

**HOLD FOR RELEASE
UNTIL PRESENTED
BY WITNESS**

**Statement of
Astronaut Peggy Whitson (Ph.D)
National Aeronautics and Space Administration**

before the

**Subcommittee on Space and Aeronautics
Committee on Science
United States House of Representatives**

June 14, 2005

Mister Chairman and Members of the Subcommittee, thank you for the opportunity to appear before you today. I consider it an honor to appear here with Mike Fincke, who was the Science Officer on Expedition 9. In just a few minutes, John Phillips, Expedition 11 Flight Engineer and Science Officer, will be appearing live, via satellite, from the ISS to answer questions about life on orbit. First, I'd like to tell you a little about my experience on the Station as part of Expedition 5 and then provide you with an overview of current activities aboard the Station.

Life and Work Aboard the International Space Station

In the over four years of continuous human presence on board the ISS, we have performed important science that will allow us to expand our presence into the solar system. We have discovered things that make our life here on Earth better. We have learned about technologies and processes which will help us meet the challenges of future exploration.

While we can to some extent simulate living conditions in space here on the ground, there is no substitute for experience in the actual space environment. Simply put, to learn how to live in space, we must live in space. Every experiment, every spacewalk, every repair and every piece of hardware assembled teaches us something new. A full time human presence aboard the ISS offers us a tremendous opportunity to study human survival in the hostile environment of space and assess how to overcome the technological hurdles to human exploration beyond Earth orbit, as called for in the Vision for Space Exploration.

During my time on Station (Expedition 5), we hosted three Shuttle assembly missions. Using the Station's robotic arm, we installed the S1 (starboard 1) and P1 (port 1) truss elements and the Mobile Base System, which serves as the platform for transporting the

robotic arm and any attached hardware or experiments to various locations along the truss.

We also performed two extravehicular activities (EVA). Spacewalks are a physical challenge, since we work in a pressurized suit that protects us from the vacuum of space, but requires us to perform hand-intensive tasks working against this pressure. EVAs are also an operational challenge, especially now while we have only two-person crews, since both crewmembers are outside. From these activities we continue to learn a great deal about assembly of Station elements, repair of external components, operational processes, and spacesuit capabilities.

As a scientist, it was, of course, exciting being the on orbit hands of the investigator teams on the ground. Being the daughter of a farmer, I would have to say that the commercial experiment involving soybean growth was very, very special to me as well. I also had the unique opportunity to be the principal investigator and the subject for my own experiment to test potassium citrate ingestion as a mechanism to reduce the kidney stone-forming potential in space travelers. In fact, I am still working on this experiment, albeit from the ground, with Expedition 11 as our primary subjects. A few of the other experiments we conducted on Expedition 5 included: super-conducting crystal materials with different technical additives and in different heating profiles to better assess the crystallization characteristics in an environment where gravity is not a variable, assessing pulmonary lung function before and after EVA, and developing procedures for diagnostic ultrasound capability.

My background in the human space life sciences provided me with a lot of insight into the potential physiologic responses that a crewmember might anticipate upon entering and returning from microgravity. However, I was still surprised by the low back pain as my spinal column relaxed, and the surrounding muscles stretched out on flight day four and five. Although individual crew responses can vary dramatically, I was also surprised by the neuro-vestibular imbalance I felt upon returning to Earth's gravity after six months on orbit. For the first 24 hours, I felt like the world was spinning around me; as if I were still on orbit, and I thought they should just send me back to the Station. Luckily for me, recovery was relatively quick after that first day.

As a result of a very intensive exercise regime, I lost no overall bone density. This is very promising for us in the development of exercise programs for extended exploration missions to Mars when we will need to have an exercise and/or pharmacologic plan to minimize the impacts of extended periods in microgravity.

We typically train prior to flight for three or more years. Much of that time is spent with crewmates in classroom training and simulations. I consider this a very important time to learn not only about us, but the best way to constructively interact with our crewmates and our ground support teams. The loss of *Columbia* meant that we had to reduce the Station crew size to two. As a result, our crews and ground teams have come up with creative new methods to squeeze in more work and provide better support. Although I had great respect for the work conducted by the ground team even before I flew, I was

surprised by how close I felt to them during my mission. As Mike and John can tell you, the ground crew acts as a “third” crew member for our two person crews by helping them with everything from monitoring the Station to assisting with research.

Safety is something we all take as a fundamental value in how we build and operate the Station. An intensive system safety engineering effort during the development and manufacture of the International Space Station system has mitigated the known hazards presented by living in low earth orbit. For example, we have design features, such as the Micro Meteoroid Orbital Debris (MMOD) shields on the Service Module to reduce the chance that orbital debris will penetrate the Station. In fact, more of these panels will be installed in the future to even further reduce this probability. We have a caution and warning system installed to alert the crew to any impending dangers, such as fire or pressure leaks that may raise the risk of injury, we have emergency equipment on the Station such as fire suppression to reduce the consequence of fire, and we have a “lifeboat,” the Soyuz crew return vehicle, which we can use as a last resort if we have to abandon the Station should the living conditions become untenable. Ground-based and on-orbit safety-related training are a large part of our pre-mission preparation and during the mission. In addition, the ground team also plays a large role in ensuring the safety of the Station and the crew by providing maintenance procedures for both critical as well as non-critical equipment, by providing real-time information and pre-cautions for events like solar flares or by providing feedback on exercise regimes.

