Fiscal Year:	FY 2007	**Task Last Updated:**	FY 11/29/2007
PI Name:	Small, Ron M.S.		
Project Title:	Modeling and Mitigating Spatial Disorientation in Low G Environments		
Division Name:	Human Research		
Program/Discipline:	NSBRI Teams		
Program/Discipline--Element/Subdiscipline:	NSBRI Teams--Sensorimotor Adaptation Team		
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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Organization Name:	Alion Science & Technology Corp.		
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City:	Boulder	**State:**	CO
Zip Code:	80301-2577	**Congressional District:**	2
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2007 NSBRI-RFA-07-01 Human Health in Space
Start Date:	09/01/2007	**End Date:**	08/31/2011
No. of Post Docs:		**No. of PhD Degrees:**	
No. of PhD Candidates:		**No. of Master' Degrees:**	
No. of Master's Candidates:		**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:		**Monitoring Center:**	NSBRI
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Oman, Charles (Massachusetts Institute of Technology) Wickens, Christopher (Alionscience & Technology) Young, Laurence (Massachusetts Institute of Technology)		
Grant/Contract No.:	NCC 9-58-SA01302		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	The goal of this industry-university research and technology development project is to extend Alion's spatial disorientation (SD) mitigation software, originally developed for aeronautical use, to NASA applications in the Shuttle, Crew Exploration Vehicle, Lunar Surface Access Module (LSAM) and Mars exploration mission programs. Alion's Spatial Disorientation Analysis Tool (SDAT) is used for post-hoc analyses of aircraft trajectory data mishaps from the United States Navy, United States Air Force and National Transportation Safety Board to determine the presence or absence of vestibular SD. The Spatial Orientation Aiding System (SOAS) is a real-time cockpit aid that has been evaluated in simulators with rated pilots. Both tools incorporate models of the vestibular system and assessor heuristics to predict the epoch and probability of an SD event such as leans, coriolis or graveyard spiral illusions and any other disparities between actual and perceived pitch attitude (somatogravic), roll rate or yaw/heading rate. SOAS assesses multi-sensory workload to determine the types of countermeasures to trigger and when to trigger them. This project will: 1. Enhance the utility of SDAT/SOAS by including comprehensive mathematical models for vestibular and visual sensory cues, help translate CNS gravitoinertial force resolution into perceived tilt and translation estimates, and revalidate existing aeronautical data sets; 2. Extend the models to describe zero gravity and Shuttle/LSAM landing illusions, validating the models using Shuttle data sets and existing (e.g. ROTTR) theory; 3. Extend SDAT/SOAS to consider multiple visual frames of reference (inside and outside), panel and heads-up (HUD) orientation displays, the effects of visual attention and sensory workload, and the cognitive costs of mental rotation and reorientation. The enhanced SDAT/SOAS from Aims 1-3 will be validated via flight experiments, and; 4. SOAS will be tailored for a lunar landing using multi-sensory workload to choose appropriate countermeasures and their timing. Countermeasures will include: * Control command displays; * Two-dimensional and perspective synthetic/enhanced vision displays; * Attitude indicator formats tailored for physically redirected, off-velocity vector viewing, and; * Auditory cues and commands. SDAT also will help human factors engineers at NASA Johnson Space Center analyze past Shuttle landing incidents and will aid CEV/LSAM landing and ascent trajectory planning. It can aid LSAM cockpit displays, caution and warning system design, workload evaluation, and crew training and mission simulation. SDAT could assist flight surgeons with postflight medical debriefings.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2007.
Bibliography Type:	Description: (Last Updated: 09/08/2020)