

Exercise Vibration Isolation on Spacecraft



Name of Technology:

Exercise Vibration Isolation System

Participating NASA Centers:

GRC (Lead); JSC

Technological Area:

X11.01Crew Exercise System

Vision for the Technology:

Space missions require crew to perform exercise due to muscle strength and bone density losses. Exercise systems need countermeasures against vibration that can be transmitted throughout the space vehicle. An exercise countermeasures systems need to be housed in vibration isolation systems (VIS) to prevent vibration transmission.

Challenges:

Presently, the VIS on International Space Station (ISS) provides acceptable vibration damping for exercise equipment that support a single exercise system. Exploration mission will

require VIS systems to protect the vehicle and provide sufficient stabilization for the exerciser during performance of all critical exercises.

The ISS VIS requires ~550 kg of passive counter-inertia and structure, which is unacceptable for exploration space vehicles. These enabling capabilities need to be achieved within exploration vehicle power, thermal, mass, and volume limitations.

If a VIS is not developed, the crew will be unable to perform the necessary exercises to maintain crew health. Also, the space vehicle would be at risk due to excessive vibration that could affect other systems, such as solar panel and radiator structural life.

NASA Seeks to Meet the Following Specs:

Success will be determined by:

- 95% of the modeled exercise data (as measured by loads and dynamics analyses) meeting the standard for vehicle loads
- VIS mass of < 20 lbs.

Overview of Student Project:

NASA seeks an innovative exercise vibration isolation system (VIS) that is compact and lightweight that meets NASA's goals. The technology is needed to prevent vibration from transmitting throughout the space vehicle causing damage to other critical system.

Innovative Areas Student Projects Can Address:

- Develop a lightweight, compact exercise vibration isolation system (VIS) for crew cardio and weightlifting workouts.
- Develop an alternative workout system that prevents vibration throughout the spacecraft.

Project Phases

- I. Conceptual and feasibility study with characteristics
- II. Proof of Concept/Prototype in lab environment

Research Funded by NASA on this Topic:

Proposal Number: 12.05-8148
[Vibration Isolation of Exercise Treadmill in Microgravity](#)

Proposal Number: B3.05-9207
[Gyroscopic Resistive Exercise Technology](#)

Proposal Number: 11-1 X12.02-8627
[EXERCISE LOAD MEASUREMENT INSOLE \(ELMI\)](#)

Proposal Number: 00-1 10.03-8523
[A Constant Force Resistive Exercise Unit](#)

Proposal Number: 08-2 X9.01-9771
[Compact, Controlled Force Crew Exercise System](#)

References:

[X11.01 Crew Exercise System](#)

[X11.02 Human Health Countermeasures](#)

[H12.01 Exploration Countermeasure Capability - Portable Activity Monitoring System](#)