Fiscal Year:	FY 2022	**Task Last Updated:**	FY 03/03/2022
PI Name:	Basner, Mathias M.D., Ph.D.		
Project Title:	Temporal Nature of Cognitive and Visuospatial Brain Domain Changes During Long-Duration Low-Earth Orbit Missions		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
Joint Agency Name:		**TechPort:**	No
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) **Sensorimotor**:Risk of Altered Sensorimotor/Vestibular Function Impacting Critical Mission Tasks		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	basner@pennmedicine.upenn.edu	**Fax:**	FY
PI Organization Type:	UNIVERSITY	**Phone:**	215-573-5866
Organization Name:	University of Pennsylvania		
PI Address 1:	Department of Psychiatry, Division of Sleep and Chronobiology		
PI Address 2:	423 Service Dr, 1013 Blockley Hall		
PI Web Page:			
City:	Philadelphia	**State:**	PA
Zip Code:	19104-4209	**Congressional District:**	2
Comments:			
Project Type:	FLIGHT	**Solicitation / Funding Source:**	2017-2018 HERO 80JSC017N0001-BPBA Topics in Biological, Physiological, and Behavioral Adaptations to Spaceflight. Appendix C
Start Date:	06/01/2019	**End Date:**	12/31/2027
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
Contact Monitor:	Whitmire, Alexandra	**Contact Phone:**	
Contact Email:	alexandra.m.whitmire@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: End date changed to 12/31/2027 per NSSC information (Ed., 1/27/21)		
Key Personnel Changes/Previous PI:			

COI Name (Institution):	Dinges, David Ph.D. (University of Pennsylvania) Gunga, Hanns-Christian M.D. (Charite - Universitatsmedizin Berlin, Germany) Gur, Ruben Ph.D. (The Trustees of the University of Pennsylvania) Hartley, Tom Ph.D. (University of York, United Kingdom) Kuehn, Simone Ph.D. (Max Planck Institute for Human Development, Berlin, Germany) Moore, Tyler Ph.D. (Trustees of Tufts College) Riecke, Bernhard Ph.D. (Simon Fraser University, Canada) Roalf, David Ph.D. (University of Pennsylvania) Wolbers, Thomas Ph.D. (German Center for Neurodegenerative Diseases, Germany) Stahn, Alexander Ph.D. (Charite - Universitatsmedizin Berlin, Germany (University of Pennsylvania)) Bell, Suzanne (NASA) Whiting, Sara (NASA)
Grant/Contract No.:	80NSSC19K1046
Performance Goal No.:	
Performance Goal Text:	
Task Description:	This is an international proposal consisting of 2 projects with synergistic aims that will be carried out in a joint effort by Deutsches Zentrum für Luft- und Raumfahrt (DLR: German Aerospace Center)/European Space Agency (ESA) and NASA. It addresses the Human Research Program (HRP) Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders, Human Research Program's requirement to demonstrate the presence or absence of unacceptable deleterious neurocognitive effects beyond the experience base of six-month expeditions, and to permit extrapolation to early interplanetary expeditions. It also addresses several other critical Human Research Program risks and gaps (e.g., BMed1, BMed2, BMed3, BMed5, CNS-1, SM26). More specifically, we will target NASA's particular interest in studying the 'Cognitive-perceptual-visuospatial brain domain changes due to isolation and confinement' as part of the integrated One-Year Mission Project (i1YMP) on the International Space Station (ISS). The data we propose to collect will - for the first time - reliably demonstrate whether prolonging mission duration to one year will have detrimental effects on general cognitive performance (measured with the Cognition test battery), spatial cognition, structural and functional brain changes in general, and hippocampal plasticity more specifically relative to the shorter 6-month and 2-month missions. Using state-of-the-art neuroimaging techniques (that include functional magnetic resonance imaging (fMRI) while performing the Cognition test battery in the scanner)), we will determine the biological basis for any changes in cognitive performance, with a focus on hippocampal plasticity. Similar data already gathered on the ISS and in several short- and long-duration space analog environments will be used to generate a normative data base for long-duration missions. Finally, we will derive dose-response relationships between cognitive-visuospatial brain domain changes and mission duration that will allow predicting vulnerability to adverse cognitive or behavioral impairment and psychiatric disorders on interplanetary expeditions such as a mission to Mars. The two 7-yr projects will deliver a highly unique and comprehensive set of integrated neuroimaging and neurocognitive tools for the evaluation and ultimately prevention of adverse effects on brain structure and function that lead to behavioral effects associated with exploration-type missions.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The two 7-yr projects will deliver a highly unique and comprehensive set of integrated neuroimaging and neurocognitive tools for the evaluation and ultimately prevention of adverse effects on brain structure and function that lead to behavioral effects associated with exploration-type missions. As the Cognition test battery was developed for high-performing subject populations, this work will also translate to high performing populations on Earth (e.g., physicians, submariners).
Task Progress:	The integrated Project A&B magnetic resonance imaging (MRI) protocol was finalized, which is ready for deployment at the Victory Lakes facility of the University of Texas Medical Branch. Video materials for NASA's Research Operations and Integration (ROI) for an integrated informed consent briefing were prepared. We are waiting for the first astronaut to consent. We are ready to set up the scanner at Victory Lakes once we have our first confirmed study participant. The goal is to set up the scanner as close to the first scan as possible as software and hardware changes are always possible and might require setting up the scanner again.
Bibliography Type:	Description: (Last Updated: 04/05/2024)