Fiscal Year:	FY 2021	**Task Last Updated:**	FY 05/12/2021
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:**	09/30/2022
No. of Post Docs:	5	**No. of PhD Degrees:**	
No. of PhD Candidates:	3	**No. of Master' Degrees:**	1
No. of Master's Candidates:		**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:		**Monitoring Center:**	NASA JSC
Contact Monitor:	Brocato, Becky	**Contact Phone:**	
Contact Email:	becky.brocato@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: End date changed to 9/30/2022 per NSSC information (Ed., 2/5/22) NOTE: End date changed to 9/30/2021 per D. Risin/HRP and NSSC information (Ed., 8/27/20) NOTE: Changed end date to 9/30/2020 per NSSC information (Ed., 10/9/19)		
Key Personnel Changes/Previous PI:	May 2021 report: Scott Wood, Ph.D., is now CoInvestigator on the project for his subject matter expertise.		
COI Name (Institution):	Bloomberg, Jacob Ph.D. (NASA Johnson Space Center) Mulavara, Ajitkumar Ph.D. (Universities Space Research Association) Wood, Scott Ph.D. (NASA Johnson Space Center)		
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 (NRA) 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:	NRA 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 proposed 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 was that measures of brain structure, function, and network integrity would change from pre to post flight in crewmembers (Aim 1). Moreover, we predicted that these changes would 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 range of sensory, motor, and cognitive assessments that were 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. We completed our data collection for this project in 2020 and have data analyses ongoing. We have published a few preliminary papers, including one showing that spaceflight is associated with an upward shift of the brain within the skull, and another focusing on fluid shifts in the brain with spaceflight. In a recent study, we showed that one year in space resulted in more brain changes than six months.
Bibliography Type:	Description: (Last Updated: 03/18/2025)
Articles in Peer-reviewed Journals	Hupfeld KE, McGregor HR, Reuter-Lorenz PA, Seidler RD. "Microgravity effects on the human brain and behavior: dysfunction and adaptive plasticity." Neurosci Biobehav Rev. 2021 Mar;122:176-89. Review. https://doi.org/10.1016/j.neubiorev.2020.11.017 ; PMID: 33454290 , Mar-2021
Articles in Peer-reviewed Journals	Noohi F, Kinnaird C, De Dios Y, Kofman IS, Wood SJ, Bloomberg J, Mulavara A, Sienko KH, Polk TA, Seidler RD. "Age differences in vestibular brain connectivity are associated with balance performance." Front Aging Neurosci. 2020 Nov 16;12:566331. https://doi.org/10.3389/fnagi.2020.566331 ; PMID: 33312123; PMCID: PMC7703342 , Nov-2020
Articles in Peer-reviewed Journals	Roberts DR, Stahn AC, Seidler RD, Wuyts FL. "Towards understanding the effects of spaceflight on the brain." Lancet Neurol. 2020 Oct 1;19(10):P808. Letter. https://doi.org/10.1016/S1474-4422(20)30304-5 ; PMID: 32949538 , Oct-2020
Articles in Peer-reviewed Journals	Hupfeld KE, McGregor HR, Lee JK, Beltran NE, Kofman IS, De Dios YE, Reuter-Lorenz PA, Riascos RF, Pasternak O, Wood SJ, Bloomberg JJ, Mulavara AP, Seidler RD; Alzheimer's Disease Neuroimaging Initiative. "The impact of six and twelve months in space on human brain structure and intracranial fluid shifts." Cereb Cortex Commun. 2020;1(1):tgaa023. https://doi.org/10.1093/texcom/tgaa023 ; PMID: 32864615; PMCID: PMC7446230, , Jun-2020