NASA Awards UVM $1.5 Million in Research Funding

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The National Aeronautics Space Administration (NASA) has awarded $1.5 million in research grants to two research groups based in the University of Vermont's College of Engineering and Mathematical Sciences (CEMS) to study topics that are NASA research priorities. Each research group has been awarded $750,000 over three years, beginning Sept. 1. William D. Lakin of CEMS, project director for Vermont's NASA EPSCoR Program and director of the Vermont Space Grant Consortium (VTSGC), is the principal investigator for both awards. CEMS is the home unit for both VT-NASA EPSCoR and the VTSGC.

"The University of Vermont is proud to have NASA grant support for these exciting research endeavors, which represent incredible innovation on the part of our faculty in CEMS," says Interim Dean Bernard "Chip" Cole. "These research collaborations will not only advance our abilities in space, but they will improve life here on Earth as well."

Research on orbital propulsion and control of "nanosats"

Professor Darren Hitt of the UVM School of Engineering (SoE) will lead a team of UVM engineers performing research involving orbital micropropulsion and control of very small spacecraft known as "nanosats". Researchers in this group also include Professors George Pinder, Dryver Huston, and Walter Varhue, all within the SoE.

Hitt's research is driven by the need to perform extremely precise orbital maneuvers and station keeping with next-generation miniaturized spacecraft weighing 20 lbs or less and being no larger than bucket. The team will engage in a number of synergistic projects, including: design a prototype microfluidic system capable of delivering monopropellant fuel in the form of discrete "micro-slugs"; design and optimization of a micro-scale catalytic chamber utilizing self-assembled catalytic nanostructures to chemically decompose a hydrogen peroxide monopropellant; and the development of a prototype MEMS-based vibrating mass gyroscope for satellite attitude control. This grant will also annually support a Senior Design Team of students from Vermont Technical College, who will partner with UVM.

Bacterial stowaways affect health of space travelers

A team led by Jane Hill in collaboration with Britt Holmén (both professors in CEMS) and researchers from the College of Medicine, including professors Matthew Poynter, Daniel Weiss, Laurie Whittaker and Matthew Wargo, will study the transmission of illnesses and immune system responses in the closed environment of a long-duration space mission. This collaboration amongst experts from multiple disciplines is a valuable component of the interactive nature of the UVM research community that is required to rigorously test the hypothesis that microgravity-grown bacteria will affect lung epithelial cells in a manner distinct from bacteria grown under conventional conditions. With manned long-term space travel becoming an important component of NASA's directives, understanding the impact of opportunistic bacterial pathogens on astronaut health is critical to the feasibility of future voyages. "We don't know how lung epithelial cells will respond to microgravity-grown bacteria; the immune response could be inadequate to properly control the infection or it could be so robust that the astronaut suffers collateral damage of a magnitude sufficient to compromise the mission," Poynter said.

The team's research studies the impact of simulated microgravity on the pathogenicity of bacteria. When grown in space, pathogenic bacteria such as *Salmonella typhimurium* express more virulence genes. Space-grown bacteria become more able to invade and infect a human or other host. The immune system of astronauts is already suppressed by the rigors of spaceflight and zero gravity, so encountering bacteria that are more infectious could pose a serious health problem for long-term missions such as maintaining outposts on the moon or a trip to Mars.

The team of basic science and translational researchers will grow pathogens common to people in a device that simulates zero gravity and investigate their virulence directly as well as via the impact of these bacteria on human lung cells. The science will incorporate new mass spectrometry technology being advanced in the Hill lab to detect the presence and metabolic activity of the bacteria as well as molecular and immunological tools in the College of Medicine research labs to measure the response of the bacteria and lung epithelial cells. The research team will also work with the Fairbanks Museum and Planetarium to engage the public in space-related science.

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