

Fiscal Year:	FY 2015	Task Last Updated:	FY 05/28/2015
PI Name:	Basner, Mathias M.D., Ph.D.		
Project Title:	Neurostructural, Cognitive, and Physiologic Changes During a 1-year Antarctic Winter-Over Mission		
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		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	19104-4209	Congressional District:	2
Comments:			
Project Type:	GROUND	Solicitation / Funding Source:	2013 HERO NNJ13ZSA002N-Crew Health (FLAGSHIP & NSBRI)
Start Date:	08/01/2014	End Date:	07/31/2017
No. of Post Docs:	1	No. of PhD Degrees:	0
No. of PhD Candidates:	0	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:			
Key Personnel Changes/Previous PI:	May 2015 report: David Roalf, PhD was added as a Co-Investigator to take over most of the tasks of Ted Satterthwaite, MD. Alexander Stahn, PhD and Hanns-Christian Gunga, MD PhD were added as Co-Investigators for Cognition in Neumayer-III, Halley-VI, and SANAE. Simone Macri and Mirjam Münch were added as Co-Investigators as we are sharing actigraphy data with them.		
COI Name (Institution):	Bilker, Warren (University of Pennsylvania) Dinges, David Ph.D. (University of Pennsylvania) Elliott, Mark Ph.D. (University of Pennsylvania) Goel, Namni Ph.D. (University of Pennsylvania) Gur, Ruben Ph.D. (University of Pennsylvania) Satterthwaite, Theodore M.D. (University of Pennsylvania) Johannes, Bernd Ph.D. (German Aerospace Center (DLR), Institute of Aerospace Medicine) Mollicone, Daniel Ph.D. (Pulsar Informatics, Inc.) Roalf, David (University of Pennsylvania) Stahn, Alexander (Charité Berlin) Gunga, Hanns-Christian (Charité Berlin)		

	Macri, Simone (Istituto Superiore di Sanità) Münch, Mirjam (Charité Berlin)
Grant/Contract No.:	NNX14AM81G
Performance Goal No.:	
Performance Goal Text:	
Task Description:	<p>This proposal primarily addresses the Behavioral Medicine (BMed) 3 Gap on the nature and duration of cognitive performance changes in-flight and post mission, by assessing neurostructural, cognitive, behavioral, physiologic, and psychosocial changes in maximally N=24-28 crewmembers during a 10-12 month Antarctic winter-over in Concordia station, and in the same number of controls matched to crewmembers based on age, gender, and educational attainment. State-of-the-art quantitative structural and functional magnetic resonance imaging (fMRI), in both resting-state and activated; diffusion tensor imaging; and arterial spin labeled fMRI will be performed in crewmembers and controls 4 months before, immediately after, and 6 months after the mission. During the mission, crewmembers will wear a wrist-watch like device that measures movement activity and proximity to other devices 24/7 to investigate sleep-wake behavior and crew cohesion. Once monthly, subjects will perform the Cognition test battery to quantify changes in cognitive performance. Cognition was specifically designed for high-aptitude astronauts and astronaut surrogates. It consists of 10 brief, validated neuropsychological tests that cover a wide range of cognitive domains. A 24-hour, two-electrode electrocardiogram (ECG) will be performed monthly to investigate systematic changes in heart rate, heart rate variability, objectively assessed workload, and sleep fragmentation with time-in-mission. Behavioral alertness will be assessed with a 3 min. Psychomotor Vigilance Test (PVT) on a weekly basis along with brief surveys to assess subjective ratings of mood, workload, stress, sleep quality, tiredness, sickness, and conflicts among crewmembers. The results will be compared with findings from Mars520 and International Space Station (ISS), as many of the variables to be gathered overlap with those successfully obtained by our team in these and other space analog environments. The Cognition test battery was also implemented in the Antarctic stations Neumayer-III, Halley-VI, and SANAE. After this project we will have a much better understanding whether, to what extent, and for how long neurostructural and neurofunctional changes are induced in subjects over-wintering in the isolated and confined space analog environment of Concordia station.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	<p>With the proposed work we will relevantly contribute to the goal of the Human Research Program (HRP) to provide human health and performance countermeasures, knowledge, technologies, and tools to enable safe, reliable, and productive human space exploration. More specifically, our findings, based on state-of-the-art neuroimaging technologies and on innovative, non-invasive, low burden, yet methodologically sound measurement technologies for cognitive, physiological, and crew cohesion outcomes, will relevantly contribute to the development of technologies to provide mission planners and system developers with strategies for monitoring and mitigating crew health and performance risks. These methodologies will also be useful for assessing subjects living in isolated, confined, and extreme environments on Earth.</p>
Task Progress:	<p>The first of two winter-over campaigns in Concordia station is currently ongoing. All 13 crewmembers are participating in our study. We obtained baseline data (neuroimaging and Cognition) in 11 crewmembers at envihab in Cologne, Germany in October 2014. The two remaining crewmembers were scanned in Christchurch, NZ and Hobart, Tasmania, in January 2015, respectively. The equipment was shipped to Concordia in November 2014 and arrived safely at Concordia station in February 2015. Data acquisition started late February 2015. Until now, all crewmembers continue to participate in our protocol. Compliance on wearing the actigraphs is variable (38% fully compliant, 31% take the actigraph off during the night, 31% only wear the actigraph during some periods of the day). Compliance on the cognitive testing (12/13) and on wearing the ECG on a monthly basis (100%) is much higher. We are in regular contact with ESA's research MD and receive data for quality control purposes on a regular basis. Cognition data acquisition in the Antarctic Neumayer-III and Halley-VI stations is ongoing with good subject compliance. We were not able to obtain any Cognition data from the SANAE station until now. Participants for the control group were selected by DLR. Scans were obtained and they have begun data acquisition (actigraphs, cognitive testing, monthly ECG).</p>
Bibliography Type:	Description: (Last Updated: 02/19/2024)
Abstracts for Journals and Proceedings	<p>Basner M, Nasrini J, McGuire S, Dinges DF, Goel N, Ecker AJ, Johannes B, Rittweger J, Gerlach D, Stahn A, Gunga H-C, Mollicone DJ, Mott CG, Satterthwaite T, Elliott M, Bilker W, Gur RC. "Neurostructural, cognitive, and physiologic changes during a 1-year Antarctic winter-over mission: study design and research methodology." Poster at 2015 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 13-15, 2015.</p> <p>2015 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 13-15, 2015. , Jan-2015</p>