

Fiscal Year:	FY 2016	Task Last Updated: FY 06/01/2016	
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 RESEARCH--Behavior and performance		
Joint Agency Name:		TechPort:	Yes
Human Research Program Elements:	(1) HFBP :Human Factors & Behavioral Performance (IRP Rev H)		
Human Research Program Risks:	(1) BMed :Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders (2) Sleep :Risk of Performance Decrements and Adverse Health Outcomes Resulting from Sleep Loss, Circadian Desynchronization, and Work Overload		
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:	12/31/2017
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:	ISS		
Flight Assignment:	ISS NOTE: End date is now 12/31/2017 per K. Ohnesorge/JSC HRP (Ed., 3/9/17) NOTE: Element change to Human Factors & Behavioral Performance; previously Behavioral Health & Performance (Ed., 1/18/17) 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)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Basner, Mathias (University of Pennsylvania School of Medicine)		
Grant/Contract No.:	NNX08AY09G		
Performance Goal No.:			

Performance Goal Text:	
Task Description:	<p>The Psychomotor Vigilance (PVT) Self Test (operational name on International Space Station (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. 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"> 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 >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 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.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	<p>The Principal Investigator (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. 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>
Task Progress:	<p>The Reaction Self Test (RST) observational study on ISS astronauts resulted in data being acquired on a total of N = 24 astronauts flying on N = 19 ISS increments from 2009 to 2013. Data acquisition yielded a total of 2,856 RST evaluations obtained throughout the ~6-month pre-flight period, ~6-month in-flight period, and up to 3 months post-flight (i.e., 78.9% of all scheduled RSTs and 83.8% of all scheduled RSTs in-flight). An overall adherence rate of = 75% was determined a priori to be sufficient to ensure valid data and meet project goals. The project achieved the targeted goal of providing extensive data on astronauts' perceived sleep times and sleep quality; their sleep and pain medication intake; their neurobehavioral alertness and psychomotor speed (via PVT-B performance); and variations in their perceptions of their basic behavioral states (i.e., sleepiness, workload, fatigue, exhaustion, tiredness, and stress). The project also fulfilled the requirement from a pre-study scientific review by a NASA-convened Non-Advocate Review (NAR) Panel that required the minimum of RST testing on ISS needed to be twice a day, every 4 days in-flight, and at prescribed times pre-flight and post-flight. The NAR Panel considered this RST assessment rate to be essential to ensure the study would address high-priority NASA research gaps related to the effects of fatigue from sleep loss, poor sleep quality, high workload, and time in mission on astronaut behavioral alertness and performance. The resulting RST data acquisition was sufficient for comprehensive data analyses and interpretation of results, which included 2,109 completed RSTs in-flight. With the exception of assessing the effects of EVAs (extravehicular activities) on RST outcomes (due to too little data), sufficient RST data was acquired for evaluating all project Specific Aims.</p>
Bibliography Type:	Description: (Last Updated: 05/08/2025)