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| **Fiscal Year:** | FY 2009 | **Task Last Updated:** | FY 06/22/2010 |
| **PI Name:** | Barshi, Immanuel Ph.D. | | |
| **Project Title:** | Spaceflight Resource Management 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 | | |
| **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:** | 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 |
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| **Flight Program:** | | | |
| **Flight Assignment:** | | | |
| **Key Personnel Changes/Previous PI:** | | | |
| **COI Name (Institution):** | Byrne, Vicky ( Lockheed-Martin/ NASA Johnson Space Center ) | | |
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| **Performance Goal Text:** | | | |
| | 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 | | |

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| **Task Description:** | 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 highrisk 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.<br>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.<br><br>The approach taken in the proposal and the particular products pursued are the result of close collaboration with 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.<br><br>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.<br>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:** | FY09 Progression<br>The FY09 follow-up included an analysis of medical errors commited on Earth, just-in-time training techniques and concepts for medical procedures, continued development and evaluation of the flight surgeon tool, and delivery of initial results from experimenting with the SFRM Generic Paper Sim prototype during FY09 ISS Flight Controller - Operator's training. |
| **Bibliography Type:** | Description: (Last Updated: 01/11/2021) |