Fiscal Year:	FY 2013	**Task Last Updated:**	FY 12/21/2012
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		
PI Email:	sherry.s.thaxton@nasa.gov	**Fax:**	FY
PI Organization Type:	NASA CENTER	**Phone:**	281-483-7413
Organization Name:	Lockheed Martin/NASA Johnson Space Center		
PI Address 1:	2101 NASA Parkway/SF3		
PI Address 2:			
PI Web Page:			
City:	Houston	**State:**	TX
Zip Code:	77058	**Congressional District:**	36
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	Directed Research
Start Date:	04/04/2011	**End Date:**	10/01/2012
No. of Post Docs:	0	**No. of PhD Degrees:**	0
No. of PhD Candidates:	0	**No. of Master' Degrees:**	0
No. of Master's Candidates:	0	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
Contact Monitor:	Sullivan, Thomas	**Contact Phone:**	
Contact Email:	thomas.a.sullivan@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: Gap change to HAB-09 from HAB-02 per IRP Rev E (Ed., 3/25/14) 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:	None		
COI Name (Institution):	Litaker, Harry (Lockheed Martin ; NASA Johnson Space Center) Morency, Richard (NASA Johnson Space Center) Pace, John (Lockheed Martin; NASA Johnson Space Center) Schuh, Susan (MEI Tech, Inc.; NASA Johnson Space Center)		
Grant/Contract No.:	Directed Research		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Currently, no established methods exist to collect near real-time human factors and habitability data during spaceflight missions. Human factors and habitability data 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 near real-time data, small issues may have a cumulative effect and continue to cause crew frustration and inefficiencies. 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 research seeks to address the Human Research Program (HRP) gap concerning tools that can be used to evaluate habitability concepts. The tools and methods proposed for development as part of this Directed Research Project (DRP) include two major components: habitability assessment tools, and space utilization assessment methods. Multiple tools will play a role in assessing habitability based on human performance data. Software-based tools will provide crewmembers with the opportunity to self-report habitability and human factors observations near real-time. In addition to this capability, software-based tools will have the capability to administer a targeted set of questions related to habitability and human factors concerns deemed specifically to be of interest. The targeted use of video will also provide crewmembers with the opportunity to provide insight into human factors and habitability observations within a habitat or vehicle, with associated training, scheduling, and flow of information to maximize the impact of these videos. The second major component proposed in this DRP is the evaluation of space utilization assessment methods. This effort will result in tools to aid in the design of the next generation of vehicles and habitats. In order to most effectively design layouts of interiors, it is important for designers to understand how space is utilized. This includes details such as the time crewmembers spend at workstations and traffic patterns between workstations. This DRP proposes to examine potential benefits of using automated methods to collect such data. As part of preliminary work, several tools and methods for near real-time data collection were tested during NASA Extreme Environment Mission Operations (NEEMO) 16, a space analog that takes place in a habitat on the ocean floor. Based on the success of the developed software tool, current plans call for transitioning this tool to operations for International Space Station (ISS). In parallel, work will continue on objectives related to investigating means to assess space utilization of habitats and vehicles through strategies such as technology assessments, ground-based experimentation, or exploration of collaboration opportunities.
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:	
Task Progress:	The major accomplishment for FY2012 was successful testing of the iPad-based Space Habitability Observation Reporting Tool (iSHORT) during NEEMO 16. iSHORT is an application that allows users to use text, photographs, video, and audio recordings to document positive or negative observations about their environment near real-time. Reports are immediately e-mailed to the test director and saved locally on the iPad. Testing began during NEEMO 15 but was cut short when inclement weather caused an early termination of the mission. In the interim months, updates to iSHORT were made and test plans were modified based on lessons learned. During NEEMO 16, four crewmembers used iSHORT daily throughout the 12-day mission, reporting observations ranging from glitches in scheduling software and communications difficulties to concerns about bathroom operations. In addition to providing a database of observations to analyze, there was an opportunity to elicit subjective feedback from the crewmembers. Crewmembers documented their impressions of iSHORT using end-of-mission electronic questionnaires, during post-mission one-on-one debriefs, and in some cases elected to use iSHORT itself to document their praises and criticisms during the mission. Overall, iSHORT was highly accepted, and the resulting observations were considered to demonstrate high potential for the tool in an operational setting. The success of iSHORT during the mission led to a plan to assess the feasibility of transitioning iSHORT to operations for International Space Station. In addition to iSHORT, NEEMO 16 crewmembers also provided video clips targeting human factors and habitability issues using a head-worn camera and a standard iPad camera, which enabled the assessment of these strategies for future use. These methods will require further development prior to implementation in an operational environment, but the lessons learned will feed into this process and may also shed light on alternate approaches to collecting this type of data. Another major accomplishment for FY2012 was the role this DRP played in hosting the 2012 Habitable Volume Workshop. In July 2012, the Human Research Program (HRP) hosted a Habitable Volume Workshop focused on assessing habitable volume of space vehicles and habitats for long-duration missions. Held in Houston, Texas, the 2012 workshop was well-attended by participants from both NASA and outside industry experts. NASA participants included Space Human Factors Engineering (SHFE) representatives, Behavioral Performance and Health (BHP) representatives, human factors handbook and standards experts, International Space Station Internal Vehicle Configuration Working Group (ISS IVC WG) team members, Flight Crew Integration (FCI) team members, Habitability Design Center (HDC) team members, Advanced Engineering Systems (AES) team members, and the Astronaut Office. Participants from outside industries and academia included representatives from oil and gas, submersibles, maritime shipping, mining, United States Navy, Lamar University, Thomas Jefferson University, and University of Pennsylvania. Together they brought a wealth of experience and differing perspectives on aspects relevant to the design of confined habitats. In addition to these activities, DRP team members mentored a group of undergraduate students from the University of Illinois at Urbana-Champagne as part of the Systems Engineering Educational Discovery (SEED) Program. This program, run by NASA's Microgravity University Program, allows NASA researchers to identify projects of interest to be paired with student research teams. These projects are intended to be small enough in scope for undergraduate students to complete with a few hours of work per week throughout a semester. The student team designed an experiment to evaluate pieces of hardware used to mount an iPad either on the user's arm or the user's torso. Students selected off-the-shelf software as well as developed custom software to provide tests of user performance. This allowed them to compare performance in microgravity to performance in 1-g as well as comparing performance across hardware mounts. In addition to providing an opportunity for students to benefit from the experience of designing and implementing an experiment aboard a parabolic flight aircraft, this project provided NASA the opportunity to gain insight into tablet use in microgravity.

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