Fiscal Year:	FY 2009	Task Last Updated:	FY 05/30/2009
PI Name:	Dinges, David F. Ph.D.		
Project Title:	Psychomotor Vigilance Test (PVT) on ISS		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline Element/Subdiscipline:	HUMAN RESEARCHBehavior and performance		
Joint Agency Name:		TechPort:	Yes
Human Research Program Elements:	(1) HFBP:Human Factors & Behavioral Performance (IRP Rev )	H)	
Human Research Program Risks:	<ol> <li>(1) BMed:Risk of Adverse Cognitive or Behavioral Conditions a</li> <li>(2) Sleep:Risk of Performance Decrements and Adverse Health O</li> <li>Desynchronization, and Work Overload</li> </ol>	and Psychiatric Disorders Outcomes Resulting from Sl	eep Loss, Circadian
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	19104-4209	Congressional District:	2
Comments:			
Project Type:	Flight	Solicitation / Funding Source:	Directed Research
Start Date:	08/01/2008	End Date:	07/31/2013
No. of Post Docs:		No. of PhD Degrees:	
No. of PhD Candidates:		No. of Master' Degrees:	
No. of Master's Candidates:	Ĩ	No. of Bachelor's Degrees:	
No. of Bachelor's Candidates:		Monitoring Center:	NASA JSC
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Flight Program:	ISS		
Flight Assignment:	ISS NOTE: start/end dates changed per J. Dardano/JSCpreviously	4/30/2008-8/31/2013 (4/16/2	2009)
Key Personnel Changes/Previous PI:			
COI Name (Institution):			
Grant/Contract No.:	NNX08AY09G		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	The Psychomotor Vigilance (PVT) Self Test (operational name on ISS is Reaction Self Test) is intended to provide astronauts with objective feedback on neurobehavioral changes in vigilant attention, psychomotor speed, state stability, and impulsivity while on ISS missions. The PVT Self Test is ideal for repeated use in spaceflight because unlike other cognitive tests, it is very brief (3-minute) while being free of learning effects and aptitude differences that make interpretation of other cognitive measures difficult. The PVT Self Test on the International Space Station can aid astronauts to objectively identify when their performance capability is degraded by various fatigue-related conditions that can occur as a result of ISS operations and time in space (e.g., acute and chronic sleep restriction, sleep shifts, extravehicular activity [EVA], and residual sedation from sleep medications). The following are the objectives (specific aims) of the project: 1) To evaluate the extent to which PVT Self Test performance of astronauts is sensitive to fatigue from sleep loss and circadian disruption during ISS missions. This will include the following conditions evaluated individually and in aggregate: i) extended wake duration between 16 hours; ii) sleep restriction defined as total sleep time >0 and <6 hours per 24-hour period; and iii) circadian perturbation associated with night work and slam shifting. 2) To evaluate the extent to which PVT Self Test performance of astronauts is degraded by or aggregate: i) extended work durations up to 16 hours per day; ii) more than 6 consecutive work days without a day off for rest; and iii) work requiring extravehicular activity (EVA). 3) To evaluate the extent to which PVT Self Test performance of astronauts will be sensitive to the carry-over effects of medications for sleep (e.g., zolpidem, ramelteon, etc.) on ISS. 5) To evaluate the extent to which PVT Self Test performance of astronauts as a useful tool for assessing performance capability. This will be addressed throughout	
Rationale for HRP Directed Research:		
Research Impact/Earth Benefits:	The PI developed the original 10-minute Psychomotor Vigilance Test (PVT), which the Reaction Self Test was derived from, to measure changes in psychomotor speed, lapses of attention, wake state instability, and impulsivity induced by fatigue and other performance-degrading factors commonly found in operational environments. Based on research supported by federal and non-US federal agencies, as well as the pharmaceutical industry, the 10-minute PVT has been extensively validated in laboratory studies, simulators and operational environments to be sensitive to a variety of performance-degrading fatigue-related factors. The PVT SelfTest (Reaction Self Test) will have utility in a wide array of safety-sensitive environments on Earth. Potentially any occupation in which alertness and fatigue management are essential to prevent errors on critical tasks will benefit from adaptations of the PVT SelfTest technology (e.g., certain military personnel, airport security screeners, physicians on night shifts and prolonged call, etc.).	
Task Progress:	During the current reporting period, we interacted with International Space Station Medical Project (ISSMP) personal to specify the system-level requirements for integrating experiment unique software into the Human Research Facility (HRF) computers and Station Support Computers (SSC). We completed internal quality assurance engineering documentation that specified the user requirements and system requirements for the PVT Self Test Software. We worked with ISSMP to identify data management procedures including data acquisition, storage, and transfer procedures to achieve a highly reliable and redundant experimental data acquisition plan. Unit-level system requirements testing related to data management procedures specifying expected functionality and input/output verification data was exceuted. We complete the user interface, a scries of PVT Self Test interface prototypes were developed to rapidly evaluate design choices for the SelfTest feedback screens and user input. At each iterative design step, prototypes were presented to astronauts that participated in NEEMO 9, 12, 13 (N=6 astronauts participated in the design process). A beta version of the PVT SelfTest was developed with a full user interface and PVT metrics analysis algorithm. Unit-level system requirements testing of the user interface and PVT metrics analysis algorithm. Unit-level system requirements testing of the user interface and PVT metrics analysis algorithm. Unit-level system requirements that participated in the Payload Display Review Team (PDRT) review process that included multiple interface design iterations and documentation (approved 8 April 2009). We completed and received approval for the VTS belfTest was performed by using an ISSMP IBM A31P laptop (replica of HRF laptop). The replica computer contained the same hardware and operating system build as the operation, maintenance, update, and removal procedures (approved 16 March 2009). Comprehensive whole-system verification of the PVT SelfTest was performed by using an ISSMP IBM A31P	
Bibliography Type:	Description: (Last Updated: 05/08/2025)	
Abstracts for Journals and Proceedings	Mollicone D, Basner M, Mott C, Ecker A, Dinges DF. "A Novel PVT Self-Test to Enhance Fatigue Mitigation Strategies in Space." Presented at the the Aerospace Medical Association's 80th Annual Scientific Meeting, Los Angeles, CA, May 4-7 2009. Aviation, Space, and Environmental Medicine 2009 Mar;80(3):224. , Mar-2009	
Articles in Peer-reviewed Journals	Lim J, Dinges DF. "Sleep deprivation and vigilant attention." Annals of the New York Academy of Sciences, 2008;1129:305-22. <u>http://dx.doi.org/10.1196/annals.1417.002</u> ; PubMed <u>PMID: 18591490</u> (Molecular and Biophysical Mechanisms of Arousal, Alertness, and Attention), Sep-2008	

Awards

Dinges DF. "2009 Raymond F. Longacre Award for Outstanding Accomplishment in the Psychological and Psychiatric Aspects of Aerospace Medicine, Aerospace Medical Association, May 2009." May-2009