Fiscal Year:	FY 2012	**Task Last Updated:**	FY 01/08/2013
PI Name:	Roma, Peter Ph.D.		
Project Title:	Psychosocial Performance Factors in Space Dwelling Groups		
Division Name:	Human Research		
Program/Discipline:	NSBRI		
Program/Discipline--Element/Subdiscipline:	NSBRI--Neurobehavioral and Psychosocial Factors Team		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **BHP**:Behavioral Health & Performance (archival in 2017)		
Human Research Program Risks:	(1) **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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PI Organization Type:	NASA CENTER	**Phone:**	
Organization Name:	KBR/NASA Johnson Space Center		
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City:	Houston	**State:**	TX
Zip Code:	77058	**Congressional District:**	36
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	2007 Crew Health NNJ07ZSA002N
Start Date:	08/01/2011	**End Date:**	09/30/2012
No. of Post Docs:	0	**No. of PhD Degrees:**	0
No. of PhD Candidates:	0	**No. of Master' Degrees:**	1
No. of Master's Candidates:	1	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	1	**Monitoring Center:**	NSBRI
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:	Dr. Peter Roma has taken over as PI as of August 1, 2011, following the passing of the previous PI, Dr. Joseph Brady, in July 2011.		
COI Name (Institution):	Hursh, Steven (Institutes for Behavior Resources, Inc.)		
Grant/Contract No.:	NCC 9-58-NBPF01602		
Performance Goal No.:			
Performance Goal Text:			
	The aims of this project focus upon the development of an experimental test bed for modeling performance effectiveness and psychosocial adaptation in support of exploratory spaceflight missions beyond Earth's atmosphere. The physical, hardware, and software environment that serves as the experimental platform is referred to as the Planetary Exploration Simulation (PES), and provides an automated means for analyzing space crew performance as well as monitoring electronically the interactive effects of simulated communication modality constraints, mission management systems, and other stressful conditions. Within this context, the objectives of this project are to provide risk assessment and countermeasure evaluation of the following fundamental behavioral interaction operations that will most likely affect crew performance effectiveness and psychosocial adaptation: 1) the structure and function of communication channels within and between simulated space-dwelling and Earth-based groups; 2) factors associated with variations in the		

Task Description:	behavioral management systems between space-dwelling and Earth-based groups; 3) factors associated with variations in workloads, stressful time pressure, and conflict conditions; and 4) behavioral and psychosocial interaction systems between spaceflight crews and Earth-centered mission support operations that are most likely to influence individual and group performance during long-duration missions. In a follow-up study to our first investigation (Roma et al., 2011) of what is now referred to as bounded autonomy, the psychosocial and performance effects of autonomous management of Planetary Exploration Simulation (PES) missions were robust to communications constraints despite a physiological stress reaction to the unexpected loss of audio and text-messaging abilities. The results of this study have been prepared for publication and are now in press (Roma et al., in press). A final experiment of increased operational fidelity further supported the performance and psychosocial benefits of autonomy as assessed in extended duty 12-hour missions conducted during different phases of the 24-hour circadian cycle (Day: 9am–9pm vs. Night: 9pm–9am). As with previous work, crew performance was higher and physiological stress reactivity lower under autonomous conditions; however, overnight workloads produced decrements in individual performances that included reaction time deficits, attentional lapses, and subjective fatigue. Importantly, despite these decrements, crew performance efficiency remained normal under autonomous operations. Lapses in individual performances thus appeared to be compensated for in the overall crew performance, further supporting the utility of well-trained multi-person crews as a countermeasure to compromised individual performance capacity under heavy workload and acute circadian misalignment. Interestingly, voluntary cooperation and fairness in a standardized behavioral assay were not affected by circadian factors, but were significantly reduced under highly scheduled mission management. This finding is significant because it indicates the potential intra-crew manifestation of an external stressor imposed by Mission Control (as opposed to enhanced cohesion through de facto ingroup-outgroup formation) and reveals a group-level lapse in voluntary cooperative propensity outside previously trained mission-specific tasks. Taken together, our ground-based experimental research program supports the