

Fiscal Year:	FY 2017	Task Last Updated:	FY 06/02/2017
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:	07/31/2018
No. of Post Docs:	0	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:	Williams, Thomas	Contact Phone:	281-483-8773
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Flight Program:			
Flight Assignment:	NOTE: Element change to Human Factors & Behavioral Performance; previously Behavioral Health & Performance (Ed., 1/17/17) NOTE: Extended to 7/31/2018 per K. Ohnesorge/JSC and NSSC information (Ed., 12/7/16)		
Key Personnel Changes/Previous PI:	May 2017: Nathalie Pattyn (Vrije Universiteit Brussel, Belgium) was added as a co-investigator. She was the research MD on Halley station and will correlate Cognition data with SINSKILL data (also acquired in Halley). May 2016 report: Damien Leger and Gabi Ambrecht were added as Co-Investigators as we are sharing actigraphy data with them. 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 SANA. 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) Leger, Damien M.D., Ph.D. (Université Paris Descartes) Ambrecht, Gabriele (Charité Berlin) Pattyn, Nathalie M.D., Ph.D. (Vrije Universiteit Brussel, Belgium)
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 second and final winter-over campaign in Concordia station is completed. 12 out of 13 crewmembers consented to participate in the study. We received MRIs from all crewmembers pre-mission at envihab Cologne. Two of these crewmembers were replaced before the start of the mission. In one of the two newly added crewmembers, we were able to receive a pre-mission scan in Hobart. Thus we were able to acquire pre-mission scans in 11 out of the 12 consenting crewmembers. Immediately post-mission, we received again 11 out of 12 scans. Finally, we were able to gather the 6-month post-mission scans in 6 out of the 12 crewmembers in May 2017. We also performed a final human phantom scan in May 2017 in the five investigators that were originally scanned at DLR (German Aerospace Center) envihab in October 2014 to investigate any systematic changes in the envihab MRI.</p> <p>Crewmember adherence was similar relative to wearing actigraphs during the 2016 winter-over campaign relative to the 2015 campaign, but substantially lower relative to cognitive test performance and 24-h ECG data acquisition. The equipment deployed in Concordia station was shipped back to France and is currently in transition to Philadelphia. We expect to find some more data on the research MD laptop that were not submitted via the Internet. Final adherence rates will depend on the amount of data we will find on this laptop.</p> <p>Cognition data acquisition at the British Halley Station and the German Neumayer station concluded in 2016 with good adherence rates. Post-mission MRI scans were obtained in 5 out of the 7 participating Neumayer crew members. We were not able to obtain any Cognition data from the SANAE station in the 2015 or 2016 winter-over season.</p> <p>Data acquisition for the 2016 winter-over control group was finalized with good adherence rates. The post-mission equivalent scan was performed in May 2017 and the 6-month post-mission equivalent scan is scheduled for November 2017.</p> <p>Preliminary neuroimaging results were presented at the 2017 NASA Human Research Program Investigators' Workshop in Houston, TX.</p>

Bibliography Type:	Description: (Last Updated: 06/19/2025)