once ISS assembly is completed and the Space Shuttle fleet is retired in 2010, transportation requirements decline from the approximately 50 – 60 Mt per year associated with assembly to approximately 10 – 20 Mt per year needed to sustain the system and utilize the internal laboratories and external platforms. NASA is continuously evaluating these space transportation requirements to ensure that maximum operating efficiencies are gained and minimum maintenance and utilization needs are met. Cargo re-supply requirements fall into two broad categories: (1) items necessary to meet internal demands, such as consumable liquids and gases (e.g., water, oxygen, and nitrogen), internal system spares, crew provisions, and internal scientific payloads; and, (2) items such as external system spares, ammonia tanks, and external scientific payloads.

NASA's analysis of post-assembly logistics demand and supply considers first the transportation assets available through the baseline ISS program. The analysis indicates that there remains a significant shortfall between the logistics demand to sustain and utilize the ISS and the logistics supply available through international agreements, contracts, and services owed. This shortfall corresponds to approximately 10 Mt per year after Space Shuttle retirement, or over 50 Mt through 2015. When one takes into consideration the packaging structure and carriers necessary to transport a net usable cargo of 50 Mt, the gross requirement approaches 80 Mt through 2015. Some options for addressing this challenge are detailed below.

In addition to cargo services, six crew members will permanently occupy the ISS in six-month rotations. Three of these crew members will be provided by Russia; the remaining three crew members will be from the U.S. and Canada, Europe, or Japan. The U.S. is obligated to provide bi-annual crew exchange, as well as emergency crew return capability and habitation accommodations, for these three crew members. Once the Space Shuttle is retired, the Russian Soyuz will be the only vehicle available for crew exchange and rescue services until a U.S. commercial crew service, or Orion is available. NASA has contracted with Roscosmos to provide Soyuz and limited cargo services through the end of FY 2011, as permitted under the Iran and Syria Non-proliferation Act of 2005 (P.L. 109-112). NASA is monitoring the progress of potential domestic commercial providers to develop cargo and crew transportation services to the International Space Station (ISS), and the Orion project is on track to reach its Initial Operational Capability in March 2015. The Administration is considering options to maintain a U.S. crew presence aboard the ISS. Purchasing cargo and crew transportation services domestically is NASA's preferred method to meet the needs of the ISS. Another option may be to seek relief from the provisions of Iran Syria Non-Proliferation Act of 2005 (P.L. 109-112) for additional Soyuz services to keep a U.S. crew presence on the

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ISS until either domestic commercial crew transportation services, or Orion, become available. We will keep the Congress fully informed of our plans.

U.S. Commercial Orbital Transportation Services (COTS)

U.S. space policy directs pursuit of commercial opportunities for providing transportation and other services to low Earth orbit and beyond. Successful COTS partners may open new space markets and provide reliable, cost effective cargo and crew transportation services, ushering in a new era for commercial space. NASA is investing $500 million to stimulate the commercial space industry and to facilitate U.S. industry demonstration of commercial space transportation capabilities under Phase 1 of the COTS project. NASA plans to utilize the commercial space industry to re-supply the ISS after Shuttle retirement of the Space Shuttle in 2010.

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The COTS launch providers are not developing systems to be operated by the government or its contractors, but are demonstrating a capability that NASA and others can later purchase as a commercial service. Since these companies are developing vehicles that they intend to use commercially for other customers in addition to NASA, they are assuming a significant portion of the financial and programmatic risk. As part of Phase 1 of the COTS project, the Agency signed two funded Space Act Agreements (SAAs) with emerging commercial launch providers or "partners" to facilitate the development and demonstration of the vehicles, systems, and operations needed to resupply, return cargo from, and transport crew to and from a human space facility, with the ISS providing the representative requirements for such a facility. Performance milestones culminate in a flight demonstration in which the partner's vehicle will launch, rendezvous and dock with ISS, and return safely to the Earth's surface. The partners are only paid a pre-negotiated, fixed amount if they successfully complete a milestone. If they do not complete the milestone to NASA's satisfaction, they are not paid. These milestones are both technical (e.g., a successful design review or hardware test) and financial (e.g., raising a certain amount of private funding). NASA has also entered into multiple unfunded SAAs with various emerging commercial launch providers to provide support in the development of a low Earth orbit transportation capability.

NASA assists the COTS partners' efforts by providing a network of Agency technical experts across all discipline areas -- known as the COTS Advisory Team. Extensive NASA technical and facility resources are also available to the commercial partners through reimbursable SAAs.

On October 18, 2007, NASA terminated one of the two funded SAAs because the commercial partner had failed to perform under the terms of the agreement. NASA remains committed to the COTS project and to stimulating a robust commercial space industry, as demonstrated by the release of a competitive announcement on October 22, 2007, seeking a new round of Phase 1 proposals. Industry proposals for this new competition are due to the Agency on November 21, 2007.

In the future, NASA's Space Operations Mission Directorate, in cooperation with NASA's Exploration Systems Mission Directorate, will oversee procurement of commercial cargo services to and from the ISS. The President's 2008 Budget included $1.9 billion over five years in the Space Operation Mission Directorate for cargo services, the majority of which will be available for commercial services. A government procurement of commercial cargo services is planned. NASA released a Commercial Space Transportation Services Request for Information (RFI) on July 7, 2007. Issuance of a Request for Proposals (RFP) is currently expected in FY 2008.

Japanese H-II Transfer Vehicle (HTV)

Japan's HTV is an expendable, automated cargo transfer vehicle designed to launch on the H-IIB expendable rocket and rendezvous with the ISS. It will include both pressurized and non-pressurized carriers, thus allowing delivery of rack-mounted equipment, water and gases, and non-pressurized system spares. The HTV has completed its critical design review and is scheduled for demonstration in the mid-2009 period. The cargo capacity will be approximately 3 Mt and the lead-time to production is estimated to be three to four years. Japanese plans currently call for a production capacity of one HTV per year. This rate corresponds to Japan's commitment to fly one HTV per year over the period 2009 – 2015.

A portion of the HTV cargo capacity is owed to the ISS program based on Japan's share of common system operations costs and prior barter arrangements. This cargo capacity is essential, since it has already been factored into the ISS baseline program for cargo supply. Approaches to acquiring further HTV cargo delivery services, particularly in the area of non-pressurized system spares, are under evaluation in the event that COTS cargo services are delayed. If system sparing becomes critical to maintain the station and U.S. commercial cargo services are delayed, it would be prudent to have the flexibility to execute a sound contingency plan and avoid a situation that could require disembarking the crew from the ISS shortly after its assembly is complete.

European Automated Transfer Vehicle (ATV)

Europe's ATV is an expendable, automated cargo transfer vehicle designed to launch on the Ariane V expendable rocket and rendezvous with the ISS. It will have capability to deliver dry cargo at the sub-rack level, and external tanks for water, gases, and propellant. The cargo capacity will be approximately 5 Mt and the lead-time to production is estimated to be about three years. The first ATV, *Jules Verne*, is currently in final integration at the Guiana Space Center, Kourou, French Guiana (South America) and is scheduled for launch to the ISS in the first quarter of calendar year 2008. European plans call for production of five ATVs, corresponding to their commitment to fly five vehicles to the ISS over the period 2008 - 2013.