value of autonomous mission operations in well-trained long-term crews, but also underscores the importance of process training to enhance group cohesion when confronted with unexpected operational and psychosocial challenges requiring communication, coordination, and cooperation beyond the specific tasks for which the crew was trained. Our recently developed behavioral task, known by the prototype software's working titles of "Team Performance Task" (TPT) or "Price of Cooperation" (PoC), has moved from initial software development into an early application phase as a simple, rapid, and objective group-level assay of voluntary cooperation, productivity, and fairness. Extensive laboratory tests have established some basic parameters and novel behavioral economic analysis methods for TPT/PoC data (Emurian et al., 2011; Hursh & Roma, in press). Additional parametric research in intact work-groups shows that the task is easily learned and remarkably sensitive to task duration, external incentives, and stable inter-crew differences; the results of this work are now being prepared for peer-reviewed publication. Additional high-throughput validation efforts are now ongoing, and reveal the TPT's ability to objectively discriminate between 3-person groups composed of friends versus groups composed of strangers.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The methodological development associated with this National Space Biomedical Research Institute (NSBRI)-funded research has provided a test bed for modeling performance effectiveness and psychosocial adaptation in computer-generated distributed interactive multi-person environments. Research conducted within the context of this distributed interactive simulation model can provide the basis for developing effective patterns of communication and problem solving strategies as well as a range of training procedures to enhance problem solving effectiveness. This project's research on better ways to assess, train, and manage small team performance effectiveness under hazardous and stressful conditions is relevant to transportation agencies, military forces, and first responders. The Earth benefits to be derived from the research extend to small operational group selection and training procedures, to the management of stressful interactions, and to the maintenance of group cohesion and productivity. Not only can the outcome of these studies be expected to have an important impact on safety and the quality of life in many Earth-based applied settings, but larger societal units will ultimately benefit from the resulting conceptual and methodological advances that effectively promote social and ecological stability while concurrently enhancing an education and training technology that assures effective communication of an expanded knowledge base. The heart of the TPT/PoC research is to develop a simple, rapid, and objective language-free behavioral assay of cooperative propensity at the group level to serve as a complement to subjective questionnaire-based assessments at the individual level. Once fully developed, this technology could be used to inform the Crew selection, composition, and even training processes through novel but heuristically informative quantitative modeling of individual- and team-level "social personality" profiles. However, this technology would not have to be limited to applications within human space exploration, as any organization that relies on cooperation in high-performance and multi-national teams including military, medical/healthcare, athletics, business, and other settings could employ this emerging technology.
Task Progress:	-- First experiment on "bounded autonomy" completed -- Data from first experiment on "bounded autonomy" published (Roma et al., 2011) -- Follow-up experiment on autonomy and communications constraints completed -- Data from follow-up experiment on autonomy and communications constraints published (Roma et al., in press) -- Procedures for experimental studies of autonomy and circadian factors under heavy workload complete -- Pilot experiment on interaction between autonomy and circadian factors under heavy workload complete -- Data from pilot experiment on interaction between autonomy and circadian factors under heavy workload submitted for publication -- Alpha-level experiments establishing TPT/PoC task parameters complete -- Portions of data from alpha-level experiments establishing TPT/PoC task and analysis parameters published (Emurian et al., 2011; Hursh & Roma, in press) -- TPT/PoC "Familiar-Stranger" validation study in European subjects complete -- TPT/PoC "Familiar-Stranger" validation study in US subjects complete

Bibliography Type:	Description: (Last Updated: 01/20/2025)
Articles in Peer-reviewed Journals	Hursh SR, Roma PG. "Behavioral economics and empirical public policy." J Exp Anal Behav. 2013 Jan;99(1):98-124. https://doi.org/10.1002/jeab.7 ; PubMed PMID: 23344991 , Jan-2013
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