

Fiscal Year:	FY 2012	Task Last Updated:	FY 02/06/2012
PI Name:	Thaxton, Sherry Ph.D.		
Project Title:	Human Factors and Habitability Assessment Tool		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Space Human Factors Engineering		
Joint Agency Name:	TechPort:	Yes	
Human Research Program Elements:	(1) SHFH :Space Human Factors & Habitability (archival in 2017)		
Human Research Program Risks:	(1) HSIA :Risk of Adverse Outcomes Due to Inadequate Human Systems Integration Architecture		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Comments:			
Project Type:	Ground	Solicitation / Funding Source:	Directed Research
Start Date:	04/04/2011	End Date:	10/01/2012
No. of Post Docs:	No. of PhD Degrees:		
No. of PhD Candidates:	No. of Master' Degrees:		
No. of Master's Candidates:	No. of Bachelor's Degrees:		
No. of Bachelor's Candidates:	Monitoring Center: NASA JSC		
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Flight Program:			
Flight Assignment:	NOTE: End date changed to 10/1/2012 per okay of E. Connell and discussions in April 2012 (Ed., 12/14/12) NOTE: Extended to 9/30/2012 per E. Connell/SHFH (Ed., 3/9/12) NOTE: End date is 4/30/2012 per HRP Master Task List dated 1/11/2012 (Ed., 1/20/2012)		
Key Personnel Changes/Previous PI:	Co-Investigator changes: Remove: Evan Twyford, Shelby Thompson Add: Richard Morency, John Pace		
COI Name (Institution):	Schuh, Susan (MEI Technologies; NASA Johnson Space Center) Litaker, Harry (Lockheed Martin ; NASA Johnson Space Center) Morency, Richard (NASA Johnson Space Center) Pace, John (Lockheed Martin; NASA Johnson Space Center)		
Grant/Contract No.:	Directed Research		
Performance Goal No.:			
Performance Goal Text:			

Task Description:

Currently, no established methods exist to collect real-time human factors and habitability data while crewmembers are living onboard the International Space Station (ISS) or while traveling onboard other space vehicles. Human factors and habitability data, i.e., problems or successes with hardware, software, or the workspace in general, are instead acquired at the end of missions during post-flight crew debriefs. These debriefs occur weeks or often longer after events have occurred, which forces a significant reliance on incomplete human memory. 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 not get resolved, and may get repeated in future vehicle/habitat designs. In addition, there is currently no means of documenting the location and movement of crewmembers within a vehicle or habitat, which prevents a thorough analysis of traffic flow, space utilization, and other efficiency issues. This type of information could be very valuable in designing next generation spacecraft and habitats.

This Directed Research Project (DRP) proposes to develop and validate tools and methods for collecting near real-time human factors and habitability data as a means of enhancing capabilities for determining lessons learned, understanding trends in issues and experience, and identifying needs for future space missions. This DRP's aims relate to near real-time crew inputs and focused video-based data collection of human factors and habitability data in operational flight and analog environments. The refinement of a set of tools and methods designed to assess real-time habitability human factors data, including targeted video data, will lead to requirements and best practice guidelines to evaluate habitability concepts for on-orbit and planetary missions, reducing the gap this task seeks to address. In addition, this DRP proposes to assess tools and methods for automated location tracking of crewmembers that would enable efficient and accurate analyses of vehicle and habitat layouts.

During preliminary work, several tools and methods for near real-time data collection were prototyped, and developmental testing in laboratory and analog environments was completed. Plans for continued work include additional analog-based testing as well as testing on the International Space Station (ISS). Well-developed tools and methods will lead to increased capabilities in evaluating human factors and habitability concerns associated with space vehicles and habitats.

Rationale for HRP Directed Research:

This research is directed because it contains highly constrained research, which requires focused and constrained data gathering and analysis that is more appropriately obtained through a non-competitive proposal.

Research Impact/Earth Benefits:

The investigative team performed preliminary work toward the development of tools and methods for the near real-time collection of habitability and human factors data. The work completed to date serves to inform further development efforts planned throughout the duration of the DRP. In addition to a literature review, additional efforts included software tool development; interviews with subject matter experts; laboratory-based pilot testing; examination of relevant spaceflight crew debrief data; and data collection during NEEMO.

A review of literature was performed to obtain a thorough background related to human factors and habitability assessments relevant to this DRP, including a broad range of publications. The review included discussion of previously developed habitability assessment tools as well as habitability and human factors assessments performed in both spaceflight and spaceflight analog environments. In addition, information pertaining to methods often used to analyze human factors data was gathered, along with a summary of uses of video in habitability and human factors studies. A literature review was provided to HRP as a deliverable, and additional work was performed in order to ensure a thorough understanding prior to completing the updated DRP proposal.

The Space Habitability Observation Reporting Tool (SHORT) was developed to collect near real-time human factors and habitability observation data from crewmembers in an operational environment. This web-based tool is intended to serve as an initial means of collecting this data, with the expectation that an actual tool deployed as part of nominal operations in spaceflight will retain elements of the web-based tool, but may be integrated into or modified to work in conjunction with pre-existing issue reporting systems. SHORT was created based on the previously developed Space Operations Issue Reporting Tool (SOIRT). In addition to the web-based format, a mobile Apple version was created, referred to as iSHORT.

Task Progress:

As part of the background research for this DRP, a series of interviews was conducted with subject matter experts. A total of nine individuals were interviewed regarding their experiences with analogs and spaceflight to discuss topics such as human factors and habitability concerns during these analog and spaceflight experiences, how closely analogs were perceived to represent long-duration spaceflight, and opinions regarding methods to collect near real-time human factors and habitability data. Feedback was collected concerning potential obstacles to success, incentive ideas for crewmember participation, and initial mockups of SHORT design.

As another part of preliminary work, investigators used ground-based pilot testing to gain feedback from test subjects regarding the use of software and video tools under development for the DRP. In order to begin evolving the prototype tools for eventual use in a high-fidelity operational environment, two ground-based pilot tests were completed. The goals of this testing included gaining feedback from subjects regarding feasibility and usability of the proposed tools and methods, gaining experience with the logistics and implementation of the tools, and confirming that software and hardware associated with the tools and methods are stable and reliable.

The investigative team for this DRP has partnered with the Operational Habitability (OpsHab) Team at Johnson Space Center, which is responsible for performing post-flight crew debriefs for ISS. The OpsHab Team has unique access to the information collected during these debriefs, and the lead of the OpsHab team serves as a co-investigator on this DRP. In order to provide more insight into crew perspective on tools and methods to collect data near real-time, during habitability and human factors crew debriefs beginning in 2011 ISS crewmembers were asked to provide feedback regarding the necessity and use of a real-time data collection method to capture habitability and human factors issues.

Finally, testing occurred as part of the NEEMO 15 mission during October 2011 and is planned to continue during NEEMO 16 during June 2012. This testing occurred as part of preliminary work in order to provide an opportunity to perform work related to iterative tool development prior to deployment on ISS. NEEMO crewmembers served as subjects, using software-based tools and focused video methods to report observations related to habitability and human factors during the duration of the mission.

Bibliography Type:	Description: (Last Updated: 06/01/2017)
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