OVERVIEW OF THE EXPLORATION EXERCISE DEVICE VALIDATION STUDY PLANS

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INTRODUCTION

The NASA has determined that a multi-functional exercise device will be developed for use as an exercise device during exploration missions. The device will allow for full body resistance and metabolic exercise necessary to minimize physiological losses during space flight and to maintain fitness necessary to perform critical mission tasks. Prior to implementation as an exercise device on an Exploration vehicle, there will be verification and validation testing completed to determine device efficacy at providing the necessary training stimuli to achieve desired goals.

METHODS

Because the exploration device will be new device that has yet be specified, specific Verification and Validation (V&V) protocols have yet to be developed. Upon delivery of an exploration exercise device training unit, stakeholders throughout NASA will develop V&V plans that include ground-based testing and testing on the International Space Station (ISS). Stakeholders will develop test protocols that include success criterion for the device.

Ground tests will occur at NASA Johnson Space Station prior to flight testing. The intents of the ground tests are to allow crew, spaceflight medicine, science, engineering, Astronaut Strength, Conditioning, and Reconditioning staff, and others to gain experience in the best utilization of the device. The goal is to obtain an evidence base for recommending use of the device on the ISS. The developed protocol will be created to achieve multiple objectives, including determining if the device provides an adequate training stimulus for 5^{th} – 95^{th} percentile males and females, allows for exercise modalities that protect functional capability, and is robust and can withstand extensive human use. Although protocols are yet to be determined, current expectations include use of the device by test subjects and current crew in order to obtain quantitative and qualitative feedback. Information obtained during the ground tests may be used to influence device modifications during design iterations.

Assuming successful ground tests, the device will be installed on the ISS for testing during space flight. Spaceflight testing is envisioned to include an activation and checkout (ACO) phase and a V&V phase. During the ACO phase, 1-2 crewmembers will exercise with the device to ensure proper function. ACO is expected to last multiple months because of the many modes and methods of exercise that need to be assessed. However, the goal is to complete the ACO as quickly as possible. Once successful ACO occurs, the crew will be free to use the device for normal exercise pending concurrence from stakeholders.

V&V tests on the ISS will ideally consist of crew using the device for all of their exercise for an entire mission. Exercise prescriptions will be supplied that replicate expected prescriptions during exploration missions. Crew that are not enrolled in the V&V studies would be also free to use the device as their schedule permits. As experience is gained by users, exercise protocols could change. The intent of all V&V testing is to ensure that all have thorough understanding of experience at optimizing device capability.