A portion of the ATV cargo capacity is owed to the ISS program based on Europe's share of common system operations costs. This cargo capacity is also essential, and has been factored into the ISS baseline program for cargo supply. In addition, the ATV is capable of performing ISS re-boost and attitude control, and propellant can be transferred to the ISS tanks for use after the ATV has departed. The boost and attitude control features make the ATV a candidate for assisting in the ISS re-entry phase upon retirement. If this option were pursued, it would require contracting for additional ATV production before the manufacturing capacity is shut down around 2012.

Russian Progress and Soyuz Vehicles

The expendable Russian Soyuz rocket has over 1,700 successful launches in the past 40 years. In the ISS Program to date, it has been used to launch 15 Soyuz crew transfer vehicles, each having a capacity for three crew, and 26 expendable, automated Progress cargo transfer vehicles. Both vehicles rendezvous with the ISS. In the future, the Russian segment is planned to expand to accommodate two Soyuz and two Progress (or a Progress and an ATV) vehicles to support six crew. The Progress has the capability to deliver dry cargo and tanks for water, gases and propellant. Its cargo capacity is approximately three Mt. The lead-time to produce a unit is estimated to be a little over two years for both Soyuz and Progress. Russian plans currently call for the production of two to four Soyuz crew vehicles per year and -three to five Progress cargo vehicles per year for missions to the ISS through at least 2015.

The ISS program has purchased approximately six Mt of cargo capacity from Russia for use during the FY 2009-11 period in order to bridge the gap between the Shuttle and U.S. commercial cargo transfer availability. These services are considered essential, and have been factored into the ISS baseline program for cargo supply. In addition, Soyuz crew rotation and rescue services have been purchased through the end of FY 2011, in order to bridge the beginning of the gap between Space Shuttle and U.S. commercial crew transfer, or Orion, services. These services have also been factored into the baseline program for crew exchange.

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Conclusion

NASA is making excellent progress toward completion of the ISS assembly phase. In the coming year, popular awareness will expand dramatically around the world as the laboratories of Europe, Japan, and later, Russia, begin operations alongside the Nation's own U.S. laboratory. The performance of on-orbit systems, transportation systems, and the flight and ground crews has been outstanding. The teams have successfully dealt with many challenges and will no doubt continue to face challenges; operating continually in space is an extremely difficult endeavor, but despite the difficulties, the ISS has now been continuously crewed for more than seven years. This remarkable level of achievement is possible only because individually, and collectively, we have learned how to actively manage risk with maturity and prudence.

The future of space transportation is uncertain in detail, but clear in direction. The next decade will offer more opportunities, and choices, than did the last decade. We must begin to make these choices now if we are to be prepared for the next phase in the ISS program. While we focus our sights on enabling discovery and a new economy in space, we must also develop our transportation plans to withstand the risk of short-term setbacks that are inevitable in the development of new technologies for new frontiers. We have done the planning, understand the options, and are prepared. We appreciate your continued support to maintain the flexibility needed in order to be successful.

Thank you for the opportunity to appear before you today. I would be pleased to respond to any questions that you may have.

Samanta Roy, Robie I.

From: OBrien, Michael F. (HQ-TA000) [Michael.F.OBrien-1@nasa.gov]

Sent: Wednesday, December 24, 2008 11:28 AM

To: Marquez, Peter J.; Miotke, Jeffrey A (OES); Samanta Roy, Robie I.; Wells, Damon R.; WittensteinEM@state.gov; Hodgkins, Kenneth D (OES); TurnerDA@state.gov; Sepulvedajl@state.gov; Christensen, Brent W (Beijing)

Cc: Condes, Albert (HQ-TA000); Hall, John F. (HQ-TH000); Bress, Kent G. (HQ-TG000); Blackerby, Christopher (HQ-TD000); Tilman, Justin (HQ-TA000); Besha, Patrick (HQ-TG000)

Subject: My Av Week rebuttal

For your information, here is the letter I sent to Av Week yesterday afternoon in response to Craig Covault's goofy article. It is also the subject of a NASA Press Release yesterday.

Enjoy the holiday!

Obie

Dec. 23, 2008

Dear Editor:

Unfortunately, Aviation Week's recent article of Dec. 21, 2008, entitled "Bush Administration Nixed NASA's U.S.-China Cooperation Idea," is inaccurate and misleading.

As an initial matter, NASA has never asked the White House for a cooperative mission such as the one described in the article. The fact is that the White House has been very supportive of a deliberate and careful establishment of relations between NASA and the China National Space Administration (CNSA) over the past two years. As a result, NASA commenced working group discussions with CNSA representatives on Earth and space science earlier this year. The discussions of potential areas of future cooperation were based on the principles of mutual benefit, reciprocity, and transparency, with the understanding that any proposal for specific projects would undergo careful review within the United States Government. Approval would, of course, be affected by the overall status of the U.S.-China government-to-government relationship. The Alpha Magnetic Spectrometer (AMS), space shuttle flights, and International Space Station were never intended by either NASA or CNSA to be considered by the NASA-CNSA working group.

Regarding AMS, it is not an international project managed by NASA; the international aspects of AMS are managed by the Department of Energy (DOE). Currently, NASA is prepared to take necessary steps to fly one additional space shuttle flight to deliver AMS to the International Space Station before the scheduled retirement of the shuttle in 2010, provided that additional funding is provided to the agency for this additional flight. However, we anticipate this flight will be reviewed by the new administration.

Michael F. O'Brien
Assistant Administrator
Office of External Relations

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FAX: 281-483-2968 Ref #: 109/1-10/854
11/20/06

M. Suffredini
ISS Program Manager, NASA

Subject: Clarification of the definition of work, taking into account additional tasks

Dear Mr. Suffredini:

Further to our letter of 13 March 2006 regarding the definition of work formulated by you in the initial request for a proposal, please be informed of the following.

You requested the capability, starting in 2009 and until 2011, to rotate and rescue six US crewmembers per year and to deliver 2 metric tons of cargo in 2009 and 4 metric tons per year as of 2010, respectively.

Up to now, you have declined to place an order for cargo delivery for 2009, which, accordingly, has not entered into Modification No. 166.

In light of the fact that this decision for 2009 represents a significant change from services requested in the initial document, we must clarify whether requirements remain for the delivery of 4 metric tons in 2010 and 2011. It should be noted that, in 2009, the Russian program has three Progress cargo vehicles planned for this period, which will not be able to meet any NASA program requirements.

An order for additional capability for the delivery of NASA cargo in 2009, if such a need exists, must be placed not later than the first quarter of 2007. If Shuttle vehicles are not going to be used to deliver consumables to ISS crews in 2009, then the likely demand for cargo deliveries in 2009 will exceed 2 metric tons, i.e., two Progress vehicles will be required by NASA (≈ 3 metric tons of dry cargo) in 2009, and three Progress vehicles will be required per year for 2010 and 2011 (≈ 4.5 metric tons of dry cargo).

This means that commencing in 2009, Roscosmos will be required to launch four Soyuz vehicles per year to the ISS, along with five Progress vehicles in 2009 and six Progress vehicles per year in 2010 and 2011. For comparison, in 2006 there were five launches to the ISS; i.e., it is a question of doubling capabilities.

