Fiscal Year:	FY 2014	**Task Last Updated:**	FY 09/25/2014
PI Name:	Cooper, Maya M.S.		
Project Title:	Functional Foods Baseline and Requirements Analysis		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Space Human Factors Engineering		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	None		
Space Biology Element:	None		
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Space Biology Special Category:	None		
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Comments:			
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No. of Master's Candidates:	0	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
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Flight Program:			
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Key Personnel Changes/Previous PI:			
COI Name (Institution):	Douglas, Grace Ph.D. (NASA Johnson Space Center)		
Grant/Contract No.:	Directed Research		
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Performance Goal Text:			
Task Description:	NASA, in planning for long duration missions, has an imperative to provide the necessary nutrition to ensure sustainment of crew health and performance. To this end, the Human Health Countermeasures (HHC) Program has identified several desired nutrients, optimally delivered from food sources, with the potential to benefit health beyond nutritional maintenance. It is expected that these nutrients, and any nutrients identified in the future, will be required to be delivered in the food system to mitigate or prevent health issues, and that determination of compatible formulation, processing, and storage conditions will enable these functional foods to meet shelf life requirements. The purpose of this task is to determine the current concentrations of these previously unmeasured nutrients in the food system and their stability to different processing conditions, formulation matrices, and storage temperatures reflective of potential vehicle architecture to inform functional food capabilities and requirements development for long duration spaceflight. Milestones and Deliverables: The study duration is 3 years. Analysis of existing nutritional data, the assessment of additional nutrients in existing food over time, and characterization of food matrices encompass much of the study and		

	occur concurrently throughout the study. The SharePoint development work will proceed throughout the course of the study with development in the first half and a supported go-live state for the latter part of the study period. At the conclusion of this task, researchers will deliver a baseline assessment of functional foods within the current ISS food system as well as provide requirements for the development of functional foods in the space food system.
Rationale for HRP Directed Research:	This research is directed because it contains highly constrained research.
Research Impact/Earth Benefits:	This research is on the forefront of establishing functional food concentrations in processed foods whereas the current research focus only considers whole, generally fresh, foods. The data will allow efforts for high nutrition to all populations regardless of access to fresh food. Consequently, the benefits of healthful diet can be extended as well.
Task Progress:	Twelve foods that were thought to have a significant concentration, or a concentration significantly greater than most spaceflight foods, of bioactive compounds (lycopene, lutein, omega-3 fatty acids, phenolics, sterols, and flavonoids) were selected for the study from the International Space Station food provisions. Recently produced food samples were sent by overnight shipment to the Food Composition Laboratory of the Linus Pauling Institute at Oregon State University (Corvallis, OR) for bioactive compound analysis. Three packages of each product were blended together for the analysis to reduce package-to-package variability. Duplicate samples of the food were placed in 4°C, 21°C, and 35°C environmental chambers within the Space Food Systems Laboratory for storage and re-analysis at periodic time points. The initial assessment of functional foods within the current spaceflight food system is mixed. Current processing technologies are adequate to provide high-lycopene, high-lutein, or high-omega-3 fatty acid foods within the spaceflight food system, at least at the beginning of shelf life, as demonstrated by the identification of the foods of this study and their initial chemical analysis. As expected, the kale, salmon, and cheese tortellini products had great amounts of their respective bioactive compounds. Sterol concentrations coincided with the sterol concentrations in the average diet. The antioxidant capability of the foods - cumulatively if not individually - is also projected to be adequate and representative of a balanced diet. Yet, the use of foods for health benefit in space could be a challenge with the current menu. The limited identification of foods with high bioactive compound concentrations highlighted the fact that the ISS provisioning menu likely does not have a variety of foods with specific bioactive compounds to fully institute a meal plan to address those health issues requiring compound-specific mitigation without creating a secondary issue of menu fatigue. Additionally, it is yet unknown whether the bioactive compounds will remain stable over the extended shelf life of five years required for a Mars mission. The balance of the menu appears to be well-suited to address those health concerns benefiting from chemical structure-specific mitigation, i.e. polyphenolic supplementation for antioxidative properties, provided that the chemical stability of the compounds maintains the structure for a long shelf life.
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