Fiscal Year:	FY 2010	Task Last Updated:	FY 12/07/2010
PI Name:	Barshi, Immanuel Ph.D.		
Project Title:	Medical Proficiency Training		
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 (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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Organization Name:	NASA Ames Research Center		
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City:	Moffett Field	State:	CA
Zip Code:	94035-1000	Congressional District:	18
Comments:			
Project Type:	GROUND	Solicitation / Funding Source:	Directed Research
Start Date:	10/02/2006	End Date:	09/30/2010
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:	Woolford, Barbara	Contact Phone:	218-483-3701
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Byrne, Vicky (Lockheed-Martin/ NASA Johnson Space Center)		
Grant/Contract No.:	Directed Research		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Ground-based pre-flight training and in-space just-in-time training and task rehearsal will continue to be an important driver for exploration missions. On-board training systems will enhance the autonomy and effectiveness of exploration crews. Long-duration missions preclude the possibility of easily substituting new crew members from the ground who have been specially trained on specific emerging problems, new tasks, and scientific or mission operations. We will continue to depend even more on the deep knowledge astronauts acquire of the idiosyncrasies of the flight systems they live with and the tasks they have to perform. However, given the nature of the missions, onboard training opportunities for individuals and teams will be necessary, such as in reconfigurable training and mission rehearsal systems. These systems will enable the crews to keep their skill levels up to par and to develop new skills or practice new procedures to resolve new challenges as they arise. Increasing communication delays between crews and ground support mean that astronauts need to be prepared to handle the unexpected on their own. As crews become more autonomous, their potential span of control and required expertise grow much greater than is needed today. It is not possible to train for every eventuality ahead of time on the ground or maintain such skills across long intervals of disuse. New training approaches must be skill-based rather than task-based, emphasizing the acquisition of general skills such as avionics trouble-shooting, or even broader skills such as creative problem solving. Furthermore, a team of experts is not necessarily an expert team. Thus, team training will be particularly important, and especially so for multicultural and international crews on long-duration missions. Research in many other high-risk domains (e.g., aviation, the military, nuclear power, and medicine) shows that effective teamwork can provide resilience in the face of challenging problems. The same is true for the people of Launch and Mission Control, particularly as mission complexity increases and resources available for training decrease. The current length of crew and flight controllers training has been identified as a major issue in various crew reports and debriefs, and it is predicted that future training will have to be more efficient. Leveraging from the investigation of existing training and the analysis of current training principles and approaches conducted during FY07 and FY08, a forward plan is proposed for FY09-FY11. Specifically, the proposal focuses on exploring some of the basics of learning and of skill acquisition and retention, as well as their practical implementation in two distinct target operations that provide a broad basis for principles and methodologies relevant for all aspects of NASA's Exploration mission: mission control, and medical operations. Because validating training implementations and particularly those aimed at the long-term retention of skills takes time, this research must maintain its timeline so as to have finalized products in time to meet Constellation needs. What's more, intermediate products from this research effort benefit current missions and allow for iterative improvement cycles with continuous feedback from key stakeholders. The approach taken in the proposal and the particular products pursued are the result of close collaboration with Mission Operations Directorate (MOD) training organizations. Significant progress has been made in the past 2 years. MOD is very interested in the proposed work which they find very responsive to their current and future needs. The same is true for SD (Space Medicine Division) and its medical operations. For FY09, products from this study will include prototype MOD team training protocols and tools, as well as recommendations for the design of medical checklists incorporating training and decision support functions.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Future space missions will be very different from current missions. Mission durations will be significantly longer than current Space Shuttle missions, new systems will be more complex than current systems, and resources will have to be used more efficiently than they are at present. Furthermore, delays in communication between space crews and Earth-based support will necessitate greater crew autonomy than is presently required. To adequately prepare NASA personnel for these challenges, new training approaches, methodologies, and tools are required. This proposal outlines a research program aiming at developing these training capabilities, and builds on significant accomplishments achieved in the past year. Well-designed interfaces, tasks, procedures, and training are critical defense layers in preventing error, and in promoting mission success. They are also critical for the early recognition of errors once made, and for minimizing the consequences of errors. Thorough understanding of human cognition, learning, and skill acquisition are foundational ingredients in the proper design process. As such, research in learning not only contributes to the design of training programs, but also to the design of the systems and the procedures to be trained. Because validating training implementations and particularly those aimed at the long-term retention of skills takes time, this research must commence as soon as possible so as to have finalized products in time to meet the needs of the Constellation Program. What's more, intermediate products from this research effort benefit current missions and allow iterative improvement cycles with continuous feedback from key stakeholders. With sufficient time for iterative cycles of development, improvements in current training programs could lead to significant improvements in future systems design. This opportunity to contribute to system design is the result of the fact that training programs must often compensate for design deficiencies.
Task Progress:	The FY10 electronic Flight Surgeon Performance Support Tool prototype assessment was conducted to determine the feasibility of an electronic implementation of a paper prototype to enable Flight Surgeons to carry the tool on their laptop computers which they bring with them to the Mission Control Center (MCC) when they have console duties. The current tool was defined for the scenario "Flight Surgeon Response to Fire/Smoke Emergency on ISS (International Space Station)." The plan is to eventually have similar tools for a wide range of situations and include multiple levels of information such that the tool could be used for initial, refresher, and just-in-time training as well as for on-task performance support. This research was based on the work done in FY08 and FY09 to develop a prototype Flight Surgeon performance support tool in the form of a paper one-pager to be used in emergency situations on board the ISS. The tool was designed to provide a single reference point for the Flight Surgeon on console, and included immediate actions, the relevant Flight Rules, and information needed to be provided or requested. The paper prototype used Fire Onboard the ISS as a sample emergency, and was developed in collaboration with our Medical Operations Stakeholder.
Bibliography Type:	Description: (Last Updated: 01/11/2021)

Abstracts for Journals and Proceedings	Byrne V, Schmid J, Barshi I. "Performance Support Tools for Space Medical Operations." Presented at the 81st Annual Aerospace Medical Association (AsMA) Conference, Phoenix, AZ, May 2010. Aviation, Space, and Environmental Medicine 2010 Mar;81(3):252. , Mar-2010
Abstracts for Journals and Proceedings	Byrne V. "Human Factors in Space Medical Training. Invited Talk." Invited talk at the Constellation Medical Capabilities Medical Training and Telemonitoring Gap Analysis, Johnson Space Center, April 2008. Constellation Medical Capabilities Medical Training and Telemonitoring Gap Analysis, Johnson Space Center, April 2008.. , Apr-2008