Fiscal Year:	FY 2017	**Task Last Updated:**	FY 12/14/2016
PI Name:	Feigh, Karen Ph.D.		
Project Title:	Objective Function Allocation Method for Human-Automation/Robotic Interaction using Work Models that Compute		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Space Human Factors Engineering		
Joint Agency Name:		**TechPort:**	Yes
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		
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:**	2015-16 HERO NNJ15ZSA001N-Crew Health (FLAGSHIP, NSBRI, OMNIBUS). Appendix A-Crew Health, Appendix B-NSBRI, Appendix C-Omnibus
Start Date:	10/07/2016	**End Date:**	10/06/2019
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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:			
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Key Personnel Changes/Previous PI:			
COI Name (Institution):	Pritchett, Amy Sc.D. (Georgia Institute of Technology)		
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Task Description:	To develop effective Human-Automation/Robotic (HAR) systems, NASA requires the development of methods and tools to inform the decisions regarding function allocation between robots and crew members that are able to objectively assess the implications of the assignment of these roles for the human-system performance trade space. This research will establish a validated method for the evaluation of function allocation between robots and automated systems and their human crew mates for use in deep space exploration missions. It will further produce computational models of different possible combinations of a three person human crew and various classes of robots for a variety of tasks which can be used as-is for additional analysis or modified for future concepts of operation. The method for function allocation will apply fast-time simulation, which will be validated by ground-based human-in-the-loop experimentation. It may also include human-in-the-loop simulation in an analog environment. The proposed research addresses three main research questions: First, how should roles and responsibilities be optimally assigned to robots and humans based on a combination of task demands, robotic capabilities and available crew resources, with special attention to the capabilities inherent to classes of robots? Second, what is the human-robot system performance trade-space that serves as the basis for the allocation? Third, how can this function allocation method be validated as creating appropriate function allocation for both nominal and off-nominal operations? We propose a three year effort to address these questions. In the first year we propose to model the function allocation design space that exists between humans and robots in deep space exploration missions. We will use a computational framework called Work Models that Compute (WMC), which allows us to model dynamical systems (such as space vehicles and robots), automated systems (such as the automated rendezvous and docking system) and human agents working together to achieve common goals. WMC was custom designed to model function allocation and to measure eight metrics of function allocation previously established by the proposers. In the second year we will explore the design space, deeply investigating each metric such as taskload, authority- responsibility mismatch, coherency, etc., while beginning the validation process through the use of human-in-the-loop experiments with simulated robots. In the final year we will move from exploring each metric individually to looking at their combined effects as we vary the design space constraints, the tasks, crew stress levels, and function allocation options. We will continue our validation efforts using human-in-the-loop experiments using a combination of simulated robots and/or real robots. These experiments will systematically explore a large number of conditions such that they serve not only to demonstrate the function allocation chosen by the method, but also to validate the method.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2017.
Bibliography Type:	Description: (Last Updated: 02/11/2021)