Three Payloads Built By CU-Boulder Set For Launch On Space Shuttle Atlantis

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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 microorganism experiments in low gravity aboard the final flight of Atlantis. (Photo by Patrick Campbell/University of Colorado)

(PhysOrg.com) -- NASA's space shuttle Atlantis will make its final flight May 14 carrying three University of Colorado at Boulder-built biomedical payload devices, including one to 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 CU-Boulder's Louis Stodieck, director of BioServe Space Technologies in the aerospace engineering sciences department. Their growth, for example, occurred in water purification and environmental controls systems on Russia's Mir Space Station and was of regular concern.

Led by Professor Cynthia Collins of Rensselaer Polytechnic Institute in Troy, N.Y., and managed by NASA's Ames Research Center in Moffet Field, Calif., the experiments 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.

Because astronauts show decreases in their immune systems during spaceflight, researchers would like to know more about how bacteria behave in space, including their apparent increase in virulence and resistance to antibiotics, said Stodieck. Such experiments have implications for astronauts on long-term space travel flight to places like the moon, Mars and beyond.

The experiments will be carried aboard Atlantis in sets of specially designed fluid-processing apparatuses known as GAPs designed and built by BioServe, said Stodieck. Atlantis astronauts will control the individual GAP experiments using hand cranks to trigger and then later terminate cell growth via fluid mixing. The samples will be returned to Earth at the end of the mission for further study.

The GAPs will ride inside BioServe's Commercial Generic Bioprocessing Apparatus, an automated, suitcase-sized device developed at CU-Boulder that has been launched on more than a dozen NASA space shuttle missions, with two of the CGBA devices now on the International Space Station. BioServe is providing the hardware,

integration and operations support for all Atlantis GAP experiments.

A second experiment using BioServe hardware, sponsored by Astrogenetix, Inc. headquartered in Austin, Tex., and designed by researchers at the Durham VA Medical Center in North Carolina will analyze changes in virulence of two particularly nasty strains of bacteria in the low gravity of space. One, Salmonella, can cause illness and death to humans by tainting food or water. The second, Staphylococcus, can cause a variety of infections, including Methicillin-resistant Staphylococcus aureus or MRSA -- a growing problem in hospitals and health clinics -- because of its ability to resist antibiotics in the penicillin class of drugs.

"Water quality, food safety and disease are age-old problems on Earth," said Stodieck. Not only do these experiments have applications for keeping crew members safe by helping scientists better understand gene and protein changes in pathogens, they also could help researchers find new ways to prevent and control infectious disease."

A third experiment designed by the University of Florida will use BioServe hardware to study cell cultivation in a tropical plant known as Jatropha that produces energy-rich nuts, a popular new renewable crop for biofuels. The researchers will be looking for genes that help or hinder growth in tropical plant species to see if it could be commercially grown in "warm-temperate" areas like the southern United States.

After the launch of Atlantis, the shuttle program has two scheduled flights remaining -- Discovery September and Endeavour in November -- before the fleet is retired. Stodieck said hardware and experiments built by BioServe are manifested on both missions as well as on future resupply vehicles traveling to the International Space Station from other countries. BioServe also has plans to fly hardware and experiments in micro-gravity on existing commercial rockets and on space vehicles now

under development, Stodieck said.

"It's been quite an era for the space shuttle program," said Stodieck. "But I fully expect we will continue to do research on the International Space Station - it will just require an adjustment in space vehicles."

Both undergraduate and graduate students play a role in designing, building and testing spaceflight payloads, said Stodieck. Master's student Christine Fanchiang, who has helped to test the payloads, will be at Cape Kennedy, Fla., for the launch.

"I had heard there were astronauts on the CU faculty, and then I found out that I could actually work with real spaceflight hardware at BioServe," Fanchiang said. "I plan on getting my doctorate here in aerospace engineering, and who knows -- maybe someday I can help to design and build lunar outposts."

BioServe also has flown several K-12 educational experiments on ISS, including seed-germination studies, crystal garden growth experiments and the life cycles of butterflies -- all of which have provided learning opportunities for middle school and high school students around the world, said Stefanie Countryman. Countryman is BioServe's business manager and coordinator of education outreach.

BioServe is a nonprofit, NASA-funded 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 35 space shuttle microgravity missions.

Provided by University of Colorado at Boulder