

## **DEVELOPMENTAL TESTING OF HABITABILITY AND HUMAN FACTORS TOOLS AND METHODS DURING NEEMO 15**

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### **BACKGROUND**

Currently, no established methods exist to collect real-time human factors and habitability data while crewmembers are living aboard the International Space Station (ISS), traveling aboard other space vehicles, or living in remote habitats. Currently, human factors and habitability data regarding space vehicles and habitats are acquired at the end of missions during postflight crew debriefs. These debriefs occur weeks or often longer after events have occurred, which forces a significant reliance on incomplete human memory, which is imperfect. Without a means to collect real-time data, small issues may have a cumulative effect and continue to cause crew frustration and inefficiencies. Without timely and appropriate reporting methodologies, issues may be repeated or lost.

### **TOOL DEVELOPMENT AND EVALUATION**

As part of a directed research project (DRP) aiming to develop and validate tools and methods for collecting near real-time human factors and habitability data, a preliminary set of tools and methods was developed. These tools and methods were evaluated during the NASA Extreme Environments Mission Operations (NEEMO) 15 mission in October 2011. Two versions of a software tool were used to collect observational data from NEEMO crewmembers that also used targeted strategies for using video cameras to collect observations.

Space habitability observation reporting tool (SHORT) was created based on a tool previously developed by NASA to capture human factors and habitability issues during spaceflight. SHORT uses a web-based interface that allows users to enter a text description of any observations they wish to report and assign a priority level if changes are needed. In addition to the web-based format, a mobile Apple (iOS) format was implemented, referred to as iSHORT. iSHORT allows users to provide text, audio, photograph, and video data to report observations. iSHORT can be deployed on an iPod Touch, iPhone, or iPad; for NEEMO 15, the app was provided on an iPad2.

Targeted use of video provides a means for crewmembers to report detailed information regarding human factors and habitability concerns. Methods evaluated during NEEMO 15 took advantage of two different compact video cameras that crewmembers were asked to use during certain scenarios. Crewmembers were asked to use a head-worn video camera while they performed specific preplanned tasks, including meal preparation, social media use, and extravehicular activity (EVA) preparation and cleanup. They were also asked to use either the head-worn camera or a compact high definition camera to provide a narrated walkthrough of their habitat. Video was also captured to supplement SHORT reports as appropriate.

Six NEEMO 15 crewmembers were asked to use SHORT or iSHORT on a daily basis, and they were asked to collect video of specified tasks and habitat walkthroughs periodically throughout the mission. After using these tools and methods during the mission, crewmembers completed questionnaires regarding usability and satisfaction with the tools; they also participated in a post-mission debrief with investigators. Although the NEEMO 15 mission was cut short due to the threat of a hurricane, crewmembers were able to use these tools throughout 5 of the originally planned 12 days of analog testing.

### **FINDINGS AND FUTURE WORK**

Investigators are currently examining findings related to compliance with scheduled tool use, quality of information provided in reports, and feedback related to usability and potential improvements to tools and methods. Investigators intend to perform additional developmental testing on the ISS or an additional spaceflight analog to provide a mature set of tools and methods to deploy as part of operations for ISS and long-duration spaceflight missions in the future.