

INITIAL SENSORIMOTOR AND CARDIOVASCULAR DATA ACQUIRED FROM SOYUZ LANDINGS: ESTABLISHING A FUNCTIONAL PERFORMANCE RECOVERY TIME CONSTANT

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INTRODUCTION

Testing of crew responses following long-duration flights has not been previously possible until a minimum of +24 hours after landing. As a result, it has not been possible to determine the trend of the early recovery process, nor has it been possible to accurately assess the full impact of the decrements associated with long-duration flight. To overcome these limitations, both the Russian and U.S. programs have implemented joint testing at the Soyuz landing site. This International Space Station research effort has been identified as the functional *Field Test*, and represents data collect on NASA, Russian, European Space Agency, and Japanese Aerospace Exploration Agency crews.

RESEARCH

The primary goal of this research is to determine functional abilities associated with long-duration space flight crews beginning as soon after landing as possible on the day of landing (typically within 1 to 1.5 hrs). This goal has both sensorimotor and cardiovascular elements. To date, a total of 15 subjects have participated in a 'pilot' version of the full 'field test'. The full version of the 'field test' will assess functional sensorimotor measurements included hand/eye coordination, standing from a seated position (sit-to-stand), walking normally without falling, measurement of dynamic visual acuity, discriminating different forces generated with the hands (both strength and ability to judge just noticeable differences of force), standing from a prone position, coordinated walking involving tandem heel-to-toe placement (tested with eyes both closed and open), walking normally while avoiding obstacles of differing heights, and determining postural ataxia while standing (measurement of quiet stance). Sensorimotor performance has been obtained using video records, and data from body worn inertial sensors. The cardiovascular portion of the investigation has measured blood pressure and heart rate during a timed stand test in conjunction with postural ataxia testing (quiet stance sway) as well as cardiovascular responses during sensorimotor testing on all of the above measures. We have also collected motion sickness data associated with each of the postflight tests. When possible rudimentary cerebellar assessment was undertaken. In addition to the immediate post-landing collection of data, postflight data has been acquired twice more within 24 hours after landing and measurements continue until sensorimotor and cardiovascular responses have returned to preflight normative values (approximately 60 days postflight).

SUMMARY

The level of functional deficit observed in the crew tested to date is more severe than expected, clearly triggered by the acquisition of gravity loads immediately after landing when the demands for crew intervention in response to emergency operations will be greatest. Measureable performance parameters such as ability to perform a seat egress, recover from a fall or the ability to see clearly when walking, and related physiologic data (orthostatic responses) are required to provide an evidence base for characterizing programmatic risks and the degree of variability among crewmembers for exploration missions where the crew will be unassisted after landing. Overall, these early functional and related physiologic measurements will allow the estimation of nonlinear sensorimotor and cardiovascular recovery trends that have not been previously captured.