UC DAVIS
MECHANICAL AND AEROSPACE ENGINEERING

MAE 298 – Bioastronautics

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Human spaceflight presents unique challenges from an engineering and physiological perspective. With the rise of commercial spaceflight providers such as SpaceX and Blue Origin, this unique field is rapidly growing and changing. Hazards due to the space environment and microgravity can include bone loss, muscle atrophy, sensory-motor deconditioning, and cardiovascular adaptation. In addition, psychological issues, fatigue, lack of training, and overreliance on automation can also affect human performance. Astronauts need to accomplish challenging tasks and a small error could have catastrophic consequences – an issue only exacerbated by the necessity of increased autonomy in future long duration exploration missions. This class will serve as an introduction to the field of bioastronautics: the intersection of engineering, science, medicine, and operations to support humans in space.

Astronaut and UC Davis Professor Stephen Robinson rides Canadarm 2 during the STS-114 mission of the Space Shuttle Discovery to the ISS in August 2005.

Learning Objectives

By the end of this course, students will:

- Be familiar with current and future human spaceflight systems, spaceflight technologies and mission architectures.
- Be familiar with the major human risks in the current space program, and the principal countermeasures in place.
- Use analytical techniques to model and understand physiological changes in space (bone, muscle, cardiovascular, etc.) using a mathematical approach.
- Get exposure to computer programs such as OpenSim (musculoskeletal modeling, currently used at NASA) and CVSim (cardiovascular modeling).
- Understand requirements for Extra-Vehicular Activities (EVA) and Life Support Systems.
- Be exposed to aerospace human factors aspects, such as psychological issues due to isolation, high workload, fatigue, training, and use of automation.
- Be familiar and use basic statistics and design of experiments focused on human research.
- Read, understand, and critique professional journal papers in space biomedical engineering and human performance.