Given the aforementioned, the following are necessary: either the definition of work must additionally include a number of tasks that will enable the attainment of this doubled capacity, or the cost of procured services must take due account of the cost of the additional tasks listed below without describing them in the definition of work. Such tasks must include the following:

1. Outfit the manufacturing base at the RSC Energia rocket and space plant.
2. Outfit the training base for cosmonauts and astronauts at RSC Energia and GCTC:

a. Create a third Soyuz TMA integrated simulator.

b. Outfit existing simulators.

c. Create a life support system simulator.

d. Acquire additional equipment, including additional spacesuits, create four new training classes, prepare and recruit 56 specialists to work with double the number of crews.

3. Outfit, maintain, and perform a set of actions to double the capacity of search and rescue personnel and resources. Expenses relating to the depreciation of S&R equipment in connection with doubled usage cycles.

4. Outfit the Soyuz launch complex at Site 31 to perform manned launches.

   a. Construct additional lines for cooling, filling, and defueling chemical components and compressed air, revise and update documentation for remote loading control systems.

   b. Retrofit and renovate launch complex facilities.

   c. Emergency rescue system equipment at the launch site for the crew.

   d. Install the appropriate cable network and communication and radio networks.

The aforementioned is not an exhaustive list of required tasks that could enable the required resources to be provided to NASA within requested timeframes. The allocation of costs to perform the tasks mentioned in the price of procured services for the delivery, rotation, and rescue of three additional NASA ISS crewmembers seems justified and explains the increase in price for services on an equivalent Soyuz vehicle.

In this regard, please confirm your request for the number of NASA cargo items required for delivery in 2009, 2010, and 2011, respectively, and communicate your decision regarding including the additional list of tasks in the definition of work, or including associated costs in the price of services furnished without describing the tasks in the definition of work.

Upon receipt of information from you concerning the aforementioned issues, we propose organizing a group of technical experts to review the definition of work in its updated form, taking account of additional tasks, either in Moscow or Houston as soon as possible (in November or December of this year). At the same time, please be informed that it has been difficult for Russian specialists to obtain visas in a timely manner (out of 14 persons in M. Khamits's group, three have obtained visas). Therefore, it may be preferable to consider Moscow as the site of the future meeting.

Best regards,

Managing Director,
Manned Programs [signature] A. B. Krasnov

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FAX: **281-483-29-68**
NASA ISS Program Manager
M. Suffredini

Dear Mr. Suffredini:

Please find attached the draft statement of work on service provision for NASA for the period to 2011 as revised by the Russian side.

Addenda on upgrading production and technical facilities, creating additional work stations for astronaut training, and the necessary work on improving launch facilities to account for the increase in the number of Progress and Soyuz vehicles manufactured and launched in order to provide a service package to the US side for the period to 2011 (refers to the increase in 2009 of the ISS crew to six) are in the concurrence stage with contractors and will be submitted in the near future.

Attachment: "Draft Statement of Work . . ." (13 pages).

Deputy Director
Human Space Flight Programs

S.V. Chernikov

P.P. Pisarenko
Phone: 631-95-16

SS32058/TTI/MPS/BL/LG/03/13/06

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Ref. 109/1-12/351
05/28/07

FAX: **281-483-2968**
M. Suffredini
Manager,
ISS Program

Dear Mr. Suffredini,

At the latest MCOP meeting different options for the ISS primary crew rotation were reviewed. In order to ensure the continued presence of the NASA astronauts onboard of the ISS the sides concluded that in case of the Shuttle launch slips the ESA astronaut from the Expedition 16 primary crew will have to be returned to Earth on Soyuz TMA in spring 2009. To protect for this case scenario ESA and NASA have requested training astronaut L. Eyharts and his backup F. De Winne as Soyuz TMA Flight Engineers (left seat). Due to time constraints, Roscosmos has started the necessary training on March 23. As you are aware, this type of training is more time and labor consuming than the Flight Engineer 2 training (right seat) which was documented in modifications signed earlier.

Therefore, please prepare and send to Roscosmos the draft modification to NAS15-10110 to include the work on training ESA astronauts as Soyuz TMA flight engineers (left seat), increasing the funding for this work by $800,000.

Sincerely,

[signed]

A. B. Krasnov
Head,
Manned Space Flight Program

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Ref. No. 109/1-12/479
dated 07/24/07

Fax: **(281) 483-2968**
NASA ISS Program Director
M. Suffredini

Dear Mr. Suffredini:

In compliance with the statement of work in Modification 166 to contract NAS15-10110 Roscosmos performs training of ISS-16 prime crew P. Whitson and M. Fincke for launch and return on Soyuz-TMA #221. At the same time in compliance with the same Modification 166, ESA astronauts L. Eyharts and F. De Winne are undergoing training at GCTC on rescue functions for Soyuz-TMA #221. To ensure the continuous presence of NASA astronauts onboard the ISS, at the request of NASA and ESA we began training astronauts L. Eyharts and F. De Winne on May 23, 2007, for nominal return on Soyuz-TMA #221 and NASA astronauts P. Whitson and M. Fincke for emergency return from the ISS on Soyuz-TMA #222, which means we commenced the work not specified in the contract. We assumed that the US side will prepare a corresponding modification to include this work. On May 28, 2007, we sent you a letter (ref. #109/1-12/351) specifying the cost associated with the additional work. However, such a modification still has not been issued.

Please give direction to prepare the draft modification as soon as possible, to include the work described above as well as to update line items in Mod 166 pertaining to increasing the number of astronauts (specifying names) for the Shuttle rotated prime crews, launch dates and the numbers for these Shuttles.

Head,
Manned Space Flight Programs Directorate [*signed*] A. B. Krasnov

P.P.Pisarenko
Tel. 631-9516

Draft
statement of work for services to be rendered to NASA until 2011 in an Extension of Contract NAS15-10110

The contractor shall perform the following activities in accordance with sections 5.0 through 9.0 below, to fulfill the requirements of the U.S. side for assured crew rescue, crew rotation, as well as delivery of cargo to the International Space Station (ISS) and disposal of waste from the ISS.

o Crew rotation and rescue for U.S. ISS crewmembers or ISS crewmembers designated by the U.S. side, using Soyuz vehicle in accordance with the nominal crew selection and designation process set forth by the MCOP, as indicated below:

- delivery of the U.S. Expedition 14 crewmember aboard Soyuz 13 (fall 2006);
- return of the U.S. Expedition 14 crewmember aboard Soyuz 13 (spring 2007);
- delivery of the U.S. Expedition 16 crewmember aboard Soyuz 15 (fall 2007);
- return of the U.S. Expedition 16 crewmember aboard Soyuz 15 (spring 2008);
- delivery of the U.S. Expedition 18 crewmember aboard Soyuz 17 (fall 2008); and
- return of the U.S. Expedition 18 crewmember aboard Soyuz 17 (spring 2009).

o To provide an on-orbit capability of rescue by Soyuz vehicle over the course of a calendar year for one U.S. or U.S.-designated permanent crewmember rotated aboard the ISS via the Space Shuttle during the crewmember's 6-month mission (not to exceed one astronaut per year between October 2006 and April 2009).

o Rotation and rescue of 6 U.S. or U.S.-designated crewmembers per year using Soyuz vehicle between April 2009 and September 2011.

o To deliver two metric tons of cargo per year (400–500 kg per flight) in 2007, 2008, and 2009 using Progress vehicles in accordance with NASA requests and ISS RS and Progress requirements (everything with an equivalent down-mass for waste disposal).

