Critical Questions for Space Human Factors

Barbara Woolford
Deputy Project Manager
Space Human Factors Engineering
NASA Advanced Human Support Technology Program

Tandi Bagian
Principal Coordinating Scientist
Space Human Factors Engineering
NASA Advanced Human Support Technology Program

Abstract

Traditional human factors contributions to NASA's crewed space programs have been rooted in the classic approaches to quantifying human physical and cognitive capabilities and limitations in the environment of interest, and producing recommendations and standards for the selection or design of mission equipment. Crews then evaluate the interfaces, displays, or equipment, and with the assistance of human factors experts, improvements are made as funds, time, control documentation, and weight allow. We have come a long way from the early spaceflight days, where men with the 'right stuff' were the solution to operating whatever equipment was given to them. The large and diverse Shuttle astronaut corps has impacted mission designs to accommodate a wide range of human capabilities and preferences. Yet with existing long duration experience, we have seen the need to address a different set of dynamics when designing for optimal crew performance: critical equipment and mission situations degrade, and human function changes with mission environment, situation, and duration.

Strategies for quantifying the critical nature of human factors requirements are being worked by NASA. Any exploration-class mission will place new responsibilities on mission designers to provide the crew with the information and resources to accomplish the mission. The current duties of a Mission Control Center to monitor system status, detect degradation or malfunction, and provide a proven solution, will need to be incorporated into on-board systems to allow the crew autonomous decision-making. The current option to resupply and replace mission systems and resources, including both vehicle equipment and human operators, will be removed, so considerations of maintenance, onboard training, and proficiency assessment are critical to providing a self-sufficient crew.

As we 'move in' to the International Space Station, there are tremendous opportunities to investigate our ability to design for autonomous crews. Yet prioritizing the research that can and should be done by NASA will be based on the critical nature of the issues, and the impact of the individual research questions on mission design. The risks to crew health and safety associated with answering critical human factors issues must be properly included and communicated in order to support the Agency's decisions regarding future space programs.