Fiscal Year:	FY 2015	Task Last Updated:	FY 08/28/2014
PI Name:	Barrett, Ann Ph.D.		
Project Title:	Stabilized Foods for Use in Extended Spaceflight: Preservation of Shelf-Life, Nutrient Content and Acceptability		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline			
Element/Subdiscipline:	HUMAN RESEARCHSpace Human Factors Eng	ineering	
Joint Agency Name:		TechPort:	No
Human Research Program Elements:	(1) HHC :Human Health Countermeasures		
Human Research Program Risks:	(1) Food and Nutrition: Risk of Performance Decre	ement and Crew Illness Due to	Inadequate Food and Nutrition
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	ann.h.barrett.civ@mail.mil	Fax:	FY
PI Organization Type:	GOVERNMENT	Phone:	508-233-4516
Organization Name:	United States Department of the Army		
PI Address 1:	NSDREC, CFD/PORT, RDNS-CFP		
PI Address 2:	U.S. Army Natick Soldier Systems Center		
PI Web Page:			
City:	Natick	State:	MA
Zip Code:	01760-5018	Congressional District:	7
Comments:			
Project Type:	Ground	Solicitation / Funding Source:	2011 Crew Health NNJ11ZSA002NA
Start Date:	11/01/2012	End Date:	10/31/2015
No. of Post Docs:	0	No. of PhD Degrees:	1
No. of PhD Candidates:	1	No. of Master' Degrees:	4
No. of Master's Candidates:	0	No. of Bachelor's Degrees:	1
No. of Bachelor's Candidates:	0	Monitoring Center:	NASA JSC
Contact Monitor:	Douglas, Grace	Contact Phone:	
Contact Email:	grace.1.douglas@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: Changed from NSBRI to NASA-monitored	project, per M. Perchonok/NA	SA JSC (Ed., 2/25/2013)
Key Personnel Changes/Previous PI:	N/A		
COI Name (Institution):	Froio, Danielle (United States Department of the Army) Richardson, Michelle (United States Department of the Army)		
Grant/Contract No.:	NNJ13HA911		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	The objective of this effort is to develop shelf stable, highly acceptable, food with increased nutrient (vitamins) stability for extended space missions utilizing innovative processing and packaging technologies. There will be two research thrusts. For the first thrust area, we will formulate, test, and optimize the quality and nutrient content of a range of fortified shelf-stable foods. The focus will be on extruded/pressed low-water activity bar-type products. Advances in innovative pre-treatment technologies (encapsulation) for vitamins will be assessed, as well as synergy with matrix chemical character. For the second thrust area, different packaging technologies will be investigated with research focused on the interaction of packaging material with various innovative sterilization processes such as microwave heating, irradiation, and high pressure treatment. The availability of highly nutritious and health-promoting food is a factor that is a significant prerequisite for prolonged space travel. The design of feeding and nutritional strategies for multi-year, non-resupplied flights is an undertaking requiring substantial research and development; it is also an endeavor and that could be founded upon our existing, considerable knowledge and experience base at Natick Soldier RD&E Center.	
Rationale for HRP Directed Research	:	
Research Impact/Earth Benefits:	The proposed study will yield strategies for the development of extremely stable, nutrient-dense foods and the development of packaging materials compatible with new quality-preserving sterilization techniques. While this work is specifically important to the health of astronauts, its significance also extends to the research that is critical to the mission of the Natick Soldier Research Development and Engineering Center: to support and promote the nutritional health of the Warfighter on extended missions with little or no means of resupply.	
Task Progress:	Matrix science effort: In the last nine months we have: (1) analyzed the results from the earlier 4-week high temperature study and selected the best encapsulant for each system. Lipid encapsulation of vitamins was selected for the low fat prototypes and carbohydrate encapsulation was selected for the high fat prototypes.; (2) Produced sufficient quantities of: low fat compressed (blueberry granola) bars containing lipid-encapsulated vitamins; high fat bars containing carbohydrate-encapsulated vitamins; low fat drink/smoothie mix (chocolate hazelnut) containing lipid-encapsulated vitamins; high fat drink/smoothie mix containing carbohydrate-encapsulated vitamins; (3) Placed all product in 70F storage for pull/analysis at 1, 2, and 3 years, and in 100F storage for pulls at 6 and 12 months; (4) conducted baseline vitamin analysis, with comparison of 2xSFR target levels; (5) conducted analysis of vitamin B1 (all products): 19-29% loss of vitamin B9 (all products): 2-14% loss of vitamin C (all products):0-8% loss of vitamin E (all products). At this time the only significant effect of food type or vitamin coating on vitamin activity loss was for B9, in which a high fat coating and matrix was comparatively protective. Processing/packaging effort: in the last nine months we have (1) conducted all year-2-scheduled processing trials (microwave-assisted, pressure-assisted, irradiation, and standard retort sterilization) with all possible innovative packaging materials (coated clear polymer pouches and standard foil/laminate MRE pouches); (2) analyzed the physical, mechanical, and barrier properties of the pouches before and after processing; and (3) evaluated the quality of a model food system (creamy cajun chicken). Processing affected the tensile strength, burst strength, microscopic appearance (bubbling) and elastic modulus of the individual pouch materials, and produced color changes in the samples. Product color degradation (i.e., browning) resulted from process type according to: retorting > MATS > PATS > irradiat	
Bibliography Type:	Description: (Last Updated: 08/25/2020)	
Abstracts for Journals and Proceedings	Barrett A, Richardson M, Froio D, Anderson D, Racicot K, Ndou T, Pecukonis L. "High-temperature, Short time stability of vitamins in different food matrices developed for NASA." Institute of Food Technologists Meeting, New Orleans, LA, June 21-24, 2014. Published abstracts. Institute of Food Technologists Meeting, New Orleans, LA, June 21-24, 2014. , Jun-2014	
Abstracts for Journals and Proceedings	Barrett A. "Military Feeding in Extreme Environments." Feeding in Extreme Environments symposium, Institute of Food Technologists Meeting, New Orleans, LA, June 21-24, 2014. Published abstracts. Institute of Food Technologists Meeting, New Orleans, LA, June 21-24, 2014. , Jun-2014	