Starting in 2010 (as annual options for procurement), a set of services may be required from the Russian side by NASA to fulfill requirements. Such requirements will presumably comprise the following:

o four metric tons of up-mass (with equivalent waste disposal) per year using Progress vehicles, in accordance with NASA requests and ISS RS and Progress requirements.

o Rotation and rescue of six U.S. or U.S.-designated crewmembers per year (starting in spring 2012) to/from the ISS.

These options may be performed only on the basis of the mutual concurrence of the parties, taking account of ISS capabilities, annual production, launch, mission, and return schedules, operational capabilities and vehicle capabilities, availability of docking ports, and the impact on the Russian program of ISS use. Final option terms and prices shall conform to the proposed scope of work and consider additional expenses.

5.0 Delivery, return, and rescue of a specified U.S. or U.S.-designated Flight Engineer 1/Soyuz crewmember

5.1 To deliver a specified U.S. or U.S.-designated crewmember to the ISS, to provide a rescue aids for this crewmember, and to return the U.S. or U.S.-designated crewmember to the ground aboard a Soyuz vehicle.

5.1.a. Training of the U.S.-designated crewmember as a Flight Engineer in a Soyuz crew (one primary and one backup).

5.1.a.1. To provide theoretical and practical training, to furnish equipment (e.g., Sokol spacesuit, seat liner, thermal suit, water survival suit, and basic survival suit), to provide access to facilities, and to certify the specified U.S. or U.S.-designated member of the primary and backup crews for flight to and return from the ISS aboard a Soyuz vehicle, and landing aboard a Soyuz vehicle. To furnish necessary training materials (electronic and document) in Russian prior to the start of training requiring such materials, in accordance with applicable Russian laws and regulations.

5.1.a.2. Prior to the start of training, the specified U.S. or U.S.-designated crewmember shall be furnished with the Soyuz crew procedures. This documentation shall be in the possession of each crewmember, in accordance with applicable Russian laws and regulations.

5.1.a.3. Develop and implement a Flight Engineer training plan and a corresponding travel schedule within the framework of the integrated ISS crew training plan.

5.1.a.4.Except for the last training phase, the specified U.S. or U.S.-designated primary and backup crewmembers shall be provided with interpretation into English during all sessions, to the extent that such services are required for a given crewmember.

5.1.b. Transport and lodging (except in Baikonur) for up to five NASA personnel (by decision of Roskosmos, taking account of NASA proposals).

5.1.b.1. To provide transportation and facility access (provided that appropriate personal data are furnished in accordance with internal regulations) to the extent required for the specified U.S. or U.S.-designated crewmember and NASA service personnel (for example, training specialists, flight surgeons, crew support astronauts, and interpreter) for survival training. Food and lodging shall also be provided during survival training.

5.1.c. Services at the Baikonur cosmodrome for up to fifteen NASA personnel (by decision of Roskosmos, taking account of NASA proposals).

5.1.c.1. In accordance with current practice, to make available necessary permits and badges to allow facility access (provided that appropriate personal data are furnished in accordance with internal regulations) for the specified U.S. or U.S.-designated primary and backup crewmembers, as well as for up to thirteen NASA service personnel (by decision of Roskosmos, taking account of NASA proposals) (for example, flight surgeons, NISN computer communication specialist, PAO representative, NASA administrative personnel, and interpreter), upon the concurrence of stay duration by the parties.

5.1.c.2.To transport primary and backup crewmembers upon return to GCTC between fitting and launch, if so required by the training program.

5.1.c.3. Roskosmos shall secure access (provided that appropriate personal data are furnished in accordance with internal regulations) to NASA NISN specialists to set up telephone and computer links at the Kosmonavt hotel, RSC Energia hotel 3, the building of the federal state unitary enterprise "Center for Ground-Based Space Infrastructure Facilities Operation" (ФГУП ЦЭНКИ) and the NASA office at site 254 (Soyuz assembly building), on the basis of the existing communication configuration and in accordance with current practice.

5.1.c.4. To provide transport for the specified U.S. or U.S.-designated primary and backup crewmembers, as well as for up to thirteen NASA service personnel (by decision of Roskosmos, taking account of NASA proposals) (for example, flight surgeons, NISN computer communication specialist, PAO representative, NASA administrative personnel, and interpreter), from Moscow to Baikonur and back, as well as local transportation at Baikonur that is required for training activities, prelaunch operations, and launch.

5.1.c.5. To provide lodging for the specified U.S. or U.S.-designated primary and backup crewmembers, as well as for up to thirteen NASA service personnel (by decision of Roskosmos, taking account of NASA proposals) (for example, flight surgeons, NISN computer communication specialist, PAO representative, NASA administrative personnel, and interpreter), at Baikonur during all required training sessions, prelaunch operations, and launch. As a minimum, the launch team coordinator, the cosmonaut office lead or his representative, and the flight surgeon must be lodged at the Kosmonavt hotel together with the crewmembers. Remaining NASA personnel shall be lodged at nearby hotels at the mutual concurrence of the parties.

5.1.d. Landing area deployment airfield and search-and-rescue services under normal landing conditions and weather (including ballistic descents within the nominal landing area).

5.1.d.1. To provide the following services at deployment airfields: airport access, access to concurred facilities and necessary permits for the specified U.S. or U.S.-designated crewmember, as well as for up to ten NASA service personnel (by decision of Roskosmos, taking account of NASA proposals) (for example, flight surgeons, crew support astronauts, PAO representative, NASA administrative personnel, and interpreter). The actual number of NASA staff at the landing area shall be regulated by the provisions of section 5.1.d.4.

5.1.d.2. To provide transport for up to ten NASA crew support group personnel (for example, flight surgeons, crew support astronauts, PAO representative, NASA administrative personnel, and interpreter) from GCTC to deployment airfields and back, as well as local transportation at deployment airfields that is required to support crew evacuation. The NASA delegation shall pay for its own food and lodging. Roskosmos shall arrange lodging at the location where the search-and-rescue group is accommodated. The actual number of NASA staff at the landing area shall be regulated by the provisions of section 5.1.d.4.

5.1.d.3. To provide transportation for the specified U.S. or U.S.-designated crewmember, from the landing area deployment airfield to GCTC, as well as directly at the landing area deployment airfield as required to complete crew evacuation activities.

5.1.d.4. To provide search-and-rescue helicopter transport for up to five NASA crew support group personnel (by decision of Roskosmos, taking account of NASA proposals) (and two additional persons in case of a ballistic entry into the nominal landing area) (for example, flight surgeons, crew support astronauts, PAO representative, NASA administrative personnel, and interpreter) from the deployment airfield to the landing area and back, as well as to other locations that may be required to support Soyuz evacuation operations.

