Fiscal Year:	FY 2018	**Task Last Updated:**	FY 05/17/2019
PI Name:	Greene, Maya Ph.D.		
Project Title:	Vehicle NHV and Habitability Assessment		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
Joint Agency Name:		**TechPort:**	Yes
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 (2) **HSIA**:Risk of Adverse Outcomes Due to Inadequate Human Systems Integration Architecture		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	maya.r.greene@nasa.gov	**Fax:**	FY
PI Organization Type:	NASA CENTER	**Phone:**	281-483-3841
Organization Name:	KBRWyle/NASA Johnson Space Center		
PI Address 1:	2400 E NASA Parkway		
PI Address 2:	Mailcode: Wyle/HSE		
PI Web Page:			
City:	Houston	**State:**	TX
Zip Code:	77058	**Congressional District:**	36
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	Directed Research
Start Date:	02/06/2017	**End Date:**	09/30/2018
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:	Williams, Thomas	**Contact Phone:**	281-483-8773
Contact Email:	thomas.j.will1@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: Extended to 9/30/2018 from original end date of 6/29/2018, per PI (Ed., 8/7/18)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Schuh, Susan M.S. (MEI Technologies/NASA Johnson Space Center) Vasser, Katie M.S. (MEI Technologies/NASA Johnson Space Center) Archer, Ron M.S. (Lockheed Martin/NASA Johnson Space Center) Whitmire, Alexandra Ph.D. (KBRWyle/NASA Johnson Space Center)		
Grant/Contract No.:	Directed Research		
Performance Goal No.:			
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Task Description:	NOTE: Continuation of "Vehicle NHV and Habitability Assessment" with Principal Investigator (PI) Dr. Sherry Thaxton due to Dr. Thaxton's move to Human Factors & Behavioral Performance Deputy Element Scientist, as of 2/5/2017. The purpose of this study is to assess habitability on the International Space Station (ISS) in order to better prepare for long-duration spaceflight missions of the future. The project deliverables will include information to help prioritize and reduce research gaps, operational inputs to the Human Performance Data Repository, and data for modeling and simulation tool development and validation to use for future designs.The knowledge gained through this project will provide valuable insight into a day-in-the-life of an astronaut as well as providing initial steps to characterize/quantify how we work and live in a microgravity environment during a year-long mission. Thus, it will help address specific research needs identified as part of the Human Research Program's (HRP's) 2012 Habitable Volume Workshop and Standing Review Panel comments, and result in recommendations for future vehicle design layout and minimum net habitable volume (NHV). In addition, another potential outcome of the project will be enhancing the current ISS human factors crew debrief processes, resulting in higher quality data with minimal impact on crew time. This study is led by the Human Factors and Behavioral Performance (HFPB) element. Specific Aims: Specific Aim 1: Characterize the current state of ISS habitability using tools to capture data near real-time. o Aim 1a: Document/quantify details about crew task performance in a long-duration microgravity environment, including influences from the habitable environment and relationship impacts to the behavioral state of crewmembers. o Aim 1b: Determine whether mission duration leads to changes in habitability/human factors reporting by crewmembers. o Aim 1c: Assess the cost versus benefit of implementing near real-time tools compared to traditional post-mission debriefs. Specific Aim 2: Document/characterize details about how crewmembers currently utilize the space on ISS. o Aim 2a: Quantify time spent by crewmembers at workstations/habitation areas. o Aim 2b: Collect naturalistic data to document movement of crewmembers throughout ISS (e.g., frequency of translations between locations). o Aim 2c: Collect evidence to use toward validating estimates of required volume for performance of volume-driving tasks. o Aim 2d: Capture changes in strategies for crew tasks such as translation, stowage handling, etc. throughout the course of the mission.
Rationale for HRP Directed Research:	This research is directed due to a time constraint. This proposal focuses on the research opportunity afforded by the 2015 year-long mission of two crewmembers aboard the International Space Station (ISS).
Research Impact/Earth Benefits:	Innovative technology developed includes the Space Habitability Observation Reporting Tool (iSHORT). iSHORT is an iPad-based application that allows crewmembers to document near real-time observations about their surroundings using text, photographs, video, and audio recordings. iSHORT was reviewed by the Johnson Space Center (JSC) New Technology Evaluation Board, which recommended it for publication in a future edition of the NASA Tech Briefs magazine.
Task Progress:	ED. NOTE (5.17.2019): Compiled from PI's final progress report submitted to NASA Human Research Program in early 2019. Poorly designed habitats and vehicles reduce crew safety, introduce inefficiencies and errors, and reduce satisfaction. It is therefore important to study and characterize habitability and human factors on board the International Space Station (ISS) to improve future vehicle and habitat design. Research was performed under the directed research project titled Habitability Assessment of International Space Station (ISS Habitability) Human Factors and Behavioral Performance (HFBP). The aim of the study was to address the Risk of an Incompatible Vehicle/Habitat Design, and researchers collected and analyzed data about human factors and habitability on board the ISS and made recommendations for redesign of future vehicles. The participants of the study used two custom iPad applications: they recorded observations about their living and working environment using the Space Habitability Observation Reporting Tool (iSHORT), and they responded to questionnaires on the iQuestion and Answer (iQ&A) application. Six ISS crewmembers participated in the study; one crewmember spent a year on the ISS and the other five crewmembers spent six months on board. Participants collected data throughout their missions: they were asked to capture observations about their environment about once every two weeks; to capture a video as they passed through an area of ISS about once per month; to narrate a task about once per month; to complete a human factors and habitability questionnaire three times during the mission; and to participate in a conference with the investigator's team after they had filled out each questionnaire. Content analysis was used to categorize the data, draw general conclusions, and make recommendations for future vehicle and habitat designs. This study revolved around two primary aims. The first aim, to characterize human factors and habitability aboard ISS, was fully achieved by the study. Details about habitability and human factors during a long duration microgravity exposure were documented, and the relationship between environmental factors and performance were analyzed and used to derive recommendations for future missions and vehicle design (Aim 1a). The effect of mission length on human factors reporting by crewmember were examined by looking at mission breakdown by phase, and did not appear to have a consistent pattern (Aim 1b). However, it is important to note that only 1 of the 6 crewmembers who participated in the study was a 1-year mission crewmember. In future studies, the potential effect of variable mission length should be examined with additional participants. Aim 1c, examine the cost versus benefit of implementing the use of near-real time

	tools for collecting feedback, was addressed by the feasibility and success of implementing the data collection tools. The second aim, to characterize the utilization of space on ISS, was partially addressed by examining specific locations about which participants submitted observations. A future study focusing on achieving aim 2 should include the development/refinement of existing tools in order to fully address these important questions. In general, the study participants provided thoroughly detailed and insightful feedback for all data collection types. The participants had a good understanding of the types of details that will be of interest to habitability and human factors experts, and have provided a wealth of information relevant for the design of future space vehicles and habitats. Providing an opportunity for participants to capture observations while on-orbit allowed them to give demonstrations and discuss details that are fresh on their mind. Ideally, this type of near real-time reporting of human factors and habitability concerns should continue as part of regular operations on ISS and in future programs, potentially as an integrated part of the Crew Notes functionality. This data will be of outstanding value not only to human factors researchers and vehicle designers, but to the greater operational community as well.
Bibliography Type:	Description: (Last Updated:)