N91-27112

Mechanics, Impact Loads and EMG on the Space Shuttle Treadmill

Final Report

NASA/ASEE Summer Faculty Fellowship Program--1990

Johnson Space Center

TR 341683

Prepared by: William G. Squires Ph.D.
Academic Rank: Professor

University & Department: Dept of Biology Texas Lutheran College

NASA/JSC

Directorate: Space and Life Sciences

Division: Medical Sciences

Branch: SBRI

JSC Colleague: Mike Greensien, Ph. D.

Date Submitted: August 17, 1990

Contract Number: NGT-44-005-803

ABSTRACT

The ability of astronauts to egress the Shuttle, particularly during emergency conditions, is likely to be reduced following physiological adaptations in space.

It is well established that effective application of exercise counter measures requires the exercise be applied specifically. The problem is that objective scientific evidence is not available to validate the space shuttle treadmill with respect to in its role in diminishing the deleterious effects of a prolonged exposure to the microgravity environment.

INTRODUCTION

The purpose of this study is to analyze locomotion and resulting impact loads during treadmill walking and running on orbit during STS missions . This data will be acquired with video motion tracking, force measurement instrumentation and electromyography (EMG) . The data will be used to analyze the gait, to determine impact forces and to determine skeletal muscle responses, during extended O g conditions. These results will be used to determine appropriate exercise countermeasures prescriptions to counteract space adaptations in general and to prepare for the contingency of emergency egress in specific.

This study requires video recording astronaut performance during locomotion in zero g on the space shuttle treadmill mated to a six degrees of freedom force plate while wearing EMG telemetered electrodes

A total of twenty assigned astronauts (n=20) will be requested, five pilots and fifteen mission specialists, to participate in this study. Repeated measures on the same individual are necessary to avoid the large variance associated with comparisons between individuals.

This study will be conducted in three phases.

Phase 1. In the full fuselage trainer , crewmembers will be video recorded while performing locomotion tasks on the instrumented treadmill while wearing EMG telemetered electrodes.

Phase 2. During parabolic flight on the KC 135, crewmembers will be video recorded performing locomotion tasks on the instrumented treadmill while wearing EMG telemetered electrodes.

Phase 3. On orbit, crewmembers will be video recorded while performing locomotion tasks on the instrumented treadmill while wearing EMG telemetered electrodes.

An accurate measurement of the gait patterning, locomotion impact loads and EMG data can provide real data into the system for further exercise countermeasure prescriptions.