5.1.e Health care/Medical aid

5.1.e.1.To provide information regarding the entire program of mission medical operations. To perform medical operations in accordance with these requirements and requirements concurred by the parties in the Medical Operations Requirements Document (MORD) (SSP-50260). To render aid to the U.S. flight surgeon to monitor the health of the specified U.S. or U.S.-designated crewmember.

5.1.e.2.To render necessary aid to the U.S. flight surgeon during the State Medical Commission session at GCTC for the purpose of medically certifying the specified U.S. or U.S.-designated crew member for Soyuz flight prior to launch.

5.1.e.3. To provide postflight rehabilitation in accordance with current practice.

5.1.f Personal belongings

5.1.f.1. To allow 1.5 kg of up-mass and down-mass (as defined in SSP 50261-01, GGR&C) aboard the Soyuz vehicle for personal use items belonging to each specified U.S. or U.S.-designated crewmember, and to provide for the return of such items with the crew in accordance with nominal cargo item return procedures.

5.1.f. 2 The medical kit, water and air samples, radiation dosimeters shall comprise a portion of nominal most-recent access items and shall not be considered to be part of the crew's personal items.

5.1.g. Consumables

5.1.g.1. During the Soyuz flight, the specified U.S. or U.S.-designated crewmember shall be provided with Soyuz crew consumables, including (but not limited to): food, lodging, clothing, crew support items, and life support.

5.1.h. (Primary and backup) crewmember personal gear

5.1.h.1. To place all necessary nominal Soyuz flight equipment at the disposal of the specified U.S. or U.S.-designated crewmember, including: a Sokol spacesuit, seat liner, thermal suit, water survival suit, and basic survival set.

5.1.h.2. To perform all necessary measurements and verify the suitability of equipment for the specified U.S. or U.S.-designated crewmember, including an evaluation of operations safety and familiarization with flight equipment.

5.1.i. Visa support

5.1.i.1. To provide visa support for entry into the Russian Federation, including invitations for the specified U.S. or U.S.-designated crewmember, the NASA support team, and administrative personnel.

5.1.j. Providing information regarding the Soyuz mission/flight

5.1.j.1. Information regarding flight parameters shall be provided during all phases of Soyuz flight, including docked operations, for the purpose of obtaining complete information regarding the mission, in accordance with current practice.

5.1.j.2. To provide MCC-Houston (MCC-H) with necessary Soyuz telemetry data via the Russian Telemetry From Moscow (RTFM) channel from MCC-Moscow (MCC-M) to MCC-Houston (MCC-H) upon vehicle AOS by Russian ground stations (RGS), in accordance with current practice.

5.1.j.3. To provide for transmission of video information from the Baikonur cosmodrome (launch of the Soyuz transport vehicle) from MCC-M to MCC-H and to the Houston Support Group (HSG).

5.1.j.4. To provide real-time transmission of information from the MCC-M simulating complex to MCC-H and to the Houston Support Group (HSG) regarding the progress of and conditions aboard Russian Soyuz and Progress transport vehicles.

5.1.j.5. To transmit ballistic data from MCC-M to MCC-H to assure the safe flight of the Soyuz transport vehicle while performing maneuvers during the active flight phase, descent, and search-and-rescue operations.

6.0 Capability of using the Soyuz vehicle as an rescue vehicle for U.S. primary expedition crewmembers delivered to the ISS aboard a Space Shuttle.

6.1 To prepare and furnish rescue services aboard a Soyuz vehicle, for one calendar year, to one U.S.-designated primary expedition crewmember, delivered aboard a Space Shuttle, for the duration of the crewmember's 6-month expedition.

6.1.a. Training of the U.S.-designated astronaut to be a Soyuz crewmember

6.1.a.1. To provide theoretical and practical training, to furnish equipment (e.g., Sokol spacesuit, seat liner, thermal suit, water survival suit, and basic survival suit), to provide access to facilities, and to certify the specified U.S. or U.S.-designated member of the primary and backup crews for the purpose of providing emergency assured return from the ISS aboard a Soyuz vehicle, and landing aboard a Soyuz vehicle. Delivery and return of specified equipment (e.g., the Sokol spacesuit, seat liner, thermal suit, water survival suit, and basic survival suit). To furnish necessary training materials in Russian prior to the start of training requiring such materials, in accordance with applicable Russian laws and regulations.

6.1.a.2. Prior to the start of training, the specified U.S. or U.S.-designated crewmember shall be furnished with the Soyuz flight crew procedures.

6.1.a.3. Develop and implement a training plan and a corresponding travel schedule within the framework of the integrated ISS crew training plan.

6.1.a.4. Except for the last training phase, the specified U.S. or U.S.-designated primary and backup crewmembers shall be provided with interpretation into English during all sessions, to the extent that such services are required for a given crewmember.

6.1.b. Travel and lodging (except at the Baikonur cosmodrome) for up to five NASA personnel (by decision of Roskosmos, taking account of NASA proposals).

6.1.b.1. To provide transportation and facility access (provided that appropriate personal data, in accordance with internal regulations, are provided) to the extent required for the specified U.S. or U.S.-designated crewmember and NASA service personnel (for example, training specialists, a flight surgeon, crew support astronauts, and interpreter) for survival training. Food and lodging shall also be provided during survival training.

6.1.d. Landing area deployment airfield and search-and-rescue services under normal landing conditions and weather (including ballistic descents within the nominal landing area).

6.1.d.1. To provide the following services at deployment airfields: airport access, access to concurred facilities and necessary permits for the specified U.S. or U.S.-designated crewmember, as well as for up to ten NASA service personnel (by decision of Roskosmos, taking account of NASA proposals) (for example, flight surgeons, crew support astronauts, PAO representative, NASA administrative personnel, and interpreter). The actual number of NASA staff at the landing area shall be regulated by the provisions of section 6.1.d.4.

6.1.d.2. To provide transport for up to ten NASA crew support group personnel (for example, flight surgeons, crew support astronauts, PAO representative, NASA administrative personnel, and interpreter) from GCTC to deployment airfields and back, as well as local transportation at deployment airfields that is required to support crew evacuation. The NASA delegation shall pay for its own food and lodging. Roskosmos shall arrange lodging at the location where the search-and-rescue group is accommodated. The actual number of NASA staff at the landing area shall be regulated by the provisions of section 6.1.d.4.

6.1.d.3. To provide transportation for the specified U.S. or U.S.-designated crewmember, from the landing area deployment airfield to GCTC, as well as directly at the landing area deployment airfield as required to complete crew evacuation activities.

6.1.d.4. To provide search-and-rescue helicopter transport for up to five NASA crew support group personnel (by decision of Roskosmos, taking account of NASA proposals) (and two additional persons in case of a ballistic entry into the nominal landing area) (for example, flight surgeons, crew support astronauts, PAO representative, NASA administrative personnel, and interpreter) from the deployment airfield to the landing area and back, as well as to other locations that may be required to support Soyuz evacuation operations.

6.1.e. Health care/Medical aid

6.1.e.1. To provide information regarding the entire program of mission medical operations. To perform medical support operations in accordance with these requirements and requirements concurred by the parties in the Medical Operations Requirements Document (MORD) (SSP-50260). To render aid to the U.S. flight surgeon to monitor the health of the specified U.S. or U.S.-designated crewmember.

