

Fiscal Year:	FY 2010	Task Last Updated:	FY 10/25/2010
PI Name:	Holden, Kritina Ph.D.		
Project Title:	Information Presentation		
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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City:	Houston	State:	TX
Zip Code:	77058-3607	Congressional District:	22
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):	McCann, Robert (NASA Ames Research Center)		
Grant/Contract No.:			
Performance Goal No.:			
Performance Goal Text:	<p>Display and control user interfaces are the critical vehicle elements supporting crew performance for many, if not most, mission operations. Correctly defining, refining, and validating the requirements for the proper display and use of information for systems monitoring and vehicle control is critical for optimizing operational performance and minimizing operational risk. The goal of this Information Presentation Directed Research Project (DRP) is to address design questions related to the presentation of information to the crew. This includes not only the issues of information formatting, style, and layout, but also methods of interacting with the information, use of information under the extreme environments encountered in space travel, and refinement of human factors techniques, such as modeling, that will supplement traditional design techniques, and help ensure that optimal information design is accomplished in the most cost efficient manner. This DRP will result in the development of guidelines, requirements, and validation techniques for advanced information display solutions currently contemplated for the various spacecraft systems being designed and developed under the Constellation program.</p>		

Task Description:	<p>The major areas of work, or subtasks, within this DRP are: 1) Displays, 2) Controls, 3) Electronic Procedures and Fault Management, and 4) Human Performance Modeling. The Displays subtask addresses label formatting, text color, auditory alarms, and navigation across and within display units. The effects of vibration on reading and speech communication are also investigated. The Controls subtask concentrates on cursor control functionality, design, and use under vibration and microgravity. The Electronic Procedures and Fault Management subtask focuses on information architecture issues for nominal and off-nominal electronic procedures, and their integration with advanced caution and warning systems. The Modeling subtask focuses on human performance modeling of user interfaces in the space environment.</p> <p>The focus within each major subtask has been carefully selected to address either 1) a near-term identified need within ongoing Orion development work, or 2) a longer-term Exploration need that is sufficiently complex to warrant initiation of research. It is envisioned that activities within these subtasks will evolve and be modified for out-years, as additional research needs are identified.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	<p>Research on Displays involves label design, auditory alarms, and readability under vibration. Standards and guidelines resulting from this research can be applied to software labels and auditory alarms in any domain. Results from readability under vibration studies may be relevant to race car drivers, pilots or other operators in vibration environments. Research results on Controls, such as cursor control devices (CCD), can be applied in any setting using CCDs, and the CCD Test Battery developed can be used in many types of research involving CCD use or motor control related topics. Electronic Procedures and Fault Management study results apply in any domain having procedure-driven tasks that involve alerting, such as plant control rooms, air traffic control, and piloting. Modeling results can offer insights into human interaction with real-time control systems, whether these are spacecraft, aircraft, or other types of real-time task displays.</p>
Task Progress:	<p>FY10 Accomplishments for DISPLAYS</p> <p>Completed a study on the effects of peak vs. extended vibration on readability, including post vibration motor control.</p> <p>Completed a final report describing the Short Duration Bioastronautics Investigation 1904 (Visual Performance under Shuttle Launch Vibration).</p> <p>Completed a study on the effects of strobing as a countermeasure to vibration effects on reading.</p> <p>Completed a white paper describing a comparative analysis between vibration, g+vibration, and simulated vibration.</p> <p>Completed a study of candidate alarm sounds for Emergency, Warning, and Caution, including speech alarms. Finalized alarm requirements were accepted into the CxP Human-Systems Integration Requirements document.</p> <p>Completed a study on speech intelligibility and the effects of alarm source.</p> <p>Completed an evaluation of a prototype spatial auditory display to aid situation awareness for an EVA crewmember.</p> <p>Completed a study on color coding and multi-monitor display interaction.</p> <p>FY10 accomplishments for CONTROLS</p> <p>Completed the first ever test of cursor control devices under various vibration conditions (frequencies/amplitudes).</p> <p>Completed a survey of CCD needs for future lunar/exploration missions.</p> <p>Completed the first ever test of pressurized gloved operations with small controls in a glovebox with pressures up to 8.1 psid.</p> <p>Enhanced the Cursor Control Device Test Battery and completed initial paperwork for release as a NASA Innovation.</p> <p>FY10 accomplishments for ELECTRONIC PROCEDURES & FAULT MANAGEMENT</p> <p>Completed a study investigating how displayed information is used during a fault management task.</p> <p>Completed an analysis of "look forward" and "look backward" behaviors when using electronic procedures</p> <p>Completed a study on the effects of serial vs. parallel availability of electronic procedures when using system summary displays during a fault management task.</p> <p>FY10 accomplishments for MODELING</p> <p>Developed an enhanced human oculomotor performance model. Validated the model with comparisons to operator-based performance.</p>
Bibliography Type:	Description: (Last Updated: 10/29/2023)
Abstracts for Journals and Proceedings	<p>Kaiser M, Allen C, Barshi I, Billman D, Holden K. "Human Factors Research for Space Exploration: Measurement, Modeling, and Mitigation." Human Factors and Ergonomics Society 54th Annual Meeting, San Francisco, CA, October 1, 2010.</p> <p>Proceedings of the Human Factors and Ergonomics Society 54th Annual Meeting, 2010. , Sep-2010</p>
Awards	<p>Thompson S, Holden K, Ebert D, Root P, Adelstein B, Jones J. "Best Poster Award for Short Duration Bioastronautics Investigation (SDBI) 1904. Human Factors Assessment of Vibration Effects on Visual Performance During Launch. May 2010." May-2010</p>

NASA Technical Documents	Adelstein B, Beutter B, Kaiser M, McCann R, Stone L. "Effects of Transverse Seat Vibration on Near-Viewing Readability of Alphanumeric Symbolology." NASA Ames Research Center. NASA Technical Memorandum 2009-215385. , Oct-2009
NASA Technical Documents	Adelstein B, Beutter B, Kaiser M, McCann R, Stone L, Anderson M, Renema F, Paloski W. "Influence of Combined Whole-Body Vibration Plus G-Loading on Visual Performance." NASA Ames Research Center. NASA Technical Memorandum 2009-215386. , Oct-2009
Papers from Meeting Proceedings	Begault D. "Effect of Whole-Body Vibration on Speech. Part I: Stimuli Recording and Speech Analysis." Audio Engineering Society 127th Convention, New York, NY, October 9-12, 2009. Proceedings of Audio Engineering Society 127th Convention, October 2009. Paper 7820. , Oct-2009