Fiscal Year:	FY 2015	**Task Last Updated:**	FY 06/04/2015
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:**	07/31/2017
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:	0	**Monitoring Center:**	NASA JSC
Contact Monitor:	Leveton, Lauren	**Contact Phone:**	
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Flight Program:			
Flight Assignment:	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.		
COI Name (Institution):	Hunter, Jean (Cornell University) Bedwell, Wendy (University of South Florida)		
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 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:	At the time of submission of this report (06/2015) we are near the end of the second of three HI-SEAS missions supported by this grant. Here we report progress on various aspects of the project. Habitat upgrades: The HI-SEAS habitat was upgraded (at no additional cost to the grant) before the first mission to include a robust array of solar panels, an H2 fuel cell, an additional 500 gallons of water storage capacity (for a total of 1000 gallons), and high-capacity composting toilets. These measures have reduced the frequency of site servicing from 1-2 times per week to two times per month, which in turn helps maintain the isolation of the crew while reducing costs. Between the first and second missions, the communications and telemetry systems were upgraded (again, at no additional cost to the grant), resulting in far fewer failures. Thanks to this increased stability, we have actually had to introduce simulated failures in order to observe the crew's performance under sub-optimal conditions. Crew selection: In late 2013, we began recruiting crew members for all three missions. About 150 applications were received. Of these, about 120 met the basic requirements for participation. Based on education, professional background, and experience, these were down-selected to thirty interviewees for the first mission. This set also served as the pool for the eight- and twelve-month missions. Interviewees were asked to complete psychological screening tests. Based on the interviews (conducted remotely) and screening, nine applicants (crew and reserves) were selected for the second mission. Eight (one had to withdraw for personal reasons) went on an eight-day National Outdoor Leadership School (NOLS) course in summer 2014. This was an excellent addition to the selection process, as it allowed potential participants to evaluate each other and themselves in an isolated setting. We received feedback from the applicants and from the NOLS instructors. Based on all the material collected, six crewmembers were selected in July 2014 for the eight-month mission starting in October 2014 (currently nearing its end), and the remaining two became reserves. We are currently in the process of selecting the crew for the final twelve-month mission, starting in August 2015. Mission support: Mission support is divided into two tiers. First tier support (FTS) members work in four-hour shifts 8am-8pm HST. FTS responds as quickly as possible (given the 20 minute latency in communications) to requests from the crew, acknowledges crew reports, and provides the crew with information (e.g., news reports, weather forecasts, requested data). FTS is also able to approve some activities, such as EVAs in the vicinity of the habitat, and escalate all other requests for approval to second tier support (STS). STS is 'on call' 24hrs/day, seven days per week. STS approval is required for site servicing, longer EVAs, and any activities not clearly defined by the mission rules. All mission support communications, except for emergency operations, are via a project-management system, and are subject to the 20-minute delay. Mission A: In March 2014, the first crew flew to Hawaii for a week of baseline measurements, as well as training on habitat systems, geological fieldwork, and study protocols. On March 27, the crew entered the habitat, and came out four months later. During the mission, the crew collected data on: - Cognitive function, - Team processes, - Team cohesion, - Intra-crew relationships, - Team member interactions, - Team performance. The crew carried out several opportunistic research projects. These are not part of the research funded by this grant, but do support NASA's goals by raising the readiness level of technologies, protocols, and countermeasures. The opportunistic research projects on that mission include: - Evaluating anti-microbial fabrics, - Growing plants using light of varying wavelength, - Evaluating 3-D printed surgical tools, - Tracking stress and exertion on extra-vehicular activities. Mission B: The second mission is about to finish its eight month duration on June 13, 2015. They have collected the same core set of data as for Mission A, although the set of opportunistic research projects has evolved. Timeline: We have begun the selection process for the next mission, which will start in August 2015 and last twelve months. Education and public outreach: The crew and mission support have been very active in education and public outreach efforts. Regular updates are posted on the http://www.hi-seas.org site, Facebook, and Twitter. Also, crewmembers regularly post blogs and YouTube videos chronicling their mission. They respond directly to questions from students on a regular basis.

	The mission has also received a great deal of national and international media attention. Links to many of the articles written about HI-SEAS and other media are available on the website (http://www.hi-seas.org) or on the project's Facebook page. Results: As we are just coming to the end of the second mission of three, and our plan is to compare data across the three missions, we do not yet have final results to report. However, the data is coming in as expected, and crew compliance with study protocols is very high (near 100%). We are measuring crew performance in several ways: compliance with study protocols and mission rules; daily tasks (e.g., habitat maintenance, reports); opportunistic research; and geology field research. Of these, the geology is the most team-oriented (most tasks require at least three crewmembers and a series of well-planned EVAs) and progressive (in that they build on each other over the course of the mission). Only three crewmembers to date has even minimal education in geology beyond the three-day cram course that was part of the pre-mission training. Nonetheless, the crew performance on the geology tasks has been impressive.
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