Fiscal Year:	FY 2013	**Task Last Updated:**	FY 05/24/2013
PI Name:	Feary, Michael Ph.D.		
Project Title:	Needs Assessment and Work Allocation Tools for Mission Operations and Procedures		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Space Human Factors Engineering		
Joint Agency Name:		**TechPort:**	No
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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PI Organization Type:	NASA CENTER	**Phone:**	650.604.0203
Organization Name:	NASA Ames Research Center		
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City:	Moffett Field	**State:**	CA
Zip Code:	94035	**Congressional District:**	18
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	Directed Research
Start Date:	07/24/2012	**End Date:**	01/31/2015
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:	1	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
Contact Monitor:	Whitmore, Mihriban	**Contact Phone:**	281-244-1004
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Flight Program:			
Flight Assignment:	NOTE: End date is now 1/31/2015 (previously 9/30/2014) per E. Connell/JSC (Ed., 9/9/14) NOTE: End date changed to 9/30/2014 (from 7/31/2016) per M. Whitmore/JSC (Ed., 3/24/14)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Billman, Dorrit (San Jose State University Foundation at NASA Ames)		
Grant/Contract No.:	Directed Research		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Increased system automation is critical for enabling more independent operation on long-duration and farther-distance space missions. Effective integration of human and automation elements is critical to success; this is demonstrated by the widespread involvement of poor Human-Automation Integration (HAI) design as a contributor to accidents and incidents in the sister application domain of aviation, where more data are available. While much is known about HAI design from research in aviation, long-duration space flight adds demands for robustness that are not well understood. HAI designs must be robust in supporting a variety of tasks playing out in circumstances that were impossible to fully anticipate, executed long after any training on these functions, by operators who must be competent in many types of work rather than specialists in any one. The proposed research has an analytic and empirical strand. The purpose of the analytic strand is to provide methods and tools for measuring automation-to-work (ATW) alignment, for use guiding development and evaluation of HAI designs. The purpose of the empirical strand is to assess whether measured ATW alignment of HAI designs predicts the learnability of those designs, an important aspect of robustness. By ATW alignment we mean the correspondence between the elements and structure of interaction with the elements and structure of the work. Needs analysis identifies elements and structure of the work. In the analytic strand we will develop a scoring method for measuring alignment. Our approach draws on and integrates a wide set of observations and proposals in HAI, Human Computer Interaction (HCI), Work Domain Analysis (WDA), and related disciplines. In the empirical strand we test the prediction that HAI designs that align with work more strongly will be easier to learn, particularly, easier to master using the automation for novel problem solving. We test this hypothesis by identifying and measuring designs that differ in ATW alignment and then comparing the designs with high versus low scores for how easily they are learned, how well retained, and how flexibly they can be used.
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:	In FY2013, the investigation team developed the Automation to Work Alignment matrix for an analogous domain in aviation. The aviation domain was chosen because the team had access to different interface concepts that are designed to accomplish the same tasks with access to expert users and validated metrics. The process of developing the matrix has produced a need for database and statistical analysis development to deal with the complexity of mapping description of work activities to descriptions of the behavior of specific technologies for completing the work. In particular the team has worked on the development of bi-clustering methods that allow sorting and grouping of related work functions and technologies. The team is currently preparing an empirical study to test the ability to use the method to assess alignment between two proposed automation interfaces.
Bibliography Type:	Description: (Last Updated: 07/22/2015)
Abstracts for Journals and Proceedings	Feary M, Billman D, Chen X, Howes A, Lewis R, Sherry L, Singh S. "Linking Context to Evaluation in the Design of Safety Critical Interfaces." 15th International Conference on Human-Computer Interaction, Las Vegas, NV, July 21-26, 2013. 15th International Conference on Human-Computer Interaction, Las Vegas, NV, July 21-26, 2013. , Jul-2013
Books/Book Chapters	Feary M, Billman D, Chen X, Howes A, Lewis R, Sherry L, Singh S. "Linking Context to Evaluation in the Design of Safety Critical Interfaces." in "Human-Computer Interaction. Human-Centred Design Approaches, Methods, Tools, and Environments. Part I, HCII 2013." Ed. M. Kurosu. Heidelberg : Springer, 2013. Lecture Notes in Computer Science (LNCS) series 8004, p. 193-202. http://dx.doi.org/10.1007/978-3-642-39232-0_22 , Jul-2013