High-tech CU-Boulder hardware to support experiments launching to space station

December 11 2014

High-tech hardware designed and built by CU-Boulder will be used on the International Space Station to probe the virulence of bacteria in microgravity. Credit: SpaceX

The University of Colorado Boulder will fly state-of-the-art hardware on the commercial SpaceX Dragon spacecraft launching to the International Space Station (ISS) Dec. 19 to support experiments designed to better understand why the virulence of some pathogens increases in the low

gravity of space.

The hardware, developed by BioServe Space Technologies headquartered in CU-Boulder's aerospace engineering sciences department, includes devices to assess the ability of salmonella bacteria to infect a tiny nematode host organism. Learning more about the virulence of pathogens in microgravity has implications for the health of both astronauts and people on Earth, said BioServe Director Louis Stodieck.

The BioServe hardware flying on the SpaceX-5 mission includes high-tech petri dishes known as BioCells stocked with populations of the nematode C. elegans that will be infected on orbit with salmonella, which can cause food poisoning and blood disorders in humans on Earth. Nearly microscopic, the nematode is a favorite lab organism of researchers since it is fast growing, translucent and has a sequenced genome showing that nearly half its genes are closely related to human genes.

By conducting experiments in microgravity, scientists can learn more about biochemical changes in cells and organisms that the force of gravity on Earth may be masking, said Stodieck. "Studying the increased virulence of salmonella in space may allow researchers to tease apart the cellular and molecular mechanisms at work."

While BioCells have been flown on several previous SpaceX resupply missions to ISS, this will be the first time they will be set up in a six-well configuration similar to multi-well devices commonly used in labs on Earth, said Stodieck. Sponsored by NASA Ames Research Center in Moffett Field, California, the pathogen experiment was designed by Professor Cheryl Nickerson of Arizona State University.

As a way to provide on-orbit results for the researchers, BioServe built a

new automated camera system known as ScanCam that will make its debut on the SpaceX-5 mission. Each three-axis system will move an HD camera to a preset list of points over each six-well BioCell, recording video of how infected nematodes behave in space.

Videos taken by the ScanCams will be processed by operating systems in two automated, suitcase-sized Commercial Generic Bioprocessing Apparatus (CGBA) built by BioServe—one launching on the Dragon spacecraft Dec. 19 and one already on ISS. The videos will then be downlinked to BioServe's Payload Operations Control Center on the CU-Boulder campus and placed on a computer server that can be accessed by Nickerson and her science team, Stodieck said.

"This will allow researchers to determine the 'death curve' of the infected nematodes and compare it with identical experiments being conducted on Earth," Stodieck said.

Previous studies on ISS involving Nickerson and BioServe that documented increased virulence of salmonella have included preserving samples on orbit and returning them to Earth for study, which involved significant lag time and re-exposure to gravity. "This study extends those results by allowing researchers to evaluate salmonella virulence in space," said Stodieck.

SpaceX was founded in 2002 by entrepreneur Elon Musk to manufacture and launch rockets and spacecraft. SpaceX is the only commercial company with the capability to dock spacecraft with ISS and return them to Earth—in this case, splashdown occurs in the Pacific Ocean off Baja, California. "We have a very good working relationship with SpaceX and hope to continue and expand our partnership," said Stodieck.

The Dragon will be launched on a Falcon 9 rocket from Cape Canaveral, Florida, the fifth Falcon 9 launch to ISS by SpaceX. BioServe has flown

hardware and experiments on all previous Falcon 9 flights to the space station said Stodieck, a faculty member in aerospace engineering sciences. For the first time, SpaceX will attempt to land the first stage of the Falcon 9 rocket upright on a football-field sized floating barge in the Atlantic Ocean after it propels the Dragon spacecraft toward orbit.

In the past 25 years BioServe has designed, built and flown research experiments on more than 45 space missions. BioServe has a full suite of space flight hardware, both on ISS and on the ground, which supports its own research as well as research conducted by customers and partners, said BioServe Business Development Manager and Education Program Director Stefanie Countryman.

BioServe partners include large and small pharmaceutical and biotechnology companies, universities and NASA-funded researchers. Both undergraduate and graduate CU-Boulder students are involved in BioServe research efforts.

"It certainly was a transition for us, moving from NASA space shuttles to commercial space vehicles," said Stodieck. "There are a lot of new constraints and challenges, but we are adapting to those and learning how to keep good science going."

Provided by University of Colorado at Boulder