Advanced Exercise Concepts for Exploration

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Challenge
Current exercise countermeasure equipment used on the International Space Station will not be suitable for future exploration missions because of unprecedented limitations in mass, volume, and available power.

Charter
NASA’s Human Health Countermeasures Element is tasked to provide guidance to groups external to NASA’s Human Research Program (HRP) in the development of advanced exercise concepts. Currently, there are many design reference missions being considered, which include the possibility of both short- and long-duration missions. It is the goal of HRP to build a portfolio of potential technologies to meet the crew health requirements of these missions.

Requirements
The exercise device requirements have been constructed using years of NASA ground and International Space Station exercise and human physiological data and are meaningful within the context of microgravity human health maintenance. Even with that experience, this effort is in its early stages, and requirements should be considered preliminary and subject to change if needed based on changing mission and/or scope and as the exercise and performance portfolio gaps are addressed.

Reduced mass, reduced volume, and full functionality are the focus of the device requirements. The goal is not to restrict technology development, but to provide a useful guide for developers to work toward and provide consistent design criteria across development efforts.

Requirements consist of general device requirements, resistive requirements, and aerobic requirements.

The general device requirements encompass the physical requirements needed for an exercise device to fly on an exploration mission. These requirements include mass, stowage volume, operational volume, stowage and setup times, and lifecycle requirements, among others.

The resistive requirements address the need for the exercise device to allow for resistive workout mechanisms. These requirements address specific exercises that need to be achieved (i.e., squats, heel raises, and dead lifts), maximum force requirements, and adjustability, among others.

The aerobic requirements cover specific needs the exercise device needs to fulfill that are related to an aerobic workout. These requirements include minimum aerobic work rates, setup and adjustment times, and power generation, among others.

References
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