6.1.e.2. To provide for the transmission, from MCC-M to MCC-H, of medical information regarding the health of U.S. crewmembers during light aboard the Soyuz vehicle.

6.1.e.3. To provide postflight rehabilitation in accordance with current practice.

6.1.f Personal belongings

6.1.f.1. To allow 1,5 kg of down-mass (as defined in SSP 50261-01, GGR&C) aboard the Soyuz vehicle for personal preference items for each specified U.S. or U.S.-designated crewmember, and to provide for the return of such items with the crew in accordance with cargo item return procedures.

6.1.g Consumables

6.1.g.1. During Soyuz vehicle descent, the specified U.S. or U.S.-designated crewmember shall be furnished with consumable items, including (but not limited to): food, clothing stowage, crew support items, and life support.

6.1.h. (Primary and backup) crewmember personal gear
Individual flight gear shall be delivered aboard the Space Shuttle that delivers the crewmember.

6.1.h.1. To place all necessary nominal Soyuz flight equipment at the disposal of NASA, for delivery aboard a Space Shuttle for a specified U.S. or U.S.-designated crewmember, including: a Sokol spacesuit, seat liner, thermal suit, water survival suit, and basic survival gear.

6.1.h.2. Prior to delivery to NASA, to perform all necessary measurements and verify the suitability of equipment for the specified U.S. or U.S.-designated crewmember, including an evaluation of operations safety and familiarization with flight equipment. The astronaut must arrive in Russia by a date set by the Russian side for familiarization with the nominal Soyuz vehicle.

6.1.i. Providing information regarding the Soyuz mission/flight

6.1.i.1. Information shall be provided during all phases of Soyuz flight, including docked and rescue operations, for the purpose of obtaining complete information regarding the mission, in accordance with current practice.

6.1.i.2. To provide MCC-H with necessary Soyuz telemetry data via the Russian Telemetry From Moscow (RTFM) channel from MCC-M to MCC-H upon vehicle AOS by Russian ground stations (RGS), in accordance with current practice.

7.0 Delivery of U.S. cargo items to the ISS and disposal of waste from the ISS using Progress and Soyuz vehicles.

7.1 Services to be offered to support of U.S. cargo item delivery to the ISS and waste disposal from the ISS aboard Progress and Soyuz vehicles. NASA will furnish safety-certified cargo items for delivery to the ISS.

7.1.a. Transportation and customs and sanitary clearance of U.S. cargo items.

7.1.a.1. To provide for transportation of cargo items to Baikonur from Roskosmos or Roskosmos subcontractor facilities, in accordance with ISS documentation (technical specifications and data on cargo item packing, submitted for each U.S. cargo shipment), including late-load cargo items. When necessary, NASA shall provide appropriate documentation in Russian and English languages.

7.1.a.2. To provide for customs clearance and required support in Moscow and Kazakhstan. NASA shall provide necessary documents in Russian and English languages.

7.1.a.3. To provide for conformance of sanitary and public health certificates required for customs clearance.

7.1.b. Documentation and analysis

7.1.b.1. To confirm the designated Progress vehicle manifest in an international coordination protocol and IDRD Appendix 1.

7.1.b.2. To provide for the integration (model definition) of U.S. cargo items prior to launch to the ISS.

7.1.b.3. To perform flight safety certification for U.S. cargo items as configured for launch aboard Progress, Soyuz, or a concurred alternative vehicle.

7.1.b.4. A preliminary ICD for each flight (Soyuz and Progress) will be submitted to NASA for joint signature at L-2 months. The final (Soyuz and Progress) ICD for each flight will be submitted to NASA for joint signature at L+2 weeks.

7.1.b.5. To submit to NASA, prior to Soyuz or Progress launch, photographs showing how NASA cargo items are configured inside the vehicles, as well as photographs of individual items (if technically feasible) of layered stowage that must be provided. Photographs of individual items inside of preliminary NASA stowage is not required.

7.1.c. Lodging and transportation of personnel at additional NASA expense.

7.1.c.1. To provide for the transportation, from Moscow to Baikonur, of NASA cargo integration staff (up to three persons) assigned to support loading and launch aboard Soyuz and Progress vehicles.

7.1.c.2. To provide food and lodging at Baikonur for up to three NASA cargo integration staff members, at RSC Energia hotel 1 and hotel 3, as well as access to appropriate facilities.

7.1.c.3. To provide visa support for NASA cargo integration staff members to enter the Russian Federation, including invitations.

7.1.d. Cargo item maintenance at Baikonur

7.1.d.1. To provide security and storage in a controlled ambient environment at Baikonur for U.S. cargo items delivered to Baikonur for launch in accordance with current procedures. Security conditions shall be tailored for lockable premise equipped with keys (or equivalent devices) and personnel access documents. The environment parameters to be controlled shall be the standard atmospheric pressure at Baikonur and a temperature of between 15°C and 27°C.

7.1.e. Late loading of Soyuz and Progress

7.1.e.1. To provide for late loading/stowage for concurred NASA cargo items at L-1 and L-2 days, with the capability of later stowage, concurred between NASA and Roskosmos.

7.1.e.2. To provide for transportation of late-load NASA cargo items from Moscow to Baikonur, including customs clearance, provided NASA furnishes English documentation.

7.1.e.3. Cargo items that will not be launched must be stored at the NASA office in Baikonur. If NASA wishes to return the cargo items to the U.S., then the parties shall jointly agree on packaging and return to the U.S. at NASA's expense.

7.1.f. Difficult assembly

7.1.f.1. For cargo units to be delivered aboard Progress and Soyuz vehicles and requiring technical resources for integration or special trusses for transportation, Roskosmos shall develop and provide special systems for assembly, fastening, and packaging, if these do not impact the vehicle's structure and launch schedule. With this goal in mind, NASA and Roskosmos shall concur and coordinate their actions pursuant to corresponding interface and cargo stowage requirements at L-3 months.

7.1.g. Waste disposal from the ISS aboard Progress and Soyuz vehicles

7.1.g.1. To provide for declaring, integrating, modeling, and certifying of waste cargo items prior to undocking from the ISS.

7.1.f.2. Remove designated cargo items from the ISS and dispose of them.

8.0 U.S. cargo items to be returned aboard Soyuz vehicles

8.1 Basic services to be provided to support return of U.S. cargo items from the ISS aboard Soyuz vehicles.

8.1.a. Cargo item transportation and delivery

8.1.a.1. After return of cargo items to Kazakhstan, to provide transportation for designated NASA cargo items to Moscow in a conditioned state (previously concurred). NASA shall set forth appropriate requirements and submit required documentation.

8.1.a.2. To provide for customs clearance for transport of returned cargo items to the U.S. from Kazakhstan and/or Moscow. NASA shall submit appropriate documentation.

8.1.b. Documentation and analysis

8.1.b.1. To provide for integration (modeling) of descent cargo prior to return from the ISS.

8.1.c. The advanced removal of return cargo items to be returned aboard a Soyuz vehicle at NASA's election.

8.1.c.1. To provide for the immediate unloading of NASA cargo items upon landing, concurred with Roskosmos, and before the departure of the crew from the landing area.

8.1.c.2. To transport such cargo to the NASA Representative Office in Moscow, in accordance with applicable legislation. After transfer of the cargo to NASA, Roskosmos shall cease to be responsible for such equipment.

