Fiscal Year:	FY 2011	**Task Last Updated:**	FY 05/04/2011
PI Name:	Dinges, David F. Ph.D.		
Project Title:	Countermeasures for Performance Deficits from Sleep Loss and Workload in Space Flight		
Division Name:	Human Research		
Program/Discipline:	NSBRI		
Program/Discipline--Element/Subdiscipline:	NSBRI--Human Factors and Performance Team		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **BHP**:Behavioral Health & Performance (archival in 2017)		
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		
PI Email:	dinges@pennmedicine.upenn.edu	**Fax:**	FY
PI Organization Type:	UNIVERSITY	**Phone:**	215-898-9949
Organization Name:	University of Pennsylvania		
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City:	Philadelphia	**State:**	PA
Zip Code:	19104-4209	**Congressional District:**	2
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2007 Crew Health NNJ07ZSA002N
Start Date:	06/01/2008	**End Date:**	09/30/2012
No. of Post Docs:	1	**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:**	11
No. of Bachelor's Candidates:	45	**Monitoring Center:**	NSBRI
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:	NOTE: End date change to 9/30/2012 (from 5/31/2012) per NSBRI (Ed., 1/24/2012)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Banks, Siobhan (University of Pennsylvania Health System) Goel, Namni (University of Pennsylvania)		
Grant/Contract No.:	NCC 9-58-HFP01602		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	In order to be able to carry out mission-critical tasks at any time during a mission, astronauts must maintain a high level of performance in the face of demanding workloads and work-rest schedules that result in chronic sleep restriction. The proposed research will use a laboratory-based study to acquire critically-needed information on the effects on performance of high cognitive workload and sleep restriction (Specific Aim 1). We will test the hypothesis that as sleep restriction accumulates, it will potentiate the performance-impairing effects of higher cognitive workload. Another key goal of the study is to provide astronauts with an objective way to identify performance changes and the need for countermeasures for fatigue from sleep restriction and high workload. To this end, the project will complete validation of the sensitivity of the 3-minute PVT Self Test to high workload and sleep restriction. PVT Self Test feedback interfaces will also be evaluated, and the task will be tested in analog operations to establish its technical feasibility (Specific Aim 2). Tertiary goals of the project include identification of biobehavioral predictors of differential vulnerability to the cognitive effects of sleep restriction and high workload (Specific Aim 3), and development of individualized biomathematical models that predict performance on the PVT Self Test during high workload (Specific Aim 4). The project has primary relevance to the strategic goals of the NSBRI Human Factors and Performance (HFP) Team. To date N=59 (of the N=80 total subjects to be tested) have completed the laboratory protocol; thus the project is 73.75% completed. Data acquisition will continue at this rate in the coming year to ensure the project ends with the required number of subjects needed to evaluate the effects of high cognitive workload and sleep restriction on performance.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The research builds on an extensive body of work we have conducted to help manage the cognitive performance of astronauts in space while they undergo high workload and sleep restriction. The acquisition of critically needed knowledge on how these factors potentiate fatigue effects on performance will help set standards and improve individualized mathematical models that predict countermeasure needs. The continued development of the PVT Self Test will offer a tool by which astronauts can autonomously assess their performance fitness and make decisions about countermeasures. These deliverables will also have utility in a broad range of Earth-based applications in which sleep restriction and workload have major adverse impacts on human performance (e.g., transportation modes, power plants, military operations).
Task Progress:	The project is on schedule in terms of recruitment and data collection in the study has occurred without incident. This year, N=19 healthy adults have completed the 11-day experimental protocol (for a total of 209 laboratory days). Thus, collectively across 3 years, N=59 healthy adults have completed the 11-day experimental protocol (for a total of 649 laboratory days). We expect to recruit another 20 subjects (for an additional 220 laboratory days) in the upcoming grant year. Throughout the 11-day experimental protocol, in which subjects are under continuous behavioral monitoring, we collect a large number of neurobehavioral and physiological tests to determine the effects of cognitive workload. These include the following: the 10-minute Psychomotor Vigilance Test (PVT) and the PVT Self Test, which assess vigilant attention; a modified version of the Maintenance of Wakefulness Test (MWT), which lasts 30 minutes and assesses sleep propensity during waking; the Karolinska Sleepiness Scale (KSS); executive function tests that relate to prefrontal cortex functioning; cardiac measurements of heart rate and heart rate variability; polysomnography; power spectral analysis of non-REM slow-wave activity; waking EEG; and blood draws for biomarker identification.
Bibliography Type:	Description: (Last Updated: 04/24/2024)
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