Fiscal Year:	FY 2019	**Task Last Updated:**	FY 07/01/2019
PI Name:	Dinges, David F. Ph.D.		
Project Title:	NSCOR for Evaluating Risk Factors and Biomarkers for Adaptation and Resilience to Spaceflight: Emotional Valence and Social Processes in ICC/ICE Environments		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline-- Element/Subdiscipline:	HUMAN RESEARCH--Behavior and performance		
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) **Team**:Risk of Performance and Behavioral Health Decrements Due to Inadequate Cooperation, Coordination, Communication, and Psychosocial Adaptation within a Team		
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
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City:	Philadelphia	**State:**	PA
Zip Code:	19104-4209	**Congressional District:**	2
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2016-2017 HERO NNJ16ZSA001N-Crew Health (FLAGSHIP, OMNIBUS). Appendix A-Omnibus, Appendix B-Flagship
Start Date:	09/05/2017	**End Date:**	09/04/2021
No. of Post Docs:	2	**No. of PhD Degrees:**	1
No. of PhD Candidates:	1	**No. of Master' Degrees:**	0
No. of Master's Candidates:	1	**No. of Bachelor's Degrees:**	4
No. of Bachelor's Candidates:	33	**Monitoring Center:**	NASA JSC
Contact Monitor:	Williams, Thomas	**Contact Phone:**	281-483-8773
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:	July 2018 report: 1) Replaced Dr. Tom Williams with Dr. Pete Roma as Co-Investigator/Institutional PI at Johnson Space Center (JSC). 2) Replaced Dr. Tom Williams with Dr. Bradley C. Nindl as NSCOR Co-Director. 3) Replaced Dr. Brandon Vessey as Co-Investigator with Dr. Lauren Landon as Co-Investigator at JSC. 4) Added Dr. Alexandra Whitmire as Co-Investigator. 5) Added Diana Arias to role of Support for initiating Wyle subcontracts at JSC. 6) Replaced Dr. Sarah McGuire with Dr. Mathias Basner as NSCOR ICARUS Site Environmental Lead in Dr. Dinges' Lab at the University of Pennsylvania. 7) Added Dr. Brian Martin to role of Co-Investigator in Dr. Nindl's laboratory at the University of Pittsburgh. 8) Added Meaghan E. Beckner to role of PhD Research Fellow in Dr. Nindl's laboratory at the University of Pittsburgh. 9) Added Nathaniel Hodgson, PhD to role of Post-Doc in Dr. Hensch's laboratory Harvard Boston Children's Hospital. 10) Added Gervasio Batista, PhD to role of Post-Doc in Dr. Hensch's laboratory at Harvard Boston Children's Hospital.		

