

<b>Fiscal Year:</b>	FY 2020	<b>Task Last Updated:</b> FY 05/20/2020	
<b>PI Name:</b>	Dinges, David F. Ph.D.		
<b>Project Title:</b>	Standardized Behavioral Measures for Detecting Behavioral Health Risks during Exploration Missions		
<b>Division Name:</b>	Human Research		
<b>Program/Discipline:</b>			
<b>Program/Discipline--Element/Subdiscipline:</b>	HUMAN RESEARCH--Behavior and performance		
<b>Joint Agency Name:</b>	<b>TechPort:</b>	No	
<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>Team</b> :Risk of Performance and Behavioral Health Decrements Due to Inadequate Cooperation, Coordination, Communication, and Psychosocial Adaptation within a Team		
<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,GROUND	<b>Solicitation / Funding Source:</b>	2013-14 HERO NNJ13ZSA002N-BMED Behavioral Health & Performance
<b>Start Date:</b>	07/21/2015	<b>End Date:</b>	09/30/2022
<b>No. of Post Docs:</b>	0	<b>No. of PhD Degrees:</b>	0
<b>No. of PhD Candidates:</b>	0	<b>No. of Master' Degrees:</b>	0
<b>No. of Master's Candidates:</b>	0	<b>No. of Bachelor's Degrees:</b>	0
<b>No. of Bachelor's Candidates:</b>	0	<b>Monitoring Center:</b>	NASA JSC
<b>Contact Monitor:</b>	Williams, Thomas	<b>Contact Phone:</b>	281-483-8773
<b>Contact Email:</b>	<a href="mailto:thomas.j.will1@nasa.gov">thomas.j.will1@nasa.gov</a>		
<b>Flight Program:</b>	ISS		
<b>Flight Assignment:</b>	NOTE: End date changed to 9/30/2022 per L. Barnes-Moten/JSC (Ed., 4/7/21) NOTE: End date changed to 2/28/2021 per PI and NSSC information (Ed., 5/20/2020) NOTE: End date changed to 2/28/2020 per NSSC information (Ed., 5/22/19) NOTE: End date changed to 7/20/2019 per NSSC information (Ed., 8/10/18) NOTE: Element change to Human Factors & Behavioral Performance; previously Behavioral Health & Performance (Ed., 1/18/17)		
<b>Key Personnel Changes/Previous PI:</b>			

