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Statement of
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Before the

Subcommittee on Research and Science Education
Committee on Science and Technology
U.S. House of Representatives

Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to appear today to discuss NASA's international science and technology (S&T) cooperation.

The National Aeronautics and Space Act of 1958, as amended (42 U.S.C. 2451, et seq.) directs NASA to conduct its activities so as to "contribute materially to . . . cooperation by the United States with other nations" and effect "the widest practicable and appropriate dissemination of information concerning its activities and the results thereof." As a result, since the Agency's inception, NASA has enjoyed significant benefits to almost all of its major programs through some level of international cooperation. Since 1958, NASA's international cooperative activities have involved more than 3,000 agreements with over 100 nations or international organizations. While the majority of NASA's cooperation is accomplished with space faring nations, an increasing number of other nations are now relying on the unique vantage point of space for day-to-day activities such as urban planning, resource management, communications, weather forecasting, and navigation. As a consequence, NASA's international partnerships have continued to grow in diversity and importance, as the Agency engages both developed and developing nations in a wide range of mutually beneficial activities.

Throughout NASA's extensive history of international cooperation, the Agency has developed a series of guidelines to govern its international activities. First, cooperative activities must have scientific and technical merit and demonstrate a specific programmatic benefit to NASA. These benefits are often achieved through the pooling of resources, access to foreign capabilities or geographic advantage, addition of a unique capability to a mission, increased mission flight opportunities, or enhanced scientific return. In almost all instances, each Partner funds its respective contribution and the cooperation is conducted on a "no exchange of funds" basis. These cooperative activities

are always structured to protect against unwarranted technology transfer, take into account U.S. industrial competitiveness, and establish clearly defined managerial and technical interfaces to minimize complexity.

Currently, international cooperative activities are underway in each of NASA's four Mission Directorates (Science, Space Operations, Exploration Systems, and to a limited extent, Aeronautics Research) involving hundreds of active agreements. This cooperation includes joint mission planning and development of human space flight systems such as the International Space Station (ISS); flight of foreign astronauts on NASA's Space Shuttle; flight of NASA instruments on foreign spacecraft (and vice-versa); close coordination of independent space activities with similar mission objectives; suborbital campaigns and field research (e.g., measurements from sounding rockets, balloons, aircraft and ground-based measurements); cooperative tracking and space communications interoperability support; and scientist-to-scientist data exchanges with joint analysis, interpretation and publication of results.

International Cooperation Related to the Science Mission Directorate

As might be expected, international cooperation in a wide range of science and technology initiatives is most evident in NASA's Science Mission Directorate whose activities fall broadly under the categories of Earth science and space science. The Agency has established a robust program of scientific research, informed by input from the global science community, from National Academy of Sciences' studies and decadal surveys, and from NASA external advisory committees. International involvement in the implementation of this science-driven program has historically been welcomed at all levels, which has ranged from multi-million dollar contributions of instruments and spacecraft to data analysis by individual researchers from around the world. At the present time, two thirds of NASA's three hundred active international agreements are for missions led by the Science Mission Directorate. It should also be noted that more than half of NASA's 46 currently-operating science missions include international participation. It is anticipated that this involvement will continue to grow as NASA and international institutions with similar research objectives seek to maximize scientific return with limited domestic resources for mission development and operations. On an almost daily basis, the benefits for the broader scientific community are realized as NASA and its international partners readily make their research data available to the global research community.

NASA's Earth science activities are inherently global as we strive to understand the Earth as a system, from a variety of U.S. and international platforms. In fact, some ground-based research programs involve dozens of countries, such as the Aerosol Robotic Network (AERONET), an optical, ground-based aerosol-monitoring network and data archive system in which over 40 countries/regions participate. NASA is a major U.S. contributor to the International Polar Year (IPY) 2007-2008. IPY will involve a wide range of research disciplines, but the emphasis will be interdisciplinary in its approach

and truly international in participation. NASA is also a leader in international mechanisms such as the Committee on Earth Observation Satellites (CEOS), which coordinates the civil space-borne missions of nearly 50 space agencies and associated national and international organizations that observe and study the Earth. Global participation in these activities is a necessity.

