

Fiscal Year:	FY 2021	Task Last Updated:	FY 01/14/2021
PI Name:	Roma, Peter Ph.D.		
Project Title:	Human Factors and Behavioral Performance Exploration Measures in HERA		
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		
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Zip Code:	77058	Congressional District:	36
Comments:			
Project Type:	GROUND	Solicitation / Funding Source:	Directed Research
Start Date:	12/01/2016	End Date:	02/28/2021
No. of Post Docs:		No. of PhD Degrees:	
No. of PhD Candidates:	2	No. of Master' Degrees:	
No. of Master's Candidates:	1	No. of Bachelor's Degrees:	
No. of Bachelor's Candidates:	2	Monitoring Center:	NASA JSC
Contact Monitor:	Whitmire, Alexandra	Contact Phone:	
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Flight Program:			
Flight Assignment:	NOTE: Title change to Human Factors and Behavioral Performance Exploration Measures in HERA (previous title: Identification and Validation of BHP Standard Measures in HERA for Transport) in February 2020, per PI and HFBP HRP (Ed., 3/31/2020) NOTE: End date changed to 2/28/2021 when PI moved to Naval Research Laboratory (NRL), requiring new PI for this project (Ed., 9/30/21) NOTE: End date changed to 1/31/2023 per PI (Ed., 12/31/20) NOTE: End date changed to 1/21/2021 per L. Juliette/HFBP HRP element (Ed., 2/6/2020) NOTE: Extended to 9/30/2019 (original end date was 7/01/2018) per D. Arias/HFBP at JSC (Ed., 9/13/18) NOTE: Extended to 9/30/2018 (original end date was 7/01/2018) per D. Arias/HFBP at JSC (Ed., 8/31/18)		

Key Personnel Changes/Previous PI:	2020 January: Sara Whiting, Ph.D. joined the project as Co-Investigator. 2019 September: Suzanne T. Bell, Ph.D. joined the project as Co-Investigator. 2019 July: Jason S. Schneiderman, Ph.D. is no longer with the project. 2018 January: Co-Investigators William B. Vessey, Ph.D., Alexandra M. Whitmire, Ph.D. are no longer with the project following their move to other NASA positions. 2017 January: Original Principal Investigator (PI) Thomas J. Williams, Ph.D. no longer with the project following move to Human Factors & Behavioral Performance (HFBP) Element Scientist. 2017 January-July: Jason S. Schneiderman, Ph.D. served as interim PI. 2017 July-Present: Peter G. Roma, Ph.D. joined NASA as BHP Laboratory Lead and Principal Investigator. Project established in 2018 with Dr. Roma as PI.
COI Name (Institution):	Landon, Lauren Ph.D. (BHP Laboratory, KBR/NASA Johnson Space Center) Bell, Suzanne T. Ph.D. (BHP Laboratory, KBR/NASA Johnson Space Center) Whiting, Sara Ph.D. (BHP Laboratory, KBR/NASA Johnson Space Center)
Grant/Contract No.:	Directed Research
Performance Goal No.:	
Performance Goal Text:	NASA's Human Research Program (HRP) is developing a set of "Standard Measures" for use in spaceflight and analogs. These "standard measures" need to be validated in analog settings to ensure their validity, acceptability, and reliability in helping identify and measure indicators of risk associated with crew health and performance. Exploration missions are anticipated to create isolated and confined environments that will include stressors such as small teams living and working in extreme conditions for prolonged periods separated from family, friends; loss of the day/light cycle; loss or delay of communications with ground; partial gravity; and limited space, privacy, and food selection. HRP's Human Factors and Behavioral Performance (HFBP) Element seeks to maintain and enhance behavioral health and performance in such environments. The Behavioral Medicine risk (Risk of Adverse Behavioral or Behavioral Conditions and Psychiatric Disorders) is a high priority within the HRP because psychological and behavioral health factors reveal intra- and inter-individual variability. This variability poses significant challenge for measurement of risk and resilience in crews and individual astronauts during long-duration missions. The HFBP-EM will build upon the initial use and identification of Behavioral Core Measures (BCM), whose purpose was to evaluate the feasibility and acceptability of these outcome measures (Dinges; NNJ13ZSA002N-BMED; project title: "Standardized Behavioral Measures for Detecting Behavioral Health Risks during Exploration Missions") in high fidelity analogs. The task proposed here provides an opportunity to continue using standardized measures in order to operationalize their efficiency and effectiveness, ensure consistent measurement of these key metrics, and facilitate the analysis and understanding of these measures in assessing risk. The development and use of these expanded standardized measures are needed now to develop astronaut norms in order to determine their efficacy and ability to objectively detect, assess, and manage off nominal events; and predict future off nominal events that may compromise a mission and increase the risk of behavioral health and performance decrements. This advances our need for individualized, real-time tools that provide rapid feedback and assessment that are needed for exploration class missions. The use of BHP (Behavioral Health and Performance) Standard Measures across analogs and analog missions, allows NASA Human Research Program (HRP) to determine a baseline for assessing and monitoring specific countermeasures; and increases the construct and predictive validity of countermeasures for assessing risk and for their monitoring of behavioral health and performance in spaceflight. Specific Aims for the current proposal include: