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PHYSIOLOGICAL ASSESSMENT OF THE GRAVITY LOADING COUNTERMEASURE SKINSUIT
DURING EXERCISE**Abstract**

Astronauts suffer strong physiological deconditioning in space, due primarily to the microgravity conditions to which they are exposed during spaceflight. Bone loss, muscle atrophy, blood circulation regulation loss, and decreased aerobic capacity are some of the effects of prolonged weightlessness. The Gravity Loading Countermeasure Skinsuit (GLCS) developed by the Massachusetts Institute of Technology provides the wearer a load regime replicating that of gravity on Earth. The skinsuit gradually increases the vertical load from the shoulders to the feet, mimicking the loads imposed on the different parts of the body. Hence, the GLCS, combined with other countermeasures, may reduce physiological deconditioning during long duration spaceflight.

A first prototype of the GLCS was developed and a pilot study conducted under microgravity conditions during a parabolic flight campaign. Some practical aspects of the skinsuit were studied, such as mobility and comfort. Results showed a reasonable suit comfort and negligible impact of mobility.

In order for the GLCS to serve as a countermeasure in future missions, it must not only be effective and comfortable during passive activity, such as already been studied, but also during active periods of intra-vehicular activity such as exercise. Hence, the purpose of this study was to gain a better understanding of the physiological responses to wearing the GLCS during exercise, particularly using a cyclometer in the supine position. Subjects followed an exercise cyclometer protocol while in and out of the skinsuit. Heart rate, VO₂max, respiration chest pressure and rate, and blood pressure were measured in order to assess any physiological differences while exercising in the GLCS. In addition, force plates were mounted on the pedals to record the force in the Gz axis and validate previously measured loads imposed on the feet by the suit. We present the results of these trials as well as qualitative feedback from subjects, and make recommendations as to future uses of the GLCS in flight.