Expedition 11 Mission

In April, we sent a new crew to live on the International Space Station. Flight Engineer John Phillips and Station Commander Sergei Krikalev will perform one spacewalk, a number of experiments, and daily maintenance during their six month stay. They will greet two Russian Progress resupply vehicles, including one that arrives this week, and at least one US Space Shuttle flight. They will also relocate their Soyuz spacecraft from the Pirs docking port to the Zarya docking port in order to free up the Pirs airlock to support the spacewalk.

During the spacewalk from the Russian Pirs airlock in September, the crew will relocate and recover Russian science equipment.

Expedition 11 will be on board the Station when Commander Eileen Collins and her six crewmembers launch on the Space Shuttle *Discovery* on the first post-*Columbia* mission. It will mark the first time since the STS-113 mission in November 2002 that a Space Shuttle will arrive at the Station. The two crews plan eight days of joint docked operations, including the resupply of the Station with several tons of food and equipment, as well as three spacewalks out of the Shuttle’s airlock by *Discovery* astronauts.

Expedition 11 Science

Much of the research activities for Expedition 11 will be carried out with scientific facilities and samples already on board the Space Station, as well as with new research facilities transported by the next two Space Shuttle missions. While most equipment and samples can remain on board the Station with minimal or no detrimental effects, a few perishable samples will be returned to Earth on the Soyuz.

The Expedition 11 crew has more than 100 hours scheduled for U.S. payload activities. In addition to the crew on the Station, a team of controllers for Expedition 11 will work in the Space Station's Payload Operations Center – NASA's science command post for the Space Station at NASA's Marshall Space Flight Center in Huntsville, Alabama. Controllers link researchers around the world with their experiments and the crew aboard the Station.

Other experiments to be conducted by Expedition 11 include:

- **Advanced Diagnostic Ultrasound in Microgravity (ADUM):**

Advanced Diagnostic Ultrasound in Microgravity (ADUM) will be used to determine the ability of minimally trained Station crewmembers to perform advanced ultrasound examinations after using a computer-based training program. Verification of these advanced ultrasound techniques and telemedicine strategies could have widespread applications in emergency and rural care situations on Earth. The ADUM experiment, which uses remote guidance methodologies, has been conducted during Expeditions 8, 9 and 10 and is scheduled for completion with the Increment 11 crew.

- **Foot/Ground Reaction Forces During Spaceflight (FOOT):**

FOOT studies the load on the lower body and muscle activity in crewmembers while working on the Station. Previous portions of this study on earlier increments have provided better understanding of the bone and muscle loss in the lower extremities experienced by astronauts in microgravity. The results of this experiment will help in future space flights, as well as potentially improve our understanding to prevent and treat osteoporosis.

- **Dust and Aerosol Measurement Feasibility Test (DAFT):**

DAFT releases particles in the Space Station atmosphere to test the ability of different equipment to measure the levels of dust and air quality. It will help to improve air quality and fire detection in space.

- **Hand Posture Analyzer (HPA):**

HPA will investigate the performance degradation of the human upper limb muscle-skeletal apparatus and its morphological-functional modifications during long-term exposure to weightlessness and to study the role of gravity in how people reach, grasp, manipulate, and transport objects.

- **Passive Observatories for Experimental Microbial Systems (POEMS):**

POEMS will study the growth, ecology and performance of diverse assemblages of microorganisms in space. Understanding microbial growth and ecology in a space environment is important for maintaining human health and bioregenerative life support functions.

- **A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft (SWAB):**

SWAB uses genetic techniques for the first time to comprehensively evaluate germs, including pathogens, on board the Space Station, and to study how the germ community changes as spacecrafts visit the Space Station and modules are added. This study will monitor Station modules prior to launch to evaluate sources of new germs and find ways of preventing additional contamination on board spacecraft.

- **Crew Earth Observations (CEO):**

CEO takes advantage of the crew in space to observe and photograph natural and man-made changes on Earth, the photographs record Earth surface changes over time, as well as more fleeting events such as storms, floods, fires, and volcanic eruptions. Together they provide researchers on Earth with vital, continuous images needed to better understand the planet.

Summary

As stated at the beginning of my testimony, using the Station to study human endurance in space and to test new technologies will allow us to prepare for the longer journeys to the Moon, Mars and beyond in support of the Vision for Space Exploration. Thank you for the opportunity to testify today. My fellow witnesses and I look forward to responding to any questions you may have.