NASA sends phones, cells, spores and more to space on last shuttle

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NASA's Ames Research Center will send a variety of life science experiments and technology demonstrations aboard the final space shuttle to better our understanding of how robots can help humans live and work in space and how spaceflight affects the human body, the growth of cells, yeast and plants. Future astronauts on long-term space missions in low-Earth orbit, to asteroids, other planets and beyond will rely on robots and need to understand how to prevent illnesses during space travel.

On July 8, space shuttle Atlantis and four NASA astronauts are scheduled to lift off from NASA's Kennedy Space Center in Florida. During the 12-day mission, they will transfer tons of supplies to the International Space Station from the Raffaello multi-purpose logistics module. They also will deliver several experiments developed in collaboration with Ames, including:

Human Exploration Telerobotics-Smartphone will equip small, free-flying satellites called Synchronized Position Hold, Engage, Reorient, Experimental Satellites (SPHERES) with a Samsung Electronics Nexus S™ handset that features Google’s open-source Android™ platform. The experiment, led by Ames researcher DW Wheeler, will use the smartphone-enhanced SPHERES as remotely operated robots to conduct interior surveys and inspections, capture mobile camera images and video, and to study how robots can support future human exploration.

Space Tissue Loss experiments will study how wounds heal in space.

Eduardo Almeida, a scientist at Ames, will examine how stem cells differentiate to regenerate epidermal tissues in microgravity. The experiments will use Cell Culture Module (CCM) hardware on the Shuttle Middeck as developed by Tissue Genesis Inc., to grow cells and tissues in space using an automated hollow fiber cell culture system. This experiment will help scientists understand how to treat wounds during long-duration space missions and in extreme environments on Earth. Rasha Hammamieh at the U.S. Army Medical Research and Materiel Command and Joon Paek, an investigator funded by the Telemedicine and Advanced Technology Research Center of Fort Detrick, Md., also are conducting tissue engineering experiments using the CCM for the Department of Defense (DoD). Space Tissue Loss is a DoD payload integrated by the DoD's Space Test Program.

Commercial Biomedical Test Module-3 experiment will study whether a new drug treatment could prevent bone loss in mice living in space. Astronauts experience bone loss after spending prolonged time in space; humans on Earth experience similar problems, due to aging, disease, injury or inactivity. This work will enhance interventions that prevent bone degeneration due to microgravity exposure, an various other conditions. This collaborative experiment is supported by Ames, BioServe Space Technologies, the University of Colorado, Boulder, and Amgen Inc., Thousand Oaks, Calif., and marks the 26th time the Ames-developed Animal Enclosure Module will be flown aboard a space shuttle. BioServe will manage the overall mission and integrate experiments led by Ted Bateman of the University of North Carolina; Virginia Ferguson of the University of Colorado and a team of Amgen researchers. The NASA Ames-sponsored principal investigators include Mary Bouxsein of the Beth Israel Deaconess Medical Center, Boston, Mass., and Harvard Medical School, Boston, and Ronald J. Midura of Cleveland Clinic. Other researchers will be involved in a specimen sharing program to maximize the mission's science return.

Micro-2A experiment will study how microgravity changes the way microbes grow on surfaces enabling scientists to develop new strategies to combat their formation and reduce the impact on crew health and spacecraft operations. The growth of microbes on surfaces, called biofilms, has become an issue on spacecraft and a health concern for astronauts. On Earth, biofilms contaminate medical devices and corrode industrial work places. In collaboration with Ames, the University of Toronto, and Bioserve Space Technologies, the study, led by Cynthia Collins of Rensselaer Polytechnic Institute, Troy, N.Y., will help scientists expand their knowledge of biofilms and test the efficiency of new antimicrobial coatings.

Micro-4 study uses special genetically engineered yeast cells to understand how they physically respond and adapt to the effects of microgravity and determine which strains are best suited to survive spaceflight. The results of this study will allow researchers to better understand the genes that play a role in the growth and reproduction of microbes while in microgravity. Researchers also will learn the effects of microgravity on living systems and in life-based support systems for long-term human habitation in space. This experiment is supported by Ames, BioServe Space Technologies. Timothy Hammond of the Durham Veterans Affairs Medical Center, Durham, N.C., is the principal investigator.

Plant Signaling will study the molecular responses of plants to the space environment. The microgravity environment of space causes plants to grow differently than on Earth. Plants sense the difference in gravity and generate chemical responses within the cells. A collaboration between NASA and the European Space Agency, the experiment will use the Ames-developed Seed Cassettes within the European Modular Cultivation System. As the plants grow, images will be captured and down-linked to Earth. Samples of the plants will be harvested and returned to Earth for analysis. Scientists expect the results of this experiment could help produce food during future long-duration space missions in addition to enhancing crop production on Earth. Scientists also hope to develop supplemental methods to recycle carbon dioxide into breathable oxygen. This experiment is supported by Ames, and Imara Perera of North Carolina State University, Raleigh, is the principal investigator.

Ultrasound-2 is a cardiovascular ultrasound system to replace and upgrade a 10-year-old unit on the station that stopped operating earlier this year. The device provides images of internal organs and muscles and will be used to assess astronauts' health. It also will be used in NASA investigations, such as Integrated Cardiovascular, which studies the weakening of heart muscles associated with long-duration spaceflight, and the Integrated Resistance and Aerobic Training Study, which looks at high-intensity, low-volume exercise training to minimize loss of muscle, bone and cardiovascular performance in astronauts. Ultrasound-2 uses devices similar to those used in medical care on Earth, including the commercially-developed General Electric Medical Systems, Vivid-q that was modified and tested by Ames for spaceflight, as well as a custom-built external video/power converter assembly developed at NASA's Johnson Space Center, Houston. This system is part of the ISS Medical Project in NASA’s Human Research Program.

Forward Osmosis Bag (FOB) system is designed to convert dirty water into a liquid that is safe for astronauts to drink, using a semi-permeable membrane and a concentrated sugar solution. Forward osmosis is the natural diffusion of water through a semi-permeable membrane. The membrane acts as a barrier that allows small molecules, such as water, to pass through, while blocking larger molecules like salts, sugars, starches, proteins, viruses, bacteria and parasites. The FOB experiment will study the performance of a forward osmosis membrane during spaceflight. Michael Flynn, a researcher at Ames, developed this technology, and scientists at NASA's Kennedy Space Center in Florida will conduct the flight experiment. A small forward osmosis device could be incorporated into new long-exposure EVA suits in order to recycle metabolic wastewater (i.e., sweat and urine) into drinkable fluid.

The International Space Station Research Project Office and Space Biosciences Division at Ames collaboratively developed these experiments. The experiments are funded by the Human Exploration and Operations Mission Directorate at NASA Headquarters, Washington.

Provided by JPL/NASA

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