Strategies for Conducting Life Science Experiments Beyond Low Earth Orbit

Ronald L. Schaefer[1], Ingrid Rudolph-Angelich[1], Richard Mains[2], Darren Hughes[2], Lynn D. Harper[3], Gregory Leonard[2], and Gregory K. Schmidt[3].

1) Lockheed Martin Space Operations, Ames Research Center, Moffett Field, CA
2) Mains Associates, Berkeley, CA
3) National Aeronautics and Space Administration, NASA-Ames Research Center, Moffett Field, CA

Human exploration beyond low Earth orbit will require terrestrial life to survive and ultimately flourish in environments fundamentally different to those in which it has evolved. The effects of deep space and conditions on the surface of other planets must be studied to understand and reduce the risks to explorers, provide bioregenerative life support, and make full use of the broad research opportunities and scientific benefits offered by such unique environments. Though much is already known about biological adaptations to the space environment, key changes in terrestrial life may only be revealed over complete life cycles and across multiple generations living beyond Earth. The demands and potential risks of exploring and inhabiting other worlds necessitate a detailed understanding of these changes at all levels of biological organization, from genetic alterations to impacts on critical elements of reproduction, development, and aging. Results from experiments conducted beyond low Earth orbit will contribute to the safety of space exploration and address fundamental questions of life's potential beyond its planet of origin. Research campaigns will include a combination of core studies and innovative, PI-driven investigations. Multiple flight platforms—including free flyers and planetary bases—may support a range of manned and unmanned mission opportunities.