

Fiscal Year:	FY 2024	Task Last Updated:	FY 02/08/2024
PI Name:	Norcross, Jason M.S.		
Project Title:	Validation of Fitness for Duty Standards Using Pre- and Post-Flight Capsule Egress and Suited Functional Performance Tasks in Simulated Reduced Gravity		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
Joint Agency Name:		TechPort:	No
Human Research Program Elements:	(1) HHC: Human Health Countermeasures		
Human Research Program Risks:	(1) EVA: Risk of Mission Impacting Injury and Compromised Performance and Long-Term Health Effects due to EVA Operations (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		
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Zip Code:	77058-3711	Congressional District:	36
Comments:			
Project Type:	Flight	Solicitation / Funding Source:	2017-2018 HERO 80JSC017N0001-BPBA Topics in Biological, Physiological, and Behavioral Adaptations to Spaceflight. Appendix C
Start Date:	01/30/2019	End Date:	12/01/2027
No. of Post Docs:		No. of PhD Degrees:	
No. of PhD Candidates:		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:	Brocato, Becky	Contact Phone:	
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Flight Program:			
Flight Assignment:	NOTE: End date changed to 12/1/2027 per HHC element/JSC (Ed., 12/14/20)		
Key Personnel Changes/Previous PI:	Dr. Nicole Strock has taken over the PI responsibilities for the Space Phys study and has replaced Dr. Eric Rivas. Dr. Karina Marshall-Goebel has replaced Dr. Andrew Abercromby as Co-I in the role of H-3PO Research Lead.		
COI Name (Institution):	Karina, Marshall-Goebel Ph.D. (NASA Johnson Space Center) Young, Millennia Ph.D. (NASA Johnson Space Center) Schlotman, Taylor (KBR) Peters, Brian (KBR) Cox, Lauren (JES Tech) Strock, Nicole Ph.D. (KBR)		
Grant/Contract No.:	Internal Project		

Performance Goal No.:	
Performance Goal Text:	
Task Description:	<p>Rigorous adherence to available inflight countermeasures has effectively mitigated losses or maintained muscle strength and aerobic capacity in some returning long-duration International Space Station (ISS) crewmembers; however, all astronauts demonstrate significant decrements in functional performance upon return to a gravity environment. These losses in functional performance can be largely attributed to neurovestibular / sensorimotor deficits that can take days or weeks from which to recover and for which there is no current operational countermeasure. Although these losses are tolerable for current land-based returns to Earth, where ground personnel can quickly support the crew at the landing site, this will not be the case for future off-nominal water-based Orion landings or for nominal Mars surface landings, both of which will require crewmembers to be capable of egressing their landing vehicle unassisted.</p> <p>Quantification of astronauts' post-landing functional capacity including ability to perform an unassisted capsule egress and critical planetary extravehicular activity (EVA) tasks is necessary to design concepts of operation for Moon and Mars exploration mission systems and ultimately to promote exploration mission success. These results can then be reviewed in combination with other pre-flight, in-flight, and post-landing measures and determinants of health and performance (e.g., sleep, nutrition, exercise) to help develop and select necessary countermeasures capable of protecting all crewmembers or to identify characteristics (both behavioral and inherent) that might allow for selection of crew dependent on mission objectives.</p> <p>Data collected in this proposal will provide unique data on unassisted capsule egress while either shirt-sleeved or wearing an unpressurized launch, entry, abort (LEA) suit in Earth's gravity and on EVA-relevant functional task performance by testing astronauts shortly after return to Earth while suited and pressurized in a simulated reduced gravity analog. The research product will be a temporal profile of unassisted capsule egress and planetary EVA task performance pre-flight and at multiple post-landing intervals, the timing of which will be determined based on post-landing logistics and coordination with other investigations. Data will be collected for spaceflight missions ranging from 2 months, 6 months, and up to 1 year in duration. Results of the proposed study will be used in combination with subsequent definition and design of exploration mission systems and operations concepts to define data-based Fitness for Duty standards.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	<p>The core focus of this study is to facilitate safe exploration of Mars and return back to Earth, which albeit has limited direct impact to the people on Earth, but to the extent that space exploration is for the good of all humanity, this study will facilitate more successful missions to Mars.</p>
Task Progress:	<p>The Institutional Review Board (IRB) Approval has been completed and maintained for the pilot study (JSC eIRB STUDY00000242) and CIPHER Egress Fitness (JSC eIRB STUDY00000169) and test readiness review (TRR) documentation has been completed and maintained for both studies. [Ed. Note: CIPHER is the short title for a set of 14 studies sponsored by NASA and international partner agencies (https://www.nasa.gov/feature/experiments-to-unlock-how-human-bodies-react-to-long-space-journeys). CIPHER stands for "Complement of Integrated Protocols for Human Exploration Research".]</p> <p>Pilot Egress Fitness is unchanged since the last report and has enrolled 10 total subjects (4 complete, 4 dropped, 2 in progress). The remaining 2 subjects have had their flight delayed several times, but offer an interesting opportunity to explore Egress Fitness integration using a new space vehicle, hence the study remains open.</p> <p>CIPHER Egress Fitness has enrolled 5 total subjects, with 1 withdrawal. One subject has completed all pre-flight sessions, and one has completed the suit fit and L-180 extravehicular activity (EVA) familiarization session (however, we lost the L-60 ARGOS EVA session due to an adverse incident investigation resulting from another study that shut down the ARGOS facility from May 2023). The third subject withdrew; the fourth subject will perform capsule egress only due to the ARGOS shutdown, and a fifth subject has been enrolled but has not begun testing.</p> <p>There has been significant effort over the past few months to defend the importance of CIPHER Egress Fitness at multiple control boards and integration panels. ARGOS is currently scheduled to be back in service in time for the next post-flight Egress Fitness subject in February 2024.</p> <p>Since the last Task Book report, the only significant change has been the development of a lighter and more portable capsule egress mockup. The original version used a modified commercial tripod rescue winch and 80/20 T-slot aluminum, as well as custom machined brackets. The new version relied primarily on carbon fiber tubing to reduce the overall mass and also allowed us to reduce the longest length to 36 inches.</p>
Bibliography Type:	Description: (Last Updated: 02/12/2025)
Abstracts for Journals and Proceedings	<p>Norcross JR, Schlotman TE, Cox LI, Rhodes R, Rivas E, Young M, Abercromby AFJ, "Validation of fitness for duty standards using pre-and post-flight capsule egress and suited performance tasks in simulated reduced gravity." 2023 NASA Human Research Program Investigators' Workshop, "To the Moon: The Next Golden Age of Human Spaceflight", Galveston, TX, February 7-9, 2023.</p> <p>Abstracts. 2023 NASA Human Research Program Investigators' Workshop, "To the Moon: The Next Golden Age of Human Spaceflight", Galveston, TX, February 7-9, 2023.</p> <p>https://custom.event.com/5802E71AA4E24C3FA9A1B3F099BBD52D/files/8706f1f66af74e2f876a4715c8cfdcf3.pdf , Feb-2023</p>