Fiscal Year:	FY 2016	**Task Last Updated:**	FY 09/06/2016
PI Name:	Binsted, Kim Ph.D.		
Project Title:	Key Contributors to the Maintenance and Regulation of Team Function and Performance on Long Duration Exploration Missions		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
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) **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:	96822-2217	**Congressional District:**	1
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	2012 Crew Health NNJ12ZSA002N
Start Date:	08/01/2013	**End Date:**	09/01/2017
No. of Post Docs:	0	**No. of PhD Degrees:**	0
No. of PhD Candidates:	1	**No. of Master' Degrees:**	0
No. of Master's Candidates:	0	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	1	**Monitoring Center:**	NASA JSC
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:	NOTE: Extended to 9/01/2017 per NSSC information (Ed., 8/24/17) NOTE: Element change to Human Factors & Behavioral Performance; previously Behavioral Health & Performance (Ed., 1/17/17) NOTE: Extended to 7/31/2017 per NSSC information (Ed., 5/5/16)		
Key Personnel Changes/Previous PI:	June 2014 report--Added collaborator: Mathias Basner. June 2016 report--Added collaborators: Jay Buckey, Abigail Fellows, Raphael Rose. Added project manager: Bryan Caldwell.		
COI Name (Institution):	Hunter, Jean (Cornell University)		
Grant/Contract No.:	NNX13AM78G		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	HI-SEAS (Hawaii Space Exploration Analog and Simulation) is a habitat on an isolated Mars-like site on the Mauna Loa side of the saddle area on the Big Island of Hawaii at approximately 8200 feet above sea level. HI-SEAS is unique, in addition to its setting in a distinctive analog environment, as: - we select the crew to meet our research needs (in serendipitous analogs, such as Antarctic stations, crew selection criteria are not controlled by researchers); - the conditions (habitat, mission, communications, etc.) are explicitly designed to be similar to those of a planetary exploration mission; - the site is accessible year round, allowing longer duration isolated and confined environment studies than at other locations; - the Mars-like environment offers the potential for analog tasks, such as geological field work by human explorers and/or robots. The ability to select crew members to meet research needs and isolate them in a managed simulation performing under specific mission profiles makes HI-SEAS ideal for detailed studies in space-flight crew dynamics, behaviors, roles, and performance, especially for long-duration missions. To take advantage of this capability, the research in this proposal addresses the Integrated Research Plan (IRP) Gap Team1: “We need to understand the key threats, indicators, and life cycle of the team for autonomous, long duration and/or distance exploration missions.” In particular, we will conduct a ground-based investigation to measure and track the factors expected to have significant impacts on team function and performance, and assess that impact, over three high-autonomy missions of differing durations (four, eight, and twelve months). During crew selection for each mission we will measure participants’ cognitive capacities, communication skills, preferred communication strategies, interpersonal strategies, coping strategies, mission and crew role specific knowledge, and planning and collaborative problem solving ability. During the missions we will monitor crew communication, communication strategies, crew coping strategies, crew work load and job sharing, and conflict resolution and conflict management, as well as taking several measures of crew performance. Finally, we will examine how each of the factors affects crew performance during the missions. Our goals are: 1. To measure key factors that may contribute to crew function and performance over three high-autonomy missions of varying length. 2. To assess the impact of these factors on crew function and performance. 3. To assess the relative impact of these factors for different duration missions. 4. To suggest potential countermeasures (e.g., crew selection strategies) and interventions (e.g., responses to deteriorating crew cohesion) to maximize crew function and performance.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The ability to track team cohesion, process, and performance could benefit other teams in long-duration isolated and confined environments (e.g., military deployments, Antarctic winter-over crews).
Task Progress:	As of May 2016, two of the three HI-SEAS missions (four months and eight months) planned under this award have been completed, and the third (twelve months) is under way, scheduled to finish August 28, 2016. The current status of the research is described below, as a set of sub-projects. However, please note that all data will shared across projects and, once the final twelve-month mission is complete, we will be able to integrate this data for higher-level analysis. For all sub-projects, data collection is complete for the 4- and 8-months mission, and ongoing for the 12-month mission. TRACKING LONG-TERM DYNAMICS This research study investigates how people react, cope, and adjust to working together in ICE (isolated, confined, extreme) environments. In the environment, much like an astronaut, participants will work collaboratively with team members to accomplish a mission that requires interdependence and teamwork. We are interested in the ebb and flow of team member perceptions and reactions throughout the ICE experience. In addition, we wish to better understand the formation, maintenance, and restoration of team cohesion. Participants wear a commercially available social interaction badge that captures their interactions with other participants. CONFLICT MANAGEMENT AND EVA (Extravehicular Activity) DEBRIEFS For this study, we conduct a series of end-of-mission debriefs, to develop a timeline of crew conflict and conflict management processes. We qualitatively analyze all in-mission EVA crew debriefs, based on existing theories of task/relationship team conflict resolution processes, to identify potential decrements to cohesion across mission duration using behavioral coding (e.g., behavioral indicators of "openness" approaches and "avoid" approaches). We then compare data from EVA (Extra Vehicular Activity) debriefs to the overall conflict timeline to map conflict resolution processes to self-reported periods of heightened conflict and heightened cohesion decrements. TEAM PERFORMANCE TASK (TPT) The goal of this protocol is to characterize social dynamics, team performance capacity, and biopsychosocial adaptation over time in the isolated, confined, and extreme space analog environment of HI-SEAS. The primary research activity for this protocol is regular sessions administering our prototype "Team Performance Task" (TPT) software, an objective behavioral economic assay of cooperation, productivity, and fairness in small groups. In addition to the TPT sessions, the Crew also completes an online "Dyad Questionnaire." This survey lists a wide variety of interaction patterns (e.g., professional/collegial, personal/friendly, antagonistic/conflict), and is administered in a sociometric format where each Crew member selects the applicable interaction pattern(s) during the past week for all possible interpersonal pairings (dyads). ANSIBLE ANSIBLE (A Network of Social Interactions for Bilateral Life Enhancement), named after a fictitious interstellar communications device from science fiction, opportunistically combines Virtual Environments (VEs) and Virtual Agents (VAs) and incorporates evidence-based psychological health promoting strategies to augment asynchronous communications, increase connectedness between crew members and their informal social support system (e.g., friends, family, colleagues), enhance awareness of psychological health, and combat social and sensory monotony. ANSIBLE is a multi-modal toolset that leverages evidence based wellness promoting strategies to 1) augment asynchronous communications using VEs and facilitate novel interaction methods beyond email and video playback, 2) use the inherently immersive and stimuli rich nature of VEs to counteract sensory monotony, and 3) leverage VEs and intelligent VAs to provide companions and advisors to combat social monotony. Further, VAs capable of detecting changes in astronaut psychosocial states can increase astronaut self-awareness, suggest countermeasures, and provide rehearsal scenarios to maintain and enhance interpersonal skills. The ANSIBLE system was deployed at HI-SEAS for the beginning of the current twelve-month mission, and has been collecting data throughout.

