Fiscal Year:	FY 2021	**Task Last Updated:**	FY 01/18/2021
PI Name:	Rosen, Michael Ph.D.		
Project Title:	Developing and Validating Sensor-based Measurement Strategies for Team Member Selection		
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:	21202-3142	**Congressional District:**	7
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	2014-15 HERO NNJ14ZSA001N-MIXEDTOPICS. Appendix E: Behavioral Health & Human Health Countermeasures Topics
Start Date:	12/01/2016	**End Date:**	11/30/2021
No. of Post Docs:		**No. of PhD Degrees:**	
No. of PhD Candidates:		**No. of Master' Degrees:**	
No. of Master's Candidates:		**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:		**Monitoring Center:**	NASA JSC
Contact Monitor:	Whitmire, Alexandra	**Contact Phone:**	
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Flight Program:			
Flight Assignment:	NOTE: End date changed to 11/30/2021 per NSSC information (Ed., 10/23/2020) NOTE: End date changed to 11/30/2020 per NSSC information (Ed., 1/30/2020)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Dietz, Aaron Ph.D. (Johns Hopkins University) Lee, Nam Ph.D. (Johns Hopkins University) Oswald, Fred Ph.D. (Rice University) Sapirstein, Adam M.D. (Johns Hopkins University) Wick, Elizabeth M.D. (Johns Hopkins University) Salas, Eduardo Ph.D. (Rice University)		
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Performance Goal No.:			

Performance Goal Text:	
Task Description:	Selection of astronauts for Long Duration Spaceflight Exploration (LSDE) missions poses challenges for NASA including the need to define and select candidates based on a new set of behavioral competencies underpinning effective performance in these extended and isolated missions. Additionally, an effective selection system will require new measurement methods capable of discriminating between individuals in a population already exhibiting extreme range restriction. Sensor-based, sociometric, and more generally, unobtrusive measurement methods hold promise as valuable tools for addressing these needs and complementing existing competency assessment methods. The proposed work seeks to advance the science and practice surrounding diagnostic measurement of LDSE competencies using a blended approach where sociometric techniques are combined with traditional assessment methods. We will leverage our team's extensive, transdisciplinary experience in signal processing and analysis of complex dynamic network data, psychometrics, performance assessment, and developing theory and strategies for LDSE team improvement to: (1) generate predictive validity evidence for LDSE behavioral competencies, (2) develop sociometric indices of those competencies and provide evidence of their validity, (3) develop an open architecture system for integrating sensor-based measurement systems and extracting sociometric indices, and (4) generating guidelines for the use of sociometric measures in the selection process. Our technical approach for achieving these aims involves metric development, metric validation, assessment architecture system design, and selection guideline development. First, metric development will involve updating our current literature review of unobtrusive measurement to incorporate findings from recent NASA efforts. We will also apply reactive systems modeling to systematically map sensor-based measurement system requirements with potential metrics for assessment. Next, we will conduct exploratory human in the loop analyses to identify additional candidate measures using tensor-decomposition methods of archival data to detect performance patterns. Metric validation will occur in a LDSE analog (HERA--Human Exploration Research Analog) as well as two clinical residency programs in order to increase the sample size needed for analysis. Specifically, we will prospectively collect the following from each context: traditional assessments of competencies (self-report, observation), sociometric assessments of competencies, and multi-dimensional outcomes (task outcome measures, multiple rater assessments). Validation studies will be conducted to establish the link between LDSE competencies and performance outcomes, demonstrate the relationships between sociometric and traditional measures of LDSE competencies, as well as index the amount of variability in outcome measures accounted for by sociometric indices above and beyond traditional measures. The next phase of this project involves advancing methodology and analytic capabilities for competency assessment using sociometric indices. The analytics developed will distill meaningful metrics from complex, dynamic sensor data that can be used across a range of sensor devices, providing a generalizable ‘middle layer’ architecture for processing these data. This analytic process involves integrating and mapping these diverse measurement sources to generate a valid and actionable depiction of performance (i.e., to guide selection). Findings from these efforts will result in evidence-based, practical, and validated guidelines for incorporating unobtrusive measurement into the astronaut selection process. Overall, successful completion of this project will advance the science and practice of multi-method individual and team LDSE competency assessment.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Final products from this work will advance evidence-based selection practices for currently difficult to assess teamwork related competencies. This will result in an astronaut corps more prepared to meet the demands of long duration space exploration. Additionally, these practices can benefit other professions where these competencies are germane.
Task Progress:	Period Covered by the Report: 12/01/2019 – 11/30/2020 Overall project aims: To support astronaut selection practices for long duration space (LDSE) missions by addressing theoretical, methodological, and practical challenges for multi-level selection systems incorporating unobtrusive or sociometric measurements. Key project tasks and progress: Early project efforts centered on clarifying program focus with research and operational sponsors and building the evidence-base for assessment and selection practices through literature reviews. This past year of project effort has focused on publication of early project literature reviews, and empirical study design and execution in Human Exploration Research Analog (HERA) and ICU analogs. Task 1.1. Finalize competencies, tasks, and timescales and performance criteria for each analog. In prior project years, discussions with NASA research and operational sponsors guided us to focus on three main LDSE competencies and their sub-competencies: 1) teamwork (including team orientation, team care, communication), leadership / followership, and operational problem solving (including judgment, adaptability). These decisions were revisited with NASA operational sponsors and confirmed in a site visit two years ago. Task 1.2. Finalize traditional competency measures. This task remains largely complete but will be revisited during data analysis to identify any poor preforming measures. Task 1.3.1 Map LDSE competencies to existing sociometric evidence and theory. This task remains largely complete but will be revisited during data analysis to identify which of the candidate sociometric measures demonstrate good validity evidence for use in astronaut selection. Task 1.3.2 Reactive systems task analysis method. This task has been modified to focus on event-based measurement systems incorporating sociometric measures. A first draft of this method has been published in the Handbook of Distributed Cognition. Task 1.3.3 Sensor pilots. This task is complete and sensors for project studies have been selected and preliminary validity evidence generated. Task 4. Develop open architecture assessment system. One of the final project deliverables includes an open ‘middle layer’ system for extracting unobtrusive measures of LDSE competencies from multiple sensor systems. We have developed multiple iterations of database and scripts for linking and analyzing data from physiological, communication, and location detection systems. We will finalize analysis scripts and deliver software as an open source system for analysis, delivered via github. [Ed. note: compiled Jan 2021 from annual report submitted to Human Factors & Behavioral Performance (HFBP)

	element]
Bibliography Type:	Description: (Last Updated: 11/25/2023)
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