Fiscal Year:	FY 2015	**Task Last Updated:**	FY 04/30/2015
PI Name:	Cooper, Maya M.S.		
Project Title:	Literature Review of Factors Affecting Food and Nutrient Stability		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Space Human Factors Engineering		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **SHFH**:Space Human Factors & Habitability (archival in 2017)		
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Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	Directed Research
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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
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Flight Program:			
Flight Assignment:	NOTE: Extended to 3/31/2015 (original end date was 9/1/2014) per JSC HRP (Ed., 8/13/14)		
Key Personnel Changes/Previous PI:	None		
COI Name (Institution):			
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Task Description:	NASA, in planning for long duration missions, has an imperative to predict and plan for the shifting nutritional quality of space food provisions to ensure sustainment of crew health and performance. No cumulative source of nutrient kinetic information is available for perusal. The purpose of this task is to conduct a literature review of nutrient degradation kinetics under different processing, storage, and formulation conditions. The review will identify where information is insufficient and must be measured empirically in the space food system to determine the expected loss of nutrition. The Specific Aims are as follows: 1. Review current scientific knowledge on degradation kinetics of naturally present nutrients under various processing and storage conditions that potentially will be used for spaceflight foods, and within the context of different ingredient		

	interactions and product structural matrices. 2. Review current scientific knowledge on fortification nutrient stability under various processing and storage conditions that potentially will be used for spaceflight foods, and within the context of different ingredient interactions and product structural matrices.
Rationale for HRP Directed Research:	The review will contain both published and internal NASA documents on space food stability - information not accessible to the general public. Additionally, the processing variables which impact the stability of space food are well understood by the space food experts assigned to task.
Research Impact/Earth Benefits:	Nutrient-fortified foodstuffs are commonly sent to disaster areas to provide nutrition until more permanent feeding centers can be established. The food is made months and years ahead of need and stored in a safe location.The resolution of nutrient kinetics in processed food has impact to the commercial food sector, where millions of dollars are spent to over fortify foods. The review highlights multiple works to provide a broader view of how predicting vitamin concentration might be modeled for future predictions.
Task Progress:	NASA, in planning for long duration missions, has an imperative to predict and plan for the shifting nutritional quality of space food provisions to ensure sustainment of crew health and performance. No cumulative source of nutrient kinetic information is available -- not on a broad spectrum of vitamins nor on processed foods. This review encompasses both the current scientific knowledge of intrinsic nutrient degradation kinetics under various processing conditions, storage conditions, and within the context of different ingredients and product structural matrices. The evidence from this review indicates that nutrient degradation in food is determined by a number of factors related to the food system. The degradation rates of vitamin C in food were affected by the food matrix, pH, processing conditions, and potentially frozen state storage conditions. Thiamin degradation was influenced by the food matrix, moisture, pH, and temperature. Beta-carotene degradation rates were influenced by the product moisture, processing conditions, and frozen state storage temperatures. Riboflavin concentrations in food were affected by available light but not by the water activity of the food in the low to intermediate moisture range. The complexity of food systems and the limited data available on nutrient degradation kinetics in actual food materials make nutrient degradation predictions difficult. The general kinetic theory and the application to food systems are available in published literature upon which to build nutrient kinetic models if the correct initial data is gathered. In order to inform space food shelf life requirements, kinetic data is needed for specific combinations of food moisture, formulation, processing, and controlled-temperature storage conditions. There is significant kinetics data on thiamin, riboflavin, vitamin C, vitamin A, vitamin B6, and folic acid but the potential application for flight foods is limited due to differences in processing, packaging, and potential long duration mission storage temperature range. Freeze-dried products remain viable options for long duration missions so data is needed for a wide variety of low moisture products. Reduced temperature food storage, or even abusive food temperature storage conditions, are yet undefined for the mission scenario; kinetics applicable to a wide temperature range are also required. The conditions of experimental data would need to be similar to actual flight food conditions to facilitate accuracy in extrapolation. Other vitamins, which lack degradation kinetics data in actual food, must be considered as candidates for more detailed studies based on the expected value of such studies given the results of space food-specific nutritional snapshot studies, comparison of the anticipated concentrations to the level of quantitation necessary for analytical detection of the vitamins, and the available financial resources to support further studies.
Bibliography Type:	Description: (Last Updated: 04/23/2019)