

Fiscal Year:	FY 2017	Task Last Updated:	FY 02/03/2017
PI Name:	Holden, Kritina Ph.D.		
Project Title:	Electronic Procedures for Crewed Missions Beyond Low Earth Orbit (LEO)		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline-- Element/Subdiscipline:			
Joint Agency Name:	TechPort:	No	
Human Research Program Elements:	(1) HFBP : Human Factors & Behavioral Performance (IRP Rev H)		
Human Research Program Risks:	(1) HSIA : Risk of Adverse Outcomes Due to Inadequate Human Systems Integration Architecture (2) Medical Conditions : Risk of Adverse Health Outcomes and Decrements in Performance Due to Medical Conditions that occur in Mission, as well as Long Term Health Outcomes Due to Mission Exposures		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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City:	Houston	State:	TX
Zip Code:	77058-3607	Congressional District:	22
Comments:			
Project Type:	GROUND	Solicitation / Funding Source:	2014-15 HERO NNJ14ZSA001N-Crew Health (FLAGSHIP & NSBRI)
Start Date:	10/01/2015	End Date:	09/30/2018
No. of Post Docs:	0	No. of PhD Degrees:	1
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:	Williams, Thomas	Contact Phone:	281-483-8773
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Flight Program:			
Flight Assignment:	NOTE: End date changed to 9/30/2018 per E. Connell (JSC HRP)--Ed., 6/25/18 NOTE: End date changed to 2/1/2018 per PI (Ed., 7/13/17) NOTE: Element change to Human Factors & Behavioral Performance; previously Space Human Factors & Habitability (Ed., 1/18/17)		
Key Personnel Changes/Previous PI:	February 2017 report: Dr. Maya Greene, KBRwyle at NASA Johnson Space Center, joined the project as CoInvestigator with statistics expertise.		
COI Name (Institution):	Hamblin, Christopher Ph.D. (Honeywell International) Morin, Lee M.D., Ph.D. (NASA Johnson Space Center) Schreckenghost, Debra M.E.E. (TRAC Labs, Inc.) Greene, Maya Ravid Ph.D. (KBRwyle at NASA Johnson Space Center)		
Grant/Contract No.:	Internal Project		
Performance Goal No.:			

Performance Goal Text:	<p>The concept of operations in today's spacecraft cockpit is one in which virtually all tasks are driven by procedures. In addition, crewmembers have near constant access to ground resources and information in the performance of their tasks. As NASA once again prepares for manned spaceflight beyond low Earth orbit (LEO), future spacecraft will require automated systems that will allow the crew to perform procedures without assistance from the ground. This change threatens to increase astronaut workload, decrease efficiency, and increase the risk of inadequate task execution if electronic procedures are not designed with proper research-based guidance.</p> <p>Two ground-based investigations will be completed, leading to guidelines for designing and using electronic procedures. We will leverage and extend existing electronic procedure software and spacecraft simulations for these studies, to include the PProcedure Integrated Development Environment-PRIDE procedure authoring and execution software developed to model International Space Station (ISS) procedures, and an Orion-like electronic procedures prototype system.</p> <p>The proposed work will provide electronic procedures guidelines to contribute to the Space Human Factors Engineering (SHFE) gap SHFE-HCI-06 closure via the following specific aims:</p>
Task Description:	<p>Aim 1: Determine the effect of level of automation of procedure step execution on Situation Awareness, and other human-system performance metrics.</p> <p>Aim 2: In a complex, multiple-procedure scenario, determine the effect of procedure management aids (e.g., availability of task allocation information) on Situation Awareness and other human-system performance metrics.</p> <p>Aim 3: Determine the effect of the level of integration of system and procedural information on Situation Awareness and other human-system performance metrics.</p> <p>In study 1, we will implement and evaluate electronic procedures with three levels of automation: 1) no automation, 2) low automation, and 3) high automation. Subjects will perform representative system tasks using prototype displays and the electronic procedures prototype systems. Particular attention will be given to critical measures of human-automation interaction including: Situation Awareness, Usability, Workload, and Trust. Subjects will perform the task in 2 sessions: session 1 with a single procedure, and session 2 with multiple procedures. Training is provided as part of session 1. The procedures will be performed using two different management aid designs.</p> <p>In Study 2, levels of integration between the procedures and systems displays will be manipulated and compared experimentally; levels will range from no integration (separate displays and procedures), to high integration (relevant sections or excerpts of the display integrated with procedures). Key metrics in this study will include Situation Awareness, Usability, Workload, and Trust. Eye-tracking data will also be collected to assess eye movements.</p> <p>Results from these studies will be applicable to a variety of domains that use electronic procedures, including space vehicles, habitats, oil and gas refineries, and power plants. Candidate guidelines will also be submitted to appropriate NASA documents; for example, the Orion Display Format Standards document, NASA Human Integration Design Handbook (HIDH), and NASA-STD-3001, as applicable.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	<p>Results from these studies will be applicable to a variety of domains that use electronic procedures, including space vehicles, habitats, oil and gas refineries, and power plants. The project includes a university collaborator who will serve as liaison to an industry consortium focused on studying and improving procedure design.</p>
Task Progress:	<p>Software and procedures for the first session of Study 1 have been developed, and the first session of Study 1 has been run. Session 1 served as training, and was used as an additional experimental opportunity to examine the effect of "Send" command button location on Situation Awareness. Twenty-four participants have completed Session 1, and are ready to progress to the first experimental session (Session 2). The testing protocol for future sessions is currently being developed. The team has also received a sanitized version of the Orion procedure system to begin conceptualization of Study 2.</p>
Bibliography Type:	Description: (Last Updated: 10/29/2023)