<b>COI Name (Institution):</b>	Basner, Mathias M.D. ( University of Pennsylvania ) Mollicone, Daniel Ph.D. ( Pulsar Informatics, Inc. ) Stuster, Jack Ph.D. ( Anacapa Sciences, Inc. ) Strangman, Gary Ph.D. ( Harvard Medical School ) Stahn, Alexander Ph.D. ( University of Pennsylvania ) Roma, Peter Ph.D. ( KBRwyle / NASA Johnson Space Center ) Gur, Ruben Ph.D. ( University of Pennsylvania )
<b>Grant/Contract No.:</b>	NNX15AK76A
<b>Performance Goal No.:</b>	
<b>Performance Goal Text:</b>	
<b>Task Description:</b>	<p>Isolated and confined environments anticipated during exploration missions will include stressors such as small teams living and working in extreme conditions for prolonged periods separated from family and friends; loss of the day/light cycle; loss or delay of communications with ground; transitions in and out of partial gravity; and limited space, privacy, and food selection. NASA's Human Factors and Behavioral Performance Element seeks to maintain and enhance behavioral health and performance in such environments. The behavioral risk (Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders) is a high priority within the NASA Human Research Program (HRP) because it has face validity, but lacks sufficient evidence due to a deficiency in measurement of the risk. Thus, there is concern that the behavioral health of the crew will be challenged in a Mars mission, however there is no standardized method to detect and quantify the magnitude of the risk or its likelihood.</p> <p>The overarching goal of this project is to build on a successful record of software-based measurement of behavioral health indicators (e.g., mood, cognitive function, performance, physical and mental fatigue, sleep quality) in order to develop a complementary standardized suite of behavioral core measures (SBM) that would be quite feasible to implement within the constraints of spaceflight research, ground-based analogs (both short and long-duration), and prolonged missions in isolated, confined, extreme environments lasting up to 12 months or longer. Achievement of this goal would permit a more rapid and reliable assessment and quantification of the Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Outcomes for exploration class missions. The standardized behavioral medicine measures we are developing will be similar to the guidelines for standardization for bed-rest studies. Defining standardized measures will not only allow for the systematic collection of data across multiple analogs, but it will also facilitate risk characterization for the Behavioral Medicine (BMed) risk. Without a standardized suite of behavioral health measures, the unknown BMed risk for exploration-class missions will continue to be estimated based on anecdote and conjecture.</p> <p>The elements of the SBM include the following:</p> <p>(1) The Cognition test battery (a suite of 10 brief neuropsychological tests specifically designed for astronauts), (2) Actigraphy sleep/wake data, (3) Visual analog scales and brief questionnaires with proven validity and utility in space and space analog environments, (4) Journals (Audio/Video and/or typed), (5) The Robotic On-Board Trainer for Research (ROBoT-r, a robotic arm track-and-capture grappling task), (6) Team Measure Questionnaires designed to measure aspects of crew performance, team processes, team climate, and group living.</p>
<b>Rationale for HRP Directed Research:</b>	
<b>Research Impact/Earth Benefits:</b>	<p>This project will deliver a suite of Standardized Behavioral Measures (SBM) that will be tested for feasibility, flexibility, and acceptability in research studies in both short and long duration space analog environments and on the International Space Station (ISS). With the SBM, it will be possible for NASA's HFBP (Human Factors &amp; Behavioral Performance) program to much better assess and quantify the Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Outcomes for exploration class missions.</p> <p>With the proposed work we will relevantly contribute to HRP's goal to provide human health and performance countermeasures, knowledge, technologies, and tools to enable safe, reliable, and productive human space exploration. More specifically, the SBM will constitute an important technology to provide mission planners and system developers with strategies for monitoring and mitigating crew health and performance risks.</p> <p>Additionally, Standardized Behavioral Measures could be beneficial for monitoring behavioral health during Earth-based operations, especially those involving isolated, confined, and extreme environments (e.g., Antarctic research expeditions).</p>
<b>Task Progress:</b>	<p>Data collected during the 30-day missions in the Human Exploration Research Analog (HERA Campaign 3, N=16 subjects), a 12-14 month winter-over in the Antarctic Neumayer Station III (Neumayer III, N=7 subjects), and a 6-month mission on the International Space Station (ISS, N=2 astronauts) demonstrated that the Standardized Behavioral Measures (SBM) were feasible, acceptable, and reliable for tracking cognitive performance and behavioral health during long-duration missions in isolated, confined, and extreme conditions. Mission controllers completed a team performance questionnaire during HERA missions, and flight directors completed this brief questionnaire during the ISS study over the course of the expedition.</p> <p>Two requests for supplemental funding were submitted to NASA under the SBM study during this reporting period:</p> <p>(1) Post-flight ROBoT-r: This supplement aims to accelerate our readiness for conducting critical operations immediately post-landing on the surface of Mars. The specific goal of the supplement is to test an additional n=6 ISS astronauts at three distinct time points within the first 24 hours after return to Earth (R+0), thereby increasing our dataset from N=2 to N=8 astronauts.</p> <p>(2) Data harmonization of NASA Behavioral Health and Performance (BHP) Standardized Behavioral Measures to identify behavioral responses across spaceflight analog missions: This supplement aims to examine the neurobehavioral responses of astronauts and astronaut-like individuals across NASA spaceflight analog missions. To achieve this goal, the project proposes to harmonize SBM data across different spaceflight analog missions. This harmonized database will provide the largest database to date of SBM data across different NASA spaceflight analogs and provide the opportunity</p>

	to integrate the harmonized database with other study outcomes (e.g., other measures collected in these analogs by other investigators).
<b>Bibliography Type:</b>	Description: (Last Updated: 03/24/2024)
<b>Abstracts for Journals and Proceedings</b>	Dinges D, Basner M, Strangman G, Stuster J, Roma P, Mollicone D, Gur R, Stahn A, Dennis L, Ecker A, Nasrini J, Kaizi-Lutu M, Mott C. "Standardized behavioral measures for detecting behavioral health risks during exploration missions." Oral presentation at the 2020 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 27-30, 2020. Abstracts. 2020 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 27-30, 2020. , Jan-2020
<b>Articles in Peer-reviewed Journals</b>	Ivkovic V, Sommers B, Cefaratti DA, Newman G, Thomas DW, Alexander DG, Strangman GE. "Operationally relevant behavior assessment using the Robotic On-Board Trainer for Research (ROBoT-r)." <i>Aerosp Med Hum Perform</i> . 2019 Sep 1;90(9):819-25. <a href="https://doi.org/10.3357/AMHP.5324.2019">https://doi.org/10.3357/AMHP.5324.2019</a> ; PMID: 31426899 , Sep-2019
<b>Books/Book Chapters</b>	Roma PG, Beckner ME, Mehta SK, Nindl BC, Crucian BE. "Salivary bioscience in military, space, and operational research." in "Salivary Bioscience: Foundations of Interdisciplinary Saliva Research and Applications." Ed. D.A. Granger, M.K. Taylor. Cham: Springer, 2020. p. 585-610. <a href="https://doi.org/10.1007/978-3-030-35784-9_24">https://doi.org/10.1007/978-3-030-35784-9_24</a> , Apr-2020