9. Rotation and rescue of 6 U.S. or U.S.-designated crewmembers per year using Soyuz vehicles between April 2009 and September 2011 is TBD.

OMB Approval No. 2700-0042

AMENDMENT OF SOLICITATION/ MODIFICATION OF CONTRACT

1. CONTRACT ID CODE		PAGE OF PAGES	1 / 6
2. AMENDMENT/MODIFICATION NO. 166	3. EFFECTIVE DATE SEE BLOCK 16C	4. REQUISITION/PURCHASE REQ. NO. 062930X1	5. PROJECT NO. (If applicable)
6. ISSUED BY CODE C01		7. ADMINISTERED BY (If other than item 6) CODE	

NASA Space Station Program Office
Johnson Space Center
Attn: BG/D. DeNardo
Houston, TX 77058

APPROVED
JSC PROCUREMENT OFFICER
11/6/06
DATE

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State, and ZIP Code)

Federal Space Agency (Roscosmos)
42 Shchepkin Street
Attn: Alexey Krasnov
Moscow, 129857
Russia

CODE | FACILITY CODE

(x)		
	9A. AMENDMENT OF SOLICITATION NO.	9B. DATED (SEE ITEM 11)
X	10A. MODIFICATION OF CONTRACT/ORDER NO. NAS15-10110	10B. DATED (SEE ITEM 13) December 16, 1993

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended. Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning ☐ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)
N/A

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.(x)

(x)	
	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
X	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF 10 U.S.C. 2304(c); 48 C.F.R. Chapters 1 and 18; Agreement of the Parties
	d. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not, ☒ is required to sign this document and return 3 copies to the issuing office.

14. description of amendment/modification (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

The purpose of this modification is to 1) purchase cargo upmass, trash removal, crew rotation, and crew rescue function, training and equipment. The J-4 milestone billing schedule is updated to reflect these changes. 2) Increase the current contract value by $159,600,000 from $627,851,621 to $787,451,621 and 3) Incrementally fund the contract by $50,550,000 from $627,411,621 to $677,961,621. This modification constitutes full and complete equitable adjustment for the changes set forth herein. In consideration of this agreed to modification, the contractor hereby releases the Government from any and all liability under this contract for further equitable adjustments attributable to such facts or circumstances giving rise to these changes. (CONTINUED ON PAGE 2)

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print) Alexey Krasnov		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) Marianne D. Ruiz, Contracting Officer	
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED 10. 26 2006	16B. UNITED STATES OF AMERICA BY (Signature of Contracting Officer)	16C. DATE SIGNED 11/06/06

Block 14 Description of Amendment/Modification (continued):

1. SERVICES TO BE FURNISHED

Section J-4 of the basic contract is modified to include additional requirements for Crew Rescue/Crew Rotation on Soyuz, Cargo delivery to ISS on Soyuz and Progress vehicles, and trash removal. These requirements shall be performed in accordance with the attached Statement of Work (as referenced for each numbered item below). These requirements are as follows:

1. Launch, return, and rescue of Expedition 16 U.S. designated crewmember on Soyuz 15 and Expedition 18 U.S. designated crewmember on Soyuz 17. (SOW section 5.0)
2. Delivery of U.S. cargo to ISS on Progress and Soyuz flights 24P through 31P and 15S and 17S at a rate of approximately 375kg per Progress and a 10 – 25 kg per Soyuz for a total of 3050 kg. (1525kg in calendar year 2007 and 1525kg in calendar year 2008) (SOW section 7.0)
3. Disposal of approximately 3000kg of U.S. trash on Progress flights 24P through 31P at a rate of approximately 375kg per Progress. (payment based on agreed-to manifest 1 month before undocking) (SOW section 9.0)
4. On orbit crew rescue services, including all required training, equipment, and hardware for U.S. Expedition crewmembers delivered to the International Space Station (ISS) via Shuttle. (SOW sections 5.1.a through 5.1.c.1, 5.1.d through 5.1.e.1, 5.1.e.3 through 5.1.g.2, and 5.1.i through 5.2)

2. MODIFICATION VALUE

The total firm-fixed price of the work ordered under this modification is $159.6M based on the following unit prices and totals for 1-4 in the above paragraph:

1. $43,600,000 ($21,800,000 per seat)
2. $80,000,000 ($26,229 per kilogram) (including space allocation for NASA cargo)
3. $21,000,000 ($7,000 per kilogram) (including space allocation for U.S. trash)
4. $15,000,000 ($1,250,000 per astronaut trained)

A) $43,600,000 is added for launch, return and rescue of the US designated Exp 16 crewmember on Soyuz 15 and US designated Exp 18 crewmember on Soyuz 17, section J-4 is modified as follows:

Milestone	Title	Value	Est. Completion Date
00021a9	Preparation activities for launch of Exp 16 crewmember on Soyuz 15	$10,900,000	November 2006
00021a10	Delivery of Exp 16 on Soyuz 15	$5,450,000	October 2007
00021a11	Return of Expedition 16 on Soyuz 15	$5,450,000	April 2008
00021a12	Preparation activities for launch of Exp 18 crewmember on Soyuz 17	$10,900,000	November 2006
00021a13	Delivery of Exp 18 on Soyuz 17	$5,450,000	September 2008
00021a14	Return of Expedition 18 on Soyuz 17	$5,450,000	March 2009

B) $80,000,000 is added for delivery of 3050kg of U.S. cargo to ISS on Progress and Soyuz flights 24P through 31P and 15S and 17S at a rate of approximately 375kg per progress and

10 – 25 kg per Soyuz. (1525kg in calendar year 2007 and 1525kg in calendar year 2008) Section J-4 is modified as follows:

Milestone	Title	Value	Est. Completion Date
00022a11	Space Allocation for NASA Cargo on 24P – 31P and 15S and 17S	$20,000,000	November 2006
00022a12	Delivery of NASA Cargo 24P	$TBD	January 2007
00022a13	Delivery of NASA Cargo 25P	$TBD	May 2007
00022a14	Delivery of NASA Cargo 26P	$TBD	September 2007
00022a15	Delivery of NASA Cargo 27P	$TBD	November 2007
00022a16	Delivery of NASA Cargo 28P	$TBD	January 2008
00022a17	Delivery of NASA Cargo 29P	$TBD	July 2008
00022a18	Delivery of NASA Cargo 30P	$TBD	October 2008
00022a19	Delivery of NASA Cargo 31P	$TBD	TBD
00022a20	Delivery of NASA Cargo 15S	$TBD	October 2008
00022a21	Delivery of NASA Cargo 17S	$TBD	September 2009

C) $21,000,000 is added for disposal of approximately 3000kg of U.S. trash on Progress flights 24P through 31P at a rate of approximately 375kg per progress. (1500kg in calendar year 2007 and 1500kg in calendar year 2008) Section J-4 is modified as follows:

