A Novel Information Management Architecture for Maintaining LongDuration Space Crews

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A key factor limiting long-duration space flight is the inability to maintain the crew effectively in weightlessness. Current approaches to crew preservation involve discrete experiments to measure physiologic adaptation and post flight evaluations to assess the effectiveness of countermeasures. As the length and complexity of missions increase, these approaches will be inadequate. A revolutionary new approach is needed, where crewmembers have automated, continuous, unobtrusive, and accurate monitoring of their physiology so they can maintain themselves in space. Suitable future crew maintenance systems will require complex, automated information retrieval, monitoring, and analysis. These systems will also need to be robust and flexible enough to operate in the distributed, information intensive, bandwidth limited environment characteristic of space flight. Creating such systems will be a major challenge for the National Aeronautics and Space Administration (NASA).

We propose a revolutionary approach to automating onboard information management that could be used for many applications during future long-duration space flights. We outline a feasibility study where mobile agents, an emerging software technology, would be used to demonstrate this new architecture for onboard and spacecraft-to-Earth-based information processing, monitoring and analysis applications. The study will focus on design and implementation requirements related to crew maintenance systems for long duration space flights. The problem of bone loss will be the test case for the Phase I study, although the approach is generally applicable to other critical issues such as radiation exposure, psychosocial adaptation and medical care.

To execute the proposed research, we have assembled a multidisciplinary team with extensive and unique experience in mobile agent systems research and development and space flight. Dartmouth College has developed a mobile agent system that is used internationally for multi-language mobile agent system development. Co-Investigator Jay Buckey, Jr. M.D., a former Payload Specialist Astronaut, will provide critical insight into the domain and life science requirements of long-duration space flight.