COI Name (Institution):	Basner, Mathias M.D., Ph.D. (University of Pennsylvania) Bilker, Warren Ph.D. (University of Pennsylvania) Chouker, Alexander M.D. (University of Munich) Elliott, Mark Ph.D. (University of Pennsylvania) Feiveson, Alan Ph.D. (NASA Johnson Space Center) Flanagan, Shawn Ph.D. (University of Pittsburgh) Gehrman, Philp Ph.D. (University of Pennsylvania) Gunga, Hanns-Christian M.D. (Charite - Universitatsmedizin Berlin) Gur, Ruben Ph.D. (University of Pennsylvania) Kuehn, Simone Ph.D. (University Clinic Hamburg-Eppendorf) Landon, Lauren Ph.D. (Wyle/NASA Johnson Space Center) Nindl, Bradley Ph.D. (University of Pittsburgh) Roalf, David Ph.D. (University of Pennsylvania) Schneiderman, Jason Ph.D. (Wyle/NASA Johnson Space Center) Stahn, Alexander Ph.D. (University of Pennsylvania) Hensch, Takao Ph.D. (Boston Children's Hospital) Roma, Peter Ph.D. (KBRWyle/NASA Johnson Space Center) Whitmire, Alexandra Ph.D. (KBRwyle/NASA Johnson Space Center) Martin, Brian Ph.D. (University of Pittsburgh)
Grant/Contract No.:	80NSSC17K0644
Performance Goal No.:	
Performance Goal Text:	
Task Description:	NASA's vision for successful long-duration exploration missions (LDEM) depends on optimizing human performance, adaptability, and resiliency to reduce individual and crew behavioral risks. To date, the major emphasis in optimizing astronauts for their tolerance to prolonged spaceflight has involved human health and performance countermeasures as well as technologies and tools to ensure safety during exploration. However, considerable evidence suggests that there are individual differences among astronauts in their vulnerabilities to the various stressors of spaceflight. The goal of the proposed NSCOR (NASA Specialized Center of Research) is to obtain novel information that will help identify individuals who are resilient to the stressors of prolonged human spaceflight, thereby ensuring successful completion of exploration missions and the preservation of astronaut health over the life of the astronaut. This NSCOR project leverages the NIMH (National Instsitute of Mental Health) Research Domain Criteria (RDoC) heuristic framework to conduct experimental studies to identify biological domains (molecular, circuitry, physiology) and behavioral domains that relate to individual adaptation and resiliency (as well as behavioral vulnerability) in spaceflight-relevant confined and extreme environments (ICC and ICE). The NSCOR focuses specifically on differences among astronauts in their tolerance of and adaptability to simulated conditions of prolonged spaceflight that impact behavioral health and performance. The NSCOR will provide novel information on the extent to which behavioral and biological factors can be identified that predict astronauts who can maintain positive mood, proactive social processes, a high level of performance and personal well-being, while coping with confinement, meaningless work, limited social support, and living in the extreme environmental conditions of space. By utilizing the RDoC framework, three different human confinement analogs and an animal model, the NSCOR will generate data converging on biomarkers of neurobehavioral and neurobiological resilience to the spaceflight conditions. Such a discovery will help in selecting astronauts most likely to maintain human health and performance during long-duration exploration missions.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	This project will benefit the spaceflight community, specifically humans involved in spaceflight, by providing information that will help characterize the three less well-understood NIMH RDoC domains related to positive valence, negative valence, and social processes as they relate to performance, adaptation, and resilience of individuals living and working in ICC/ICE environments. We will identify predictive indicators and biomarkers for resilience and adaptation in individuals to aid in selection and individualized countermeasure development with the goal to maintain and optimize performance capability and behavioral health during Long Duration Exploration Missions.
Task Progress:	Animal Model: During the past year, Hensch and colleagues established molecular and behavioral biomarkers to assess confinement stress. First, we validated the accuracy with which peripheral measures of oxidative stress reflect brain levels. Isoprostanes are prostaglandin-like compounds detectable in urine formed from the free radical-catalyzed peroxidation of essential fatty acids such as lipids in both animal and human models of oxidative stress. Second, using a machine learning approach, we defined objective parameters associated with sociability. While dyadic assays have been used as a proxy of sociability in mice, this standardized test does not capture the true complexity of social behaviors that occur in groups. Social network analysis (SNA) uses graph theory to investigate the structure of social groups. This analytical approach is capable, for example, of identifying network participants that are more sociable or more likely to generate new social relationships. Human Analogs: Over the 4-year project period, N=90 healthy adult subjects (male and female, aged 30-55 years) will have been exposed to stressors that vary in intensity and duration, while living in one of the three ICC/ICE sites. Site 1 is the Isolation, Confinement, Analog Research Unit for Spaceflight (ICARUS) located at the University of Pennsylvania (Penn). Site 2 is NASA's Human Exploration Research Analog (HERA) at Johnson Space Center (JSC). Site 3 is the German Antarctic station Neumayer-Station III (Neumayer). By having three analogs that vary in key ways relative to spaceflight stressors, we will be able to determine whether RDoC assessments of neural circuitry and biomarkers will vary with indices of adaptability and resilience by analog context and conditions. During the reporting period for this Annual Report (9/5/2018-9/5/2019), all three human research sites (and the animal site at Harvard) initiated data collection. The investigator team held weekly/bi-weekly telecons (N=28) to discuss and resolve important issues related to data acquisition. This enabled the team to update its scheduled study runs as well as

refine its list of biological biomarkers and questionnaires. Thus, in the past year, the NSCOR team finalized protocols, secured IRB (Institutional Review Board) approvals, implemented measures at each site, ordered essential materials and equipment, screened and empaneled study participants, and initiated data collection. There have been a total of n=29 human subjects run through this NSCOR project across all three sites over the past year. This includes n=2 subjects who withdrew resulting in an overall completion rate of 93%. Across NSCOR human research sites there has been a high rate of subject compliance to biological measures including MRI scans, blood draws, urine samples, and saliva collection.

Bibliography Type:	Description: (Last Updated: 03/24/2024)
Abstracts for Journals and Proceedings	Dinges D, Basner M, Stahn A, Roma P, Hensch T, Nindl B, Flanagan S, Martin B, Gur R, Cordoza M, Bilker W. "NSCOR for evaluating risk factors and biomarkers for adaptation and resilience to spaceflight: Emotional valence and social processes in ICC/ICE environments." Poster presentation at the 2019 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 22-25, 2019. 2019 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 22-25, 2019. , Jan-2019
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Abstracts for Journals and Proceedings	Roma PG, Landon LB, Schneiderman JS. "Overview of NASA Behavioral Health & Performance Standard Measures." Presentation at the 2019 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 22-25, 2019. 2019 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 22-25, 2019. , Jan-2019
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