

Human Robotic Partnerships for Exploration (04)

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HUMAN-RATING AUTOMATED AND ROBOTIC SYSTEMS

Abstract

Long duration deep space human exploration missions will not be possible without unprecedented levels of automation to support the human endeavors. Automated and robotic systems must conduct routine “housekeeping” for the new generation of explorers, and assist their exploration science and engineering work with new precision. Automated and robotic systems are sophisticated and sturdy enough to do this work, but the systems themselves have never been human-rated as all other NASA physical systems used in human space flight have.

This paper provides perspective on requirements and architecture for the interfaces and interactions between human beings and the astonishing array of automated systems; and the methods necessary to create human-rated systems and implement them in the space program. The paper explains criteria for assessing automated and robotic systems for human rating, and the process by which those criteria should be evaluated and implemented, integrating Human Factors, Systems Engineering, Intelligent Systems, and many other disciplines.

The paper focuses on development of a distributed (multi-center) laboratory and testbed for development and evaluation of human-rated automated systems. The lab and testbed is also planned as a training facility for both flight crews and mission operations personnel, using high-fidelity simulation based in NASA’s Advanced Supercomputing facility.

The work described in this paper is based on real-world experience with both human system and robotic system designs; for surface operations as well as for in-flight monitoring and control; and on the necessities discovered for human-systems integration by members of NASA’s robotic and human space flight programs. The presentation is intended as an invitation to dialog, and to consideration of a new issue facing new generations of explorers and their outfitters.