Certain examples of space science missions with international involvement are well known, such as the Hubble Space Telescope, which includes cooperation between NASA and the European Space Agency, and its follow on mission-in-development, the James Webb Space Telescope, in which NASA, ESA and the Canadian Space Agency are partners. For robotic planetary missions, bilateral cooperation with multiple international partners is generally the norm. For example, seventeen nations contributed to building Cassini-Huygens, a cooperative mission led by NASA, ESA and the Italian Space Agency to explore Saturn, Titan and the other moons of Saturn. Hundreds of scientists worldwide participate in the Cassini-Huygens science teams. Looking to the future, NASA's Science Mission Directorate recently initiated discussions on potential international participation in a new NASA-led lunar network initiative. While details of the concept are still being developed, the overall concept is to work with the international community to place a network of landers on the lunar surface in the 2012-2015 timeframe.

International Cooperation Related to the Space Operations Mission Directorate

NASA's premier example of international space cooperation is the ongoing assembly of the ISS. With participation from 15 nations, NASA and its space agency counterparts have worked together to design, develop, assemble on-orbit and operate one of the most complex science and engineering projects in history. With the last two Space Shuttle missions, NASA delivered to the ISS several key international elements: the European *Columbus* laboratory, a portion of the Japanese *Kibo* laboratory and the Canadian *Dextre* robotic manipulator system. As a result, NASA continues to honor the nation's commitment to our international partners on the Space Station, while meeting the most prominent milestones of the program. As NASA Administrator Michael Griffin testified before the Committee on Science and Technology on February 13, 2008, "…its development is the largest task ever performed by the civilian agencies of the United States or our international partners. Such international partnerships will be an integral part of our next steps out beyond low Earth orbit, toward what President John Kennedy called 'this new ocean'."

The success of the ISS is all the more remarkable due to the necessary harmonization of complex engineering and technology development activities among the United States, Russia, Japan, Canada and many nations of Europe. The ISS International Partners represent over a dozen different political systems, budgetary mechanisms, and cultural, management and industrial approaches, that rely on the multilingual skills of engineers, astronauts and mission controllers around the world.

The history of Space Shuttle crew assignments clearly demonstrates the global nature of NASA's human space flight program. Fifty-nine international astronauts from 15 countries have flown on the Space Shuttle a total of 89 times, representing one-fifth of the total Shuttle Mission Specialists. As we move forward, each ISS Partner has an allocation of future Space Station crew opportunities for the lifetime of the program, based on its contributions to the ISS as articulated in the Space Station international agreements.

Further, NASA enjoys significant international cooperation in support of space communication. NASA and the international community routinely provide back up communication services for each other. NASA leads the development of international data standards and protocols for such space communications, as well as participating, in coordination with the Department of State, in International Telecommunication Union forums to ensure that sufficient radio frequency spectrum is allocated appropriately to all international partners. International interoperability is an important keystone of our joint missions. NASA also provides communications between the U.S. and the U.S. South Pole Station and, through this service, is supporting a number of international science projects that were launched under the banner of the IPY.

International Cooperation Related to Future Exploration Activities

In future exploration by humans beyond low Earth orbit, NASA expects significant international cooperation. On January 14, 2004, the President directed NASA to pursue opportunities for international participation to support U.S. space exploration goals in the implementation of its new vision. Since that direction was issued, NASA has made steady progress with its international counterparts. Most significantly, NASA and 13 space agencies from around the world developed "The Global Exploration Strategy: The Framework for Coordination." This document, which the participating agencies released in May 2007, expresses the shared vision of these agencies, both large and small, on the importance of space exploration to national objectives. The process in which 14 international space agencies agreed on common goals for space exploration was as important as the product itself.

