

<b>Fiscal Year:</b>	FY 2010	<b>Task Last Updated:</b> FY 05/28/2010	
<b>PI Name:</b>	Dinges, David F. Ph.D.		
<b>Project Title:</b>	Psychomotor Vigilance Test (PVT) on ISS		
<b>Division Name:</b>	Human Research		
<b>Program/Discipline:</b>	HUMAN RESEARCH		
<b>Program/Discipline--Element/Subdiscipline:</b>	HUMAN RESEARCH--Behavior and performance		
<b>Joint Agency Name:</b>		<b>TechPort:</b>	Yes
<b>Human Research Program Elements:</b>	(1) <b>HFBP</b> :Human Factors & Behavioral Performance (IRP Rev H)		
<b>Human Research Program Risks:</b>	(1) <b>BMed</b> :Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders (2) <b>Sleep</b> :Risk of Performance Decrements and Adverse Health Outcomes Resulting from Sleep Loss, Circadian Desynchronization, and Work Overload		
<b>Space Biology Element:</b>	None		
<b>Space Biology Cross-Element Discipline:</b>	None		
<b>Space Biology Special Category:</b>	None		
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<b>Comments:</b>			
<b>Project Type:</b>	FLIGHT	<b>Solicitation / Funding Source:</b>	Directed Research
<b>Start Date:</b>	08/01/2008	<b>End Date:</b>	07/31/2013
<b>No. of Post Docs:</b>		<b>No. of PhD Degrees:</b>	1
<b>No. of PhD Candidates:</b>		<b>No. of Master' Degrees:</b>	
<b>No. of Master's Candidates:</b>		<b>No. of Bachelor's Degrees:</b>	
<b>No. of Bachelor's Candidates:</b>		<b>Monitoring Center:</b>	NASA JSC
<b>Contact Monitor:</b>	Shea, Camile	<b>Contact Phone:</b>	281-244-2017
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<b>Flight Program:</b>	ISS		
<b>Flight Assignment:</b>	ISS NOTE: start/end dates changed per J. Dardano/JSC --previously 4/30/2008-8/31/2013 (4/16/2009)		
<b>Key Personnel Changes/Previous PI:</b>	Mathias Basner, MD, MSc, was added as Co-P.I.		
<b>COI Name (Institution):</b>	Basner, Mathias ( University of Pennsylvania School of Medicine )		
<b>Grant/Contract No.:</b>	NNX08AY09G		
<b>Performance Goal No.:</b>			
<b>Performance Goal Text:</b>			

Task Description:	<p>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 ultimate goal of the Reaction Self Test project is to validate the sensitivity of the PVT Self Test on astronauts on ISS so they can use it 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. 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 &gt;0 and &lt;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 sensitive to fatigue from work intensity during ISS missions. This will include the following conditions evaluated individually and in aggregate: i) extend 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 declines with time in mission. 4) To explore the extent to which PVT Self Test performance of astronauts will be sensitive to the carry-over effects of medications for sleep on ISS. 5) To evaluate the extent to which PVT Self Test performance feedback (via a graphical interface) is perceived by ISS astronauts as a useful tool for assessing performance capability.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	<p>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. There are currently 180 published peer-review papers on the sensitivity of the 10-min. PVT to fatigue-related factors. The Reaction Self Test is a 3-minute PVT Self Test that contains special timing and algorithm characteristics and that has been validated against the 10-minute PVT. The 3-minute 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.).</p>
Task Progress:	<p>Data acquisition began in September 2009 with Expedition 21-22, and has extended to soliciting astronauts in Expeditions 22-23, 23-24, 24-25, and 25-26. To date N=11 astronauts have given informed consent for the project. Baseline data collection is underway or been completed on all N=11 astronauts, and N=7 of these completed the baseline data acquisition period with an average 89% data completion rate (i.e., 162/182 scheduled Reaction Self Tests were completed). Most missing data pertained to the week immediately prior to flight (L-7 to L-1). In flight data acquisition has been underway or completed on N=4 astronauts. A total of 237 Reaction Self Tests have been completed in flight, out of an expected 336 scheduled tests in flight (i.e., 71%). Additional data may be forthcoming in ISS downloads of data from different ISS SSCs. Post-flight data has not yet been aggregated to gain an estimate of completion rates.</p>
Bibliography Type:	Description: (Last Updated: 03/24/2024)
Abstracts for Journals and Proceedings	<p>Dinges DF, Mollicone D, Ecker A, Basner M. "Development of the PVT Self Test for Fatigue Management--A Critical Role for Analogs." Presented at the Aerospace Medical Association's 81st Annual Scientific Meeting, Phoenix, AZ, May 9-12, 2010. Aviation, Space, and Environmental Medicine, 2010 Mar;81(3):246. , Mar-2010</p>
Articles in Peer-reviewed Journals	<p>Lim J, Tan JC, Parimal S, Dinges DF, Chee MW. "Sleep deprivation impairs object-selective attention: A view from the ventral visual cortex." PLoS One. 2010 Feb 5;5(2):e9087. <a href="http://dx.doi.org/10.1371/journal.pone.0009087">http://dx.doi.org/10.1371/journal.pone.0009087</a> ; PMID: <a href="https://pubmed.ncbi.nlm.nih.gov/20140099/">20140099</a> , Feb-2010</p>
Articles in Peer-reviewed Journals	<p>Lim J, Wu W-C, Wang J, Detre JA, Dinges DF, Rao H. "Imaging brain fatigue from sustained mental workload: an ASL perfusion study of the time-on-task effect." Neuroimage. 2010 Feb 15;49(4):3426-35. <a href="http://dx.doi.org/10.1016/j.neuroimage.2009.11.020">http://dx.doi.org/10.1016/j.neuroimage.2009.11.020</a> ; PMID: <a href="https://pubmed.ncbi.nlm.nih.gov/19925871/">19925871</a> , Feb-2010</p>
Articles in Peer-reviewed Journals	<p>Lim J, Dinges DF. "A meta-analysis of the impact of short-term sleep deprivation on cognitive variables." Psychological Bulletin, 2010 May;136(3):375-89. <a href="http://dx.doi.org/10.1037/a0018883">http://dx.doi.org/10.1037/a0018883</a> ; PMID: <a href="https://pubmed.ncbi.nlm.nih.gov/20438143/">20438143</a> , May-2010</p>