# Final space shuttle to carry five CU-Boulder-built payloads

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CU-Boulder aerospace engineering sciences graduate student Christine Fanchiang shown with BioServe Space Technologies hardware, including a Commercial Generic Bioprocessing Apparatus and a cylindrical, fluid-processing device known as a GAP that will be used for experiments in low gravity aboard the final space shuttle flight, Atlantis, now slated for launch July 8. Credit: Patrick Campbell/University of Colorado

The University of Colorado Boulder is involved with five different space science payloads ranging from antibody tests that may lead to new bone-loss treatments to an experiment to improve vaccine effectiveness for combating salmonella when Atlantis thunders skyward July 8 on the last of NASA's 135 space shuttle missions.

One experiment, sponsored by the global pharmaceutical companies Amgen and UCB, will test an antibody to sclerostin -- a protein that has a negative effect on bone formation, mass and strength -- on lab mice flying on the shuttle. Researchers on the project hope the sclerostin antibody treatment will inhibit the action of sclerostin.

The research team hopes the findings may lead to potential therapeutic treatments for astronauts, who suffer significant bone loss during spaceflight, especially on long-term missions. They also might provide insight for future research in the prevention and treatment of skeletal fragility that may be caused by stroke, cerebral palsy, muscular dystrophy, spinal cord injury and reduced physical activity. Amgen is headquartered in Thousand Oaks, Calif., while UCB is headquartered in Brussels, Belgium.

There are seven co-principal investigators on the sclerostin antibody experiment, including Louis Stodieck, director of CU-Boulder's BioServe Space Technologies and a faculty member in the aerospace engineering sciences department. The research team includes a second CU-Boulder co-principal investigator, Assistant Professor Virginia Ferguson of mechanical engineering, an expert in biomaterials, including bone.

A second payload, called the Recombinant Attenuated Salmonella Vaccine, or RASV, will allow scientists to search for novel gene targets for vaccine development and improvement using the low gravity of space. The principal investigator on the experiment is Associate Professor Cheryl Nickerson of Arizona State University.

The RASV experiment will be carried aboard Atlantis in sets of specially designed fluid-processing cylinders built by BioServe known as GAPs, said Stodieck. Each GAP holds eight test-tube-like devices that allow Salmonella and growth media to be mixed in space. Astronauts will operate the experiments using hand cranks to first trigger cell growth via fluid mixing and later to terminate it.

A third payload will allow researchers to examine genetic alterations spurred by cellular changes in yeast. Since some cells have been shown to undergo significant changes in microgravity -- like producing larger quantities of rare antibiotics or making large amounts of bioactive medicinal proteins -- the team will analyze 6,000 different genetically altered yeast strains aboard the payload to identify specific genes that are linked to such space-based changes. This knowledge could someday help efforts to produce new and better medicines, said Stodieck.

Led by Timothy Hammond of the Veteran's Administration in Washington, D.C., the payload will be flown inside two types of BioServe flight hardware known as an opticell processing module and a plate habitat that rides inside a BioServe Generic Bioprocessing Apparatus, or CGBA. The CGBA is an automated, suitcase-sized device developed by CU-Boulder that has been launched on more than 20 NASA space shuttle missions and which provides steady temperature control. There currently are two BioServe CGBA devices on the International Space Station, one of which will be used for processing the yeast experiment at an elevated temperature.

A fourth payload involving biofilms may help scientists understand how and why slimy and troublesome clumps of microorganisms flourish in the low-gravity conditions of space. The experiments on biofilms -- clusters of microorganisms that adhere to each other or to various surfaces -- are of high interest to space scientists because of their potential impacts on astronaut and spacecraft health, said Stodieck.

Led by Professor Cynthia Collins of Rensselaer Polytechnic Institute in Troy, N.Y., the biofilm experiment riding inside a second BioServe CGBA will target the growth, physiology and cell-to-cell interactions in microbial biofilms. The team will examine how the formation of the three-dimensional structure of biofilms formed by microbes differs in spaceflight versus normal gravity.

A fifth payload will be used to assess the effects of microgravity on the formation, establishment and multiplication of cells in a tropical plant known as Jatropha that produces energy-rich nuts, a popular new renewable crop for biofuels. The team will be looking for genes that help or hinder Jatropha growth to see if new strains can be developed and commercially grown in "warm-temperate" areas like the southern United States. The lead scientist on the experiment is Associate Professor Wagner Vendrame of the University of Florida.

BioServe is a nonprofit, NASA-supported center founded in 1987 at CU-Boulder to develop new or improved products through space life science research in partnership with industry, academia and government. Since 1991 BioServe has flown payloads on 37 NASA space shuttle microgravity missions.

Although NASA's space shuttle program will be shuttered following the Atlantis mission, hardware and experiments developed by BioServe are manifested on various international resupply vehicles traveling to the International Space Station, as well as on U.S. spacecraft now under development, said Stodieck.

"We would be unable to carry out all of our research without the help of CU-Boulder students," he said. "Both undergraduate and graduate students play an important role in designing, building and testing spaceflight payloads, activities that can give them a significant advantage when they move on to careers in the aerospace industry."

BioServe also has flown several K-12 educational experiments on the space station, including seed-germination studies, spider web-weaving experiments, butterfly life cycle experiments and crystal garden growth experiments -- all of which have provided learning opportunities for thousands of middle school and high school students around the world. The K-12 efforts have been led by Stefanie Countryman, BioServe's business manager and coordinator of education outreach.

**More information:**
www.colorado.edu/engineering/BioServe/index.html

Provided by University of Colorado at Boulder