For NASA, the focus on international cooperation for future exploration can be described by two parallel paths: maintaining our multilateral approach to information sharing and coordination while expanding our bilateral cooperation with international counterparts to identify new areas of space exploration. Some specific examples of bilateral cooperation that have resulted from this process include: NASA's ongoing cooperation with the Japanese Aerospace Exploration Agency on its Kaguya spacecraft currently orbiting the Moon; cooperation with the Indian Space Research Organization on its Chandrayaan lunar mission later this year, in which NASA is providing a Miniature Synthetic Aperture Radar to map ice deposits in the Moon's polar regions and a Moon Mineralogy Mapper to assess mineral resources of the Moon; and cooperation with the Russian Federal Space Agency on Russian provision of neutron detectors for NASA's Lunar Reconnaissance Orbiter and NASA's Mars Science Laboratory missions.

NASA International Cooperation and Foreign Policy Interests

While NASA's international cooperation is driven by its mission objectives, such activities also promote U.S. foreign policy interests. Two highly visible examples at different extremes of complexity and cost include the ISS and frequent U.S. astronaut visits around the world. The ISS partnership resulted in a robust program among 15 nations with scientific and technological benefits for all of the partners involved. Along the way, the partnership itself survived significant challenges such as initial delays in delivery of major components and the tragic loss of Space Shuttle *Columbia*. The success of this program has played a significant positive role in the governmental relationship between the United States and its ISS partners. In the case of U.S. astronauts, by virtue of their unique human space flight experiences and genuine admiration by international audiences, they have long been able to transcend government-to-government issues and help to enable constructive discussion on the peaceful uses of outer space for the benefit of all.

In addition, small, low-cost activities in partnership with other U.S. Government Agencies and international organizations can also have significant U.S. foreign policy benefits. Working closely with the U.S. Agency for International Development and international organizations, NASA has initiated a number of very successful pilot projects, particularly in the area of remote sensing applications. An important example of this type of cooperation is NASA's involvement in the establishment of the SERVIR operations facility in Panama. SERVIR (both a Spanish acronym and also a Spanish verb meaning "to serve") is a regional visualization and monitoring system for Mesoamerica that integrates NASA-provided satellite and other geospatial data for improved scientific knowledge and decision making. Among other things, SERVIR is used to monitor and forecast ecological changes and severe events such as forest fires, red tides, and tropical storms. Eight countries in the region are members of this network and there is international interest in using this network as a model for other parts of the world. Discussions are already underway for potential use of this model in the eastern part of Africa.

NASA's international activities have been a key component of the Agency's overall mission from the beginning. While those activities are pursued for scientific, programmatic and mission-related purposes, they also provide significant benefits to the United States more broadly, requiring close coordination with other government agencies during the negotiation of the related international agreements. NASA's authority to enter into international agreements, combined with effective, long-standing relationships with the Office of Science and Technology Policy, the Department of State and other organizations in the Executive Branch, provides an effective basis for the development and implementation of NASA's international cooperation. In the vast majority of cases, such as bilateral agreements with long standing traditional partners from Europe, the consultation and approval process is straight forward and relatively streamlined. In other cases, NASA clearly recognizes that as we explore opportunities for cooperation with

non-traditional partners such as India, Korea, Ukraine, China and others, enhanced interagency and Congressional coordination will be required to ensure that broader U.S. government interests and any potential legal restrictions are carefully addressed.

Summary

International cooperation will continue to be fundamentally important to NASA. By direction of the President and Congress, NASA is pursuing a bold agenda that commits the United States to complete assembly of the ISS and retire the Space Shuttle in 2010, and also develop the next generation of launch systems, vehicles, and other capabilities that will carry humans and robots beyond low Earth orbit as an integral part of a balanced program of human and robotic exploration, science and aeronautics research. As we continue to implement this exciting new chapter in space exploration, NASA will seek opportunities for mutually beneficial cooperation around the world.

Again, thank you for the opportunity to appear before you today. I would be pleased to respond to any questions that you or other Members of the Subcommittee may have.