The HOME Space Technology Research Institute for Deep Space Habitat Design
Habitats Optimized for Missions of Exploration (HOME)

Vision Statement The HOME research team integrates proven engineering, groundbreaking research, and diverse team-member expertise in systems automation, machine learning, artificial intelligence, predictive analytics, robotics, and human-crewed spacecraft design to develop new paradigms for the design of NASA's deep-space habitats.

Research Objectives

1. Develop Design Reference Mission functional-driven requirements and concepts of operation to serve as a context for autonomous system technology research.
2. Design evolvable sensor systems and data-driven analytics to assess, model, and predict system and infrastructure state, performance, and maintenance needs.
3. Develop and test methods to autonomously maintain spacecraft, utilizing subsystem redundancy, engineered graceful degradation, and robotic repair, with intermittent human assistance/supervision.
4. Develop novel interfaces, training, and performance measures for teaming of the SmartHabcrew and the onboard robotics and autonomous systems to take maximum advantage of humans' capabilities when they are resident.

Approach - Four research Thrusts

1. Vehicle Functional Design: Functionally-driven spacecraft design and operational principles for self-reliant spacecraft with intermittent human habitation.
2. Spacecraft Self-Awareness: Integrated predictive and prescriptive analytic methodology.
3. Decision-Making & Interfaces: Enable safe and timely decisions made by both humans and autonomous systems.
4. Self-Sufficiency: Design, development and demonstration of techniques and technologies for active intervention, to ensure the long term functioning and survivability of the habitat.

These Research Thrusts are pursued via a series of projects and technical evaluations, culminating in a capstone technical demonstration in a new spaceflight analog at UC Davis.

Team - Key Personnel and Organizations

Director/Co-PI *Dr. Stephen Robinson (UC Davis)*
Executive Advisor/Co-PI *Dr. Bobby Braun (CU Boulder)*
Deputy Director/Co-I *Dr. David Klaus (CU Boulder)*

University of California, Davis
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Howard University
Hazel Edwards
University of Southern California
Garrett Reisman
Texas A&M
Alaa Elwany

Benefits - Potential Impact

1. The deliverables of the HOME STRI research will lead to highly autonomous, self-aware, resilient deep-space habitats for human exploration of space
2. Enable improvements in crew safety and spacecraft resilience to reach practical criteria for developing vehicle and subsystemdesign requirements
3. Reduced risk through research and testing of integrating new technology for large-sensor systems, data analytics that learn, predict, and correct, and decision methodologies to optimize logistics, resupply, and maintenance
4. Significant technology spinoff to benefit Earth-based smart structures, robotic/human teaming, sensor/data systems, and autonomous vehicles
5. Diverse, well-educated student pipeline to the aerospace industry