

<b>Fiscal Year:</b>	FY 2015	<b>Task Last Updated:</b> FY 05/28/2015	
<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		
<b>PI Email:</b>	<a href="mailto:dinges@pennmedicine.upenn.edu">dinges@pennmedicine.upenn.edu</a>	<b>Fax:</b>	FY
<b>PI Organization Type:</b>	UNIVERSITY	<b>Phone:</b>	215-898-9949
<b>Organization Name:</b>	University of Pennsylvania		
<b>PI Address 1:</b>	Department of Psychiatry		
<b>PI Address 2:</b>	423 Service Dr., 1013 Blockley Hall		
<b>PI Web Page:</b>			
<b>City:</b>	Philadelphia	<b>State:</b>	PA
<b>Zip Code:</b>	19104-4209	<b>Congressional District:</b>	2
<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>	03/31/2017
<b>No. of Post Docs:</b>		<b>No. of PhD Degrees:</b>	
<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>	Leveton, Lauren	<b>Contact Phone:</b>	
<b>Contact Email:</b>	<a href="mailto:lauren.b.leveton@nasa.gov">lauren.b.leveton@nasa.gov</a>		
<b>Flight Program:</b>	ISS		
<b>Flight Assignment:</b>	ISS NOTE: End date is now 3/31/2017 per NSSC information (Ed., 5/5/14) NOTE: End date is now 7/31/2014 per PI (Ed., 5/3/2013) 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>			
<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>			

<b>Task Description:</b>	<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 International Space Station (ISS) missions, as well as recording their subjective ratings of workload, sleep timing and quality, tiredness, fatigue, and stress. The PVT Self Test is suited for repeated use in spaceflight because unlike other cognitive tests, it is very brief (3-5 minutes) while being free of learning effects and aptitude differences that make interpretation of other cognitive measures difficult.</p> <p>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:</p> <ol style="list-style-type: none"> <li>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 above 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.</li> <li>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).</li> <li>3) To evaluate the extent to which PVT Self Test performance of astronauts declines with time in mission.</li> <li>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.</li> <li>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.</li> </ol>
<b>Rationale for HRP Directed Research:</b>	<p>The PI developed the original 10-minute Psychomotor Vigilance Test (PVT), from which the Reaction Self Test was derived, 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.</p> <p>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).</p>
<b>Research Impact/Earth Benefits:</b>	<p>Data acquisition is complete for 24 of the 26 enrolled subjects and data collection is underway for the remaining two subjects. The target sample size was originally N=24 but has now been extended to N=26 to include the two 12 month mission subjects. As of March 31, 2015, all 26 astronauts have given informed consent for the project. On the date of the last data download from ISS (December, 2014), baseline data collection has been completed in N=26 astronauts. N=24 astronauts have completed in-flight data acquisition. N=24 astronauts have completed post-flight data acquisition. 507 Reaction Self Tests were performed pre-flight, 2109 Reaction Self Tests were performed in-flight, and 353 Reaction Self Tests were performed post-flight. We have de-briefed 24 astronauts post-flight and gained important insights on astronauts' perception of the Reaction Self Test. Preliminary results were shown to Dr. Mark Shelhamer (NASA) at his request to supply evidence for the need of longer duration missions on ISS (i.e., 1 year mission) to study the dynamic behavioral changes of astronauts living and working on ISS. The PI gave permission to Dr. Shelhamer to present preliminary data at the Aerospace Medicine conference. Additionally, preliminary results were also shown to Dr. Lauren Leveton (NASA Behavior, Health, and Performance--BHP).</p> <p>Pulsar Informatics, Inc. has established a quality control process that extracts the data of every PVT SelfTest bout immediately after it was downloaded to allow plausibility and compliance checks. Momentarily, Pulsar Informatics, Inc. generates graphs for each individual astronaut containing information on PVT performance, scheduled and self-reported sleep times, critical mission events, and self-reported measures (like perceived stress levels and workload). These graphs are used for astronaut debriefs.</p> <p>We have made several changes to the Reaction SelfTest software based on astronaut feedback during debriefs. We designed changes to the user interface to ease the burden of data entry, with updates to functionality such as sliding scales and drop down menus. We also modified the questionnaires in the software to exclude questions that astronauts felt were extraneous.</p>
<b>Task Progress:</b>	<p>Data acquisition is complete for 24 of the 26 enrolled subjects and data collection is underway for the remaining two subjects. The target sample size was originally N=24 but has now been extended to N=26 to include the two 12 month mission subjects. As of March 31, 2015, all 26 astronauts have given informed consent for the project. On the date of the last data download from ISS (December, 2014), baseline data collection has been completed in N=26 astronauts. N=24 astronauts have completed in-flight data acquisition. N=24 astronauts have completed post-flight data acquisition. 507 Reaction Self Tests were performed pre-flight, 2109 Reaction Self Tests were performed in-flight, and 353 Reaction Self Tests were performed post-flight. We have de-briefed 24 astronauts post-flight and gained important insights on astronauts' perception of the Reaction Self Test. Preliminary results were shown to Dr. Mark Shelhamer (NASA) at his request to supply evidence for the need of longer duration missions on ISS (i.e., 1 year mission) to study the dynamic behavioral changes of astronauts living and working on ISS. The PI gave permission to Dr. Shelhamer to present preliminary data at the Aerospace Medicine conference. Additionally, preliminary results were also shown to Dr. Lauren Leveton (NASA Behavior, Health, and Performance--BHP).</p> <p>Pulsar Informatics, Inc. has established a quality control process that extracts the data of every PVT SelfTest bout immediately after it was downloaded to allow plausibility and compliance checks. Momentarily, Pulsar Informatics, Inc. generates graphs for each individual astronaut containing information on PVT performance, scheduled and self-reported sleep times, critical mission events, and self-reported measures (like perceived stress levels and workload). These graphs are used for astronaut debriefs.</p> <p>We have made several changes to the Reaction SelfTest software based on astronaut feedback during debriefs. We designed changes to the user interface to ease the burden of data entry, with updates to functionality such as sliding scales and drop down menus. We also modified the questionnaires in the software to exclude questions that astronauts felt were extraneous.</p>
<b>Bibliography Type:</b>	Description: (Last Updated: 05/08/2025)
<b>Abstracts for Journals and Proceedings</b>	<p>Dinges DF, Basner M, Mollicone DJ, Ecker AJ, Jones CW, Hyder EC, DiAntonio A, Savelev I, Kan K, Morukov BV, Sutton JP. "Reaction Self-Test (RST) results from astronauts on ISS compared to RST assessments from the crew of the 520-day simulated mission to Mars." Presented at 2015 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 13-15, 2015.</p> <p>2015 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 13-15, 2015. , Jan-2015</p>