COGNITION

We measure a range of cognitive functions using Cognition, a comprehensive, software-based, neurocognitive toolkit. The ten Cognition tests include (but go beyond) what is currently measured by WinSCAT and the Reaction Self Test on the International Space Station (ISS), and take 20-30 minutes to complete. The toolkit will permit rapid assessment of performance in cognitive, social-emotional, and sensorimotor domains. The Cognition toolkit has been validated in a NASA ground-based study as well as on the ISS. We use these measures as base controls to control for the effects of other factors (e.g., emotional state, crew cohesion) on performance.

SMART-OP

SMART-OP (Stress Management and Resilience Training for Optimal Performance) is a self-guided, multimedia, interactive, computer-based, stress management and resilience training program based on evidenced-based cognitive-behavioral principles and emotion regulation approaches. The main aim of this project is to evaluate SMART-OP for acceptability and usability in a space analog environment with a sample of individuals participating in 8- and 12-month missions at the HI-SEAS facility.

VIRTUAL SPACE STATION (VSS)

Living in an ICE analog can induce conflict, stress, and depression. Computer-based behavioral health countermeasures are appealing for training and treatment in ICE because they provide confidentiality and do not require communication with the outside environment. Autonomous, confidential, training, and treatment for behavioral health issues will need to be a critical component of long duration spaceflight travel. This work provides an evaluation of such a tool in a relevant ICE environment.

We evaluated the Virtual Space Station (VSS), a suite of interactive computer-delivered psychological training and treatment programs, during the eight-month HI-SEAS mission. This evaluation continues in the 12-month mission, which is currently ongoing.

GEOLOGY FIELD TASKS

One goal of HI-SEAS is to evaluate crew performance over missions of increasing length. To meet this objective, a team of geologists works with the research team to develop geology field tasks for the crew to complete in the area surrounding the habitat. These team-oriented tasks are designed to be gradable with quantifiable metrics so that meaningful conclusions about crew performance can be drawn. The tasks are designed to specify what the crew should accomplish, without telling them how, in order to test the crew's effectiveness in managing the tasks under high-autonomy conditions.

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