Fiscal Year:	FY 2019	**Task Last Updated:**	FY 05/16/2019
PI Name:	Seidler, Rachael D. Ph.D.		
Project Title:	Spaceflight Effects on Neurocognitive Performance: Extent, Longevity, and Neural Bases		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Biomedical countermeasures		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	(1) **HSIA**:Risk of Adverse Outcomes Due to Inadequate Human Systems Integration Architecture (2) **Sensorimotor**:Risk of Altered Sensorimotor/Vestibular Function Impacting Critical Mission Tasks		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	rachaelseidler@ufl.edu	**Fax:**	FY
PI Organization Type:	UNIVERSITY	**Phone:**	352-294-1722
Organization Name:	University of Florida		
PI Address 1:	Applied Physiology & Kinesiology		
PI Address 2:	FLG 142, P.O. Box 118205		
PI Web Page:			
City:	Gainesville	**State:**	FL
Zip Code:	32611-8205	**Congressional District:**	3
Comments:	NOTE: PI moved to University of Florida in July 2017; previous affiliation was University of Michigan.		
Project Type:	FLIGHT,GROUND	**Solicitation / Funding Source:**	2010 Crew Health NNJ10ZSA003N
Start Date:	07/14/2017	**End Date:**	09/30/2020
No. of Post Docs:	3	**No. of PhD Degrees:**	
No. of PhD Candidates:	2	**No. of Master' Degrees:**	
No. of Master's Candidates:		**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:		**Monitoring Center:**	NASA JSC
Contact Monitor:	McFather, Jon	**Contact Phone:**	
Contact Email:	jon.c.mcfather@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: Changed end date to 9/30/2020 per NSSC information (Ed., 10/9/19)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Bloomberg, Jacob Ph.D. (NASA Johnson Space Center) Mulavara, Ajitkumar Ph.D. (Universities Space Research Association)		
Grant/Contract No.:	80NSSC17K0461		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	NOTE: Continuation of "Spaceflight Effects on Neurocognitive Performance: Extent, Longevity, and Neural Bases," grant NNX11AR02G, due to Principal Investigator Seidler's move to University of Florida from University of Michigan. NASA Research Announcement NNJ10ZSA003N requested proposals to assess changes in elemental neurocognitive functions such as perception, motor control, memory, attention, language, executive function, and emotional processing following long duration spaceflight using both behavioral assessments and monitoring technologies such as fMRI. In response to this call, we propose to perform structural and functional MR brain imaging to identify the relationship between changes in crewmember neurocognitive function and neural structural alterations following a six month International Space Station mission. Our central hypothesis is that measures of brain structure, function, and network integrity will change from pre to post flight in crewmembers (Aim 1). Moreover, we predict that these changes will correlate with indices of cognitive, sensory, and motor function in a neuroanatomically selective fashion (Aim 2). Our interdisciplinary approach utilizes cutting edge neuroimaging techniques and a broad ranging battery of sensory, motor, and cognitive assessments that will be conducted pre flight, during flight, and post flight to investigate neuroplastic and maladaptive brain changes in crewmembers following long duration spaceflight. Success in this endeavor would 1) result in identification of the underlying neural mechanisms and operational risks of spaceflight-induced changes in behavior, and 2) identify whether a return to normative behavioral function following re-adaptation to Earth's gravitational environment is associated with a restitution of brain structure and function or instead is supported by substitution with compensatory brain processes.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The results of this project will have relevance not only to understanding the effects of spaceflight on the human brain and behavior, but also for delineating the capacity of the brain to remodel in response to adaptive stimuli. As such, the results should prove informative for understanding the neural mechanisms associated with adaptive behavioral change and the rehabilitation of these changes during recovery periods.
Task Progress:	We are completing the seventh year of this project. We have 15 participants in varying states of data collection (two were approximately one year flight subjects). Three of these fifteen are still undergoing data collection, with the final test sessions to occur in 2020. During the reporting period, we have a published a paper applying similar metrics to retrospectively acquired clinical MRI scans of astronauts (Lee et al., 2019 JAMA Neurology). We reported patterns of fluid distribution within the brain that reflect an upward shift of the brain within the skull. This results in less fluid around the top of the brain, and increased fluid in the lower portions. We also found changes in brain connection pathways that are involved in processing sensory information and controlling movement. Preliminary analyses of our ongoing data further reveal that crewmembers are slower post flight on tests of bimanual coordination and mental rotation. These are not generalized slowing effects, as other measures showed no changes in speed. Moreover, accuracy was unchanged despite these slowing effects, supporting that the changes were not simply reflecting strategic speed-accuracy trade off effects.
Bibliography Type:	Description: (Last Updated: 01/24/2024)
Articles in Peer-reviewed Journals	Lee JK, Koppelmans V, Riascos RF, Hasan KM, Pasternak O, Mulavara AP, Bloomberg JJ, Seidler RD. "Spaceflight-associated brain white matter microstrucural changes and intracranial fluid redistribution." JAMA Neurology. 2019 Apr;76(4):412-9. https://doi.org/10.1001/jamaneurol.2018.4882 ; PubMed PMID: 30673793 , Apr-2019
Articles in Peer-reviewed Journals	Koppelmans V, Scott JM, Downs ME, Cassady KE, Yuan P, Pasternak O, Wood SJ, De Dios YE, Gadd NE, Kofman I, Riascos R, Reuter-Lorenz PA, Bloomberg JJ, Mulavara AP, Ploutz-Snyder LL, Seidler RD. "Exercise effects on bed rest-induced brain changes." PLoS One. 2018 Oct 11;13(10):e0205515. https://doi.org/10.1371/journal.pone.0205515 ; PubMed PMID: 30308004; PubMed Central PMCID: PMC6181401 , Oct-2018