Milestone	Title	Value	Est. Completion Date
00022c1	Space Allocation for U.S trash on 24P – 31P and 15S through 17S	$5,250,000	November 2006
00022c2	Disposal of NASA Cargo 24P	TBD	May 2007
00022c3	Disposal of NASA Cargo 25P	TBD	August 2007
00022c4	Disposal of NASA Cargo 26P	TBD	January 2008
00022c5	Disposal of NASA Cargo 27P	TBD	April 2008
00022c6	Disposal of NASA Cargo 28P	TBD	July 2008
00022c7	Disposal of NASA Cargo 29P	TBD	December 2008
00022c8	Disposal of NASA Cargo 30P	TBD	February 2009
00022c9	Disposal of NASA Cargo 31P	TBD	TBD

D) $15,000,000 is added to purchase on orbit crew rescue services, including all required training and necessary individual equipment for U.S. Expedition crewmembers delivered to the International Space Station (ISS) via Shuttle. Training means that each person will be trained two times (two cycles), once as a back up crew member and once as a prime crew member. If additional training is required for a crew member already trained twice, equitable adjustment shall be provided to the contractor. Individual equipment for each crew member shall be manufactured once. If re-manufacture of individual equipment is required due to a change made by NASA, equitable adjustment shall be provided to the contractor. For planning purposes, section J-4 is modified as follows for crew members anticipated to be rotated on 12A.1, 13A.1, 10A, 1E, 1J/A, 15A, ULF2, 2J/A, 17A:

Milestone	Title	Value	Est Completion Date
00023a1	Crew Rescue Function, Training, and equipment (S. Williams)	$1,000,000	November 2006
00023a2	Return to Earth	$250,000	Per Shuttle Schdl
00023a3	Crew Rescue Function, Training, and equipment (C. Anderson)	$1,000,000	November 2006
00023a4	Return to Earth	$250,000	Per Shuttle Schdl
00023a5	Crew Rescue Function, Training, begins (G. Chamitoff)	$500,000	November 2006
00023a6	Training Completed	$500,000	TBD
00023a7	Return to Earth	$250,000	Per Shuttle Schdl
00023a8	Crew Rescue Function, Training begins	$500,000	September 2007
00023a9	Training Completed	$500,000	TBD
00023a10	Return to Earth	$250,000	Per Shuttle Schdl
00023a11	Crew Rescue Function, Training begins	$500,000	November 2006
00023a12	Training Completed	$500,000	TBD
00023a13	Return to Earth	$250,000	Per Shuttle Schdl
00023a14	Crew Rescue Functiou, Training begins	$500,000	September 2007
00023a15	Training Completed	$500,000	TBD
00023a16	Return to Earth	$250,000	Per Shuttle Schdl
00023a17	Crew Rescue Function, Training begins	$500,000	TBD
00023a18	Training Completed	$500,000	TBD
00023a19	Return to Earth	$250,000	Per Shuttle Schdl
00023a20	Crew Rescue Functiou, Training begins	$500,000	TBD
00023a21	Training Completed	$500,000	TBD
00023a22	Return to Earth	$250,000	Per Shuttle Schdl
00023a23	Crew Rescue Function, Training begins	$500,000	TBD
00023a24	Training Completed	$500,000	TBD
00023a25	Return to Earth	$250,000	Per Shuttle Schdl
00023a26	Crew Rescue Function, Training begins	$500,000	TBD
00023a27	Training Completed	$500,000	TBD
00023a28	Return to Earth	$250,000	Per Shuttle Schdl
00023a29	Crew Rescue Function, Training begins	$500,000	TBD

00023a30	Training Completed	$500,000	TBD
00023a31	Return to Earth	$250,000	Per Shuttle Schdl
00023a32	Crew Rescue Function, Training begins	$500,000	TBD
00023a33	Training Completed	$500,000	TBD
00023a34	Return to Earth	$250,000	Per Shuttle Schdl

3) Contract Clause B.1 Supplies and/or Services to Be Furnished is revised to read as follows:

Total Firm-Fixed Price including Options $787,451,621

4) Contract Clause G.8 Obligation of Funds is revised to read as follows:

The total amount of funds allotted to this contract is $677,961,621. Each time additional funds are allotted the Contracting Officer shall amend this clause accordingly.

5) Contract Clause H.10 Limitation of Funds (Fixed Price Contract) is revised in part as follows:

(a) Of the total price of $787,451,621 for items 0001 through 00023, the sum of $677,961,621 is presently available for payment and allotted to this contract. It is anticipated that from time to time additional funds will be allocated to the contract until funds consistent with the total contract price are allotted.

(c) (1) It is contemplated that funds presently allotted to this contact will cover the work to be performed until **March 2009.**

6) Paragraph 5.0 of the statement of work is revised to include Soyuz 15 and 17 as follows:

From:

5.0 Launch, return, and rescue of Expedition 13 U.S. crewmember on Soyuz 12 (Spring 2006 through Fall 2006) and Launch, return, and rescue of Expedition 14 U.S. crewmember on Soyuz 13.

To:

5.0 Launch, return, and rescue of Expedition 13 U.S. crewmember on Soyuz 12 (Spring 2006 through Fall 2006) , Launch, return, and rescue of Expedition 14 U.S. crewmember on Soyuz 13 **and Launch, return and rescue of Expedition 16 and 18 U.S. designated crewmembers on Soyuz 15 and 17.**

7) Paragraph 5.2 is revised to include Soyuz 15 and 17 as follows:

From:

5.2 Return of approximately 3kg of downmass on Soyuz 12 and 3kg of downmass on Soyuz 13

To:

5.2 Return of approximately 3kg of downmass on Soyuz 12, 3kg of downmass on Soyuz 13, **and 3kg of downmass on both Soyuz 15 and 17.**

8) Paragraph 5.2.1 is revised to include Soyuz 15 and 17 as follows:

From:

5.2.1 Base services to be provided in support of U.S. cargoes to be returned from ISS on Soyuz 12 and Soyuz 13

To:

5.2.1 Base services to be provided in support of U.S. cargoes to be returned from ISS on Soyuz 12, Soyuz 13, **Soyuz 15 and Soyuz 17**

9) Paragraph 7.0 of the statement of work is revised to include delivery of approximately 3050kg on 24P through 31P and Soyuz 15 and 17

From:

7.0 Delivery of U.S. cargo to ISS on Progress flights 20P, 21P, 22P and 23P at a rate of approximately 192kg on 20P, approximately 250kg on 21P, approximately 350kg on 22P and approximately 270kg on 23P (payment by NASA shall be based on agreed-to manifest 1 month prior to launch) and delivery of approximately 20kg on Soyuz 12 and approximately 30kg on Soyuz 13 (payment by NASA shall be based on agreed-to manifest 1 month prior to launch)

To:

7.0 Delivery of U.S. cargo to ISS on Progress flights 20P, 21P, 22P, 23P **and 24P – 31P at** a rate of approximately 192kg on 20P, approximately 250kg on 21P, approximately 350kg on 22P and approximately 270kg on 23P (payment by NASA shall be based on agreed-to manifest 1 month prior to launch), **approximately 375kg per Progress vehicle for flights 24P – 31P (Payment by NASA will be based on paragraph 2B of this modification)** and delivery of approximately 20kg on Soyuz 12, approximately 30kg on Soyuz 13 (payment by NASA shall be based on agreed-to manifest 1 month prior to launch), **and approximately 10 – 25 kg per Soyuz for both Soyuz 15 and 17 (Payment by NASA will be based on paragraph 2B of this modification).**