Aim 1. Provide a set of BHP standard measurements for investigators to use in proposed projects. Significance: This allows NASA HRP to streamline and make more efficient the use of multiple measurements collected on research participants during analog research and helps to ensure a reduced burden on these research participants by using a "standard" set of measures for data sharing by multiple principal investigators (PIs). Aim 2. Enable comparison of multiple missions across spaceflight analog campaigns to quantify risk using reliable metric-based data. Significance: The "standardized measures" increase the generalization of findings across research analogs, increasing the validity and reliability of measures used to quantify, characterize, and assess the impact of spacelike analogs on prevalence of behavioral health issues, incidence rates, longer term health, and performance errors. This allows generation of reliable and sensitive metrics that can be used systematically to inform accurate risk assessment and mitigation status for future exploration spaceflight missions. Aim 3. Provide database for data-mining and integrative modeling and increase research data quality and transfer to the Life Sciences Data Archive (LSDA). Significance: Collection of "Standardized Measures" allows for greater consistency and fidelity of data collected, enhancing the data archiving capabilities of analog outcomes, increasing accessibility of data for NASA use, metrics assessment associated with red to yellow, and yellow to green risk status, and trending, and increasing the probability that the standardized set of measures are appropriately archived in a timely manner. Although data management agreements require PIs to submit their data after completion of their research, the exact format and timeliness of that data submission varies greatly among PIs. The collection of "standardized measures" via internal directed studies helps to ensure more timely, valid, and accessible data resources to help guide risk reduction. ----- NOTES 2018 August: Original Principal Investigator (PI) was Thomas J. Williams, PhD, who became HRP Human Factors & Behavioral Performance (HFBP) Element Scientist shortly after the award was made; Jason S. Schneiderman, Ph.D. served as interim PI until July 10, 2017, when Peter G. Roma, Ph.D. came to Johnson Space Center and became Principal Investigator. At that time, title was changed to "Identification and Validation of BHP Standard Measures in HERA for Transport" (original title was "Identification and Validation of BHP Standard Measures"). 2020 February: Project title was changed to "Human Factors and Behavioral Performance Exploration Measures in HERA" (Short Title: HFBP-EM in HERA). 2021 September: PI Dr. Peter Roma moved to Naval Research Laboratory (NRL) in early 2021, requiring new PI for this project. See project "Human Factors and Behavioral Performance Exploration Measures in HERA (PI: Bell)" with Dr. Suzanne Bell as Principal Investigator.

Rationale for HRP Directed Research:	This research is directed because NASA must define complete scientific activities in a short time and there is insufficient time to issue a solicitation. This task is in direct response to both the August 2014 HSRB requirement and the baselined HRP Path to Risk Reduction milestone of providing standard measures to monitor crew health and performance. This will allow HRP to establish, evaluate, and manage a common set of measures for use in spaceflight and analog research to: develop baselines, systematically characterize risk likelihood and consequences, and assess effectiveness of countermeasures that work for human factors and behavioral performance risk factors. This proposal qualifies for a directed study due to the urgent, time-sensitive need to provide "standard measures" as the foundation to achieve consistent research measure for data-sharing in HERA (Human Exploration Research Analog) and to meet the highly constrained, operationally-focused data gathering and analysis that allows for greater consistency in the research methods that are specific to NASA HRP standard measures development. Additionally, the set of BHP standardized measures in the HERA analogy reflects the more operational nature of the measures while allowing the multiple and frequent internal and external collaborations required to execute this study. The directed nature of this study also allows NASA to provide the unique research and support expertise that is needed to integrate and manage the data from all of the various participating studies to achieve HRP's intent and support to the Flight Analogs Project (FAP) within a highly constrained time schedule. Completion of the required research, support to both analog and operational requirements, and vetting of the evidence-based standards makes the solicitation process prohibitive. In addition, our group, the BHP Lab has already performed similar work across various analogs in support of previous NASA research and the use of the BHP Lab offers considerable efficiencies that are realized by building upon our existing work and that expertise. Finally, two panels of extramural subject matter experts with experience in critical task identification in academic, military, and spaceflight analog settings met at Johnson Space Center (JSC) and provided recommendations consistent with the enclosed project related to team processes (November 2015) and psychometric assessment of cognition (April 2016).
