

## AEROBIC CAPACITY FOLLOWING LONG DURATION INTERNATIONAL SPACE STATION (ISS) MISSIONS: PRELIMINARY RESULTS

A.D. Moore, Jr.<sup>1</sup>, S.M.C. Lee<sup>1</sup>, M.E. Everett<sup>2</sup>, J.R. Guined<sup>2</sup>, P. Knudsen.<sup>3</sup>

<sup>1</sup>Wyle Laboratories, NASA Johnson Space Center, Houston, TX; <sup>2</sup>University of Houston, Houston, TX; <sup>3</sup>Damec Research Aps, Odense, DK.

**Introduction:** Maximum oxygen uptake ( $\text{VO}_2\text{max}$ ) is reduced immediately following space flights lasting <15 d, but has not been measured following long-duration missions. The purpose of this study is to measure  $\text{VO}_2\text{max}$  and maximum work rate ( $\text{WRmax}$ ) data from astronauts following ISS flights (91 to 188 d). **Methods:** Five astronauts [3 M, 2 F:  $47 \pm 6$  yr,  $174 \pm 6$  cm,  $71.9 \pm 10.9$  kg (mean  $\pm$  SD)] have participated in the study. Subjects performed upright cycle exercise tests to symptom-limited maximum. An initial test was done  $\sim 270$  d before flight to establish work rates for subsequent tests. Subsequent tests, conducted  $\sim 45$  d before flight and repeated on the first or second day (R+1/2) and at  $\sim 10$  d (R+10) following landing, consisted of  $3 \times 5$  min stages designed to elicit 25%, 50%, and 75% of preflight  $\text{VO}_2\text{max}$ , followed by  $25 \text{ W}\cdot\text{min}^{-1}$  increases.  $\text{VO}_2$ , WR, and heart rate (HR) were measured using the ISS Portable Pulmonary Function System [Damec, Odense, DK]. Descriptive statistics are reported. **Results:** On R+1/2 mean  $\text{VO}_2\text{max}$  decreased compared to preflight (Pre:  $2.98 \pm 0.99$ , R+1/2:  $2.63 \pm 0.56 \text{ L}\cdot\text{min}^{-1}$ ); 4 of 5 subjects demonstrated a loss of > 6%.  $\text{WRmax}$  also decreased on R+1/2 compared to preflight (Pre:  $245 \pm 69$ , R+1/2:  $210 \pm 45 \text{ W}$ ). On R+10,  $\text{VO}_2\text{max}$  was  $2.86 \pm 0.62 \text{ L}\cdot\text{min}^{-1}$ , with 2 subjects still demonstrating a loss of > 6% from preflight.  $\text{WRmax}$  on R+10 was  $240 \pm 49 \text{ W}$ .  $\text{HRmax}$  did not change from pre to post-flight. **Conclusions:** These preliminary results, from the first 5 of 12 planned subjects of an ongoing ISS study, suggest that the majority of astronauts will experience a decrease in  $\text{VO}_2\text{max}$  after long-duration space-flight. Interestingly, the two astronauts with the highest preflight  $\text{VO}_2\text{max}$  had the greatest loss on R+1/2, and the astronaut with the lowest preflight  $\text{VO}_2\text{max}$  increased by 13%. Thus, maintenance of  $\text{VO}_2\text{max}$  may be more difficult in astronauts who have a high aerobic capacity, perhaps requiring more intense in-flight exercise countermeasure prescriptions.