Fiscal Year:	FY 2021	**Task Last Updated:**	FY 04/20/2021
PI Name:	Sirmons, Takiyah Ph.D.		
Project Title:	Improvement of Shelf Life for Space Food Through Hurdle Approach		
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) **Food**:Risk of Performance Decrement and Crew Illness Due to an Inadequate Food System		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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PI Organization Type:	NASA CENTER	**Phone:**	281-244-8443
Organization Name:	KBR/NASA Johnson Space Center		
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PI Address 2:			
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City:	Houston	**State:**	TX
Zip Code:	77058	**Congressional District:**	22
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	Directed Research
Start Date:	12/01/2019	**End Date:**	03/31/2027
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:	Brocato, Becky	**Contact Phone:**	
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Flight Program:			
Flight Assignment:	NOTE: Start date revised to 12/01/2019 from 10/01/2019 per discussions with PI and HRP (Ed., 8/2/21)		
Key Personnel Changes/Previous PI:	December 2019--With this continuation project, Takiyah Sirmons takes over the project from Maya Cooper. Maya Cooper remains as CoInvestigator (CoI). Lea Mohr, who was CoI on the project with PI Cooper, has passed away.		
COI Name (Institution):	Cooper, Maya M.S. (Leidos/NASA Johnson Space Center) Froio-Blumsack, Danielle M.S. (U.S. Army Natick Soldier RD&E Center) Douglas, Grace Ph.D. (NASA Johnson Space Center) Young, Millenia Ph.D. (NASA Johnson Space Center)		
Grant/Contract No.:	Directed Research		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	[Ed. note 12/13/2019: Continuation of "Improvement of Shelf Life for Space Food Through Hurdle Approach" with Principal Investigator (PI) Maya Cooper, due to PI Cooper relocating within Human Research Program at Johnson Space Center.] Most items of the current space food system will not achieve the minimum 5-year shelf life required for a Mars mission due to decrements in nutritional quality or sensory acceptability. Previous Advanced Food Technology (AFT) studies have shown critical losses in some nutrients in a number of space food products after 3 years of ambient storage [Cooper project, “Effects of Processing and Subsequent Storage on Nutrition (PI Cooper)”], unacceptable losses in quality after 3 years [Catauro, P.M. & Perchonok, M.H. Assessment of the long-term stability of retort pouch foods to support extended duration spaceflight. Journal of food science (2012) 77, S29-39], and the inability of individual processing and storage solutions to achieve a projected 5-year shelf life (Cooper project “Integration of Product, Package, Process, and Environment: A Food System Optimization”). This task will investigate the use of hurdle approach to increase the shelf life of the current space food system, as well as assess the stability a supplemental component food system (homogeneous, shelf-stable foods and an assortment of condiments) stored under similar conditions. The study will produce the 5-year data essential to fully inform the state of a Mars food system and indicate the best countermeasures to nutritional and sensory degradation. Putting a 7-year data option in place initially will ensure that the PRR is not unnecessarily extended by several years if it is determined at that time that a longer-term shelf life study was necessary to determine mission requirements. Specific Aims: Determine how reduced storage temperatures (-80C, -20C, 4C) and alternative processing and packaging impact the quality and nutrient concentrations of space food over a 5-7 year shelf life period as compared to the quality and nutrient concentrations of space food produced under traditional methods and stored at ambient temperature (21C).
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The discovery of pathways to extend the shelf life of space food is directly transferable to the extension of shelf life of military food, emergency food rations, and commercial food items. Longer food shelf life leads to lower food waste, higher food quality in aging food samples, and an opportunity to increase variety within stored food inventory. The exploration of an alternative technology, specifically microwave-assisted thermal sterilization, provides additional data for the FDA (Food & Drug Administration) approval of this new processing technology, which drives commercial innovation in the food industry.
Task Progress:	The procurement, production, and packaging of all International Space Station (ISS) standard menu, microwave-assisted thermal sterilization (MATS), and condiment foods was completed in 2018. In 2019, the research plan was expanded to include the evaluation of eight plain component foods (homogeneous, shelf-stable proteins, starches, and vegetables), which are uniquely processed and stored, easily interchanged, and preferentially sauced to provide custom dishes to the crew. Nine condiments were later added to evaluate the acceptability of representative condiments currently used on ISS, as well as a dry condiment powder intended to be rehydrated at use. Center closures due to COVID-19 delayed the evaluation of several products in 2020. To date only 22 of the 36 planned foods have undergone year one evaluations, including 8 out of 9 condiments, which have undergone year-one evaluation. A pilot evaluation of a new Radiant Energy Vacuum (REV) technology was also added to this work and the initial comparison of REV to Feeding Directorate (FD) prototypes has been completed.
Bibliography Type:	Description: (Last Updated: 11/05/2020)