Research Impact/Earth Benefits:	
Task Progress:	The Human Factors and Behavioral Performance Exploration Measures in HERA (HFBP-EM in HERA) project was successfully completed for HERA Campaign 5. A total of 16 healthy adults contributed as HERA crew members, with four crew per mission across four 45-day missions. HFBP-EM measures included physiology/biomarkers of physical and behavioral health, objective performance tasks assessing cognition and complex operational task performance, and multiple surveys and quantitative self-reports assessing individual and team behavioral health and performance functioning. Operational feasibility was high, with successful implementation of all measures. Operational acceptability was mixed, but data quality remained high. Average data yield was 98%, with yields for each measure type ranging from 92-100%. The forthcoming HERA Campaign 6 missions will provide an opportunity to test Human Factors and Behavioral Performance Exploration Measures in HERA and validate a revised HFBP-EM survey suite, and further contribute to the HFBP-EM database for characterizing individual and team behavioral health and performance risks in isolated, confined, and extreme environments. NOTE (9/30/2021): PI Dr. Peter Roma moved to Naval Research Laboratory (NRL) in early 2021, requiring new PI for this project. See project "Human Factors and Behavioral Performance Exploration Measures in HERA (PI: Bell)" with Dr. Suzanne Bell as Principal Investigator. See that project for future reporting.
Bibliography Type:	Description: (Last Updated: 07/05/2023)
Articles in Peer-reviewed Journals	Banks S, Landon LB, Dorrian J, Waggoner LB, Centofanti SA, Roma PG, Van Dongen HPA. "Effects of fatigue on teams and their role in 24/7 operations." Sleep Med Rev. 2019 Dec;48:101216. Epub 2019 Sep 28. Review. https://doi.org/10.1016/j.smrv.2019.101216 ; PubMed PMID: 31630015 , Dec-2019
Articles in Peer-reviewed Journals	Sirmons TA, Roma PG, Whitmire AM, Smith SM, Zwart SR, Young M, Douglas GL. "Meal replacement in isolated and confined mission environments: Consumption, acceptability, and implications for physical and behavioral health." Physiol Behav. 2020 May 15;219:112829. https://doi.org/10.1016/j.physbeh.2020.112829 ; PMID: 32068108 , May-2020
Articles in Peer-reviewed Journals	Marcinkowski MA, Bell ST, Roma PG. "The nature of conflict for teams in isolated, confined, and extreme environments." Acta Astronautica. 2021 Apr;181:81-91. Available online 8 January 2021. https://doi.org/10.1016/j.actaastro.2021.01.004 , Apr-2021
Articles in Peer-reviewed Journals	Roma PG, Blackwell Landon L, Spencer CA, Whitmire AM, Williams TJ. "The Subjective Habitability & Acceptability Questionnaire (SHAQ): Development and validation." Hum Factors. 2022 Jan 29. https://doi.org/10.1177/00187208211053462 ; PMID: 35094601 , Jan-2022
Books/Book Chapters	Bell ST, Roma PG, Caldwell BJ. "Special considerations for conducting research in analog environments: Challenges, solutions, and what is needed." in "Psychology and Human Performance in Space Programs, Vol. 1: Research at the Frontier." Ed. L.B. Landon, K.J. Slack, E. Salas. Boca Raton, FL: CRC Press, 2020. p. 47-65. Book: https://doi.org/10.1201/9780429440878 , Oct-2020
Books/Book Chapters	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. First Online: 08 April 2020. https://doi.org/10.1007/978-3-030-35784-9_24 , Apr-2020
Books/Book Chapters	Schorn JM, Roma PG. "Physical hazards of space exploration and the biological bases of behavioral health and performance in extreme environments." in "Psychology and Human Performance in Space Programs, Vol. 1: Research at the Frontier." Ed. L.B. Landon, K.J. Slack, E. Salas. Boca Raton, FL: CRC Press, 2020. p. 1-22. Book doi: https://doi.org/10.1201/9780429440878 , Oct-2020