Fiscal Year:	FY 2011	Task Last Updated:	FY 09/07/2010
PI Name:	Catauro, Patricia M.S.	·	
Project Title:	Suited Contingency Ops Food		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline Element/Subdiscipline:	HUMAN RESEARCHSpace Human Factors Engineer	ing	
Joint Agency Name:		TechPort:	Yes
Human Research Program Elements:	(1) SHFH:Space Human Factors & Habitability (archiva	al in 2017)	
Human Research Program Risks:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	77058	Congressional District:	22
Comments:			
Project Type:	Ground	Solicitation / Funding Source:	Directed Research
Start Date:	10/01/2008	End Date:	09/30/2011
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
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Flight Program:			
Flight Assignment:	NOTE: Start date changed to 10/01/2008 per M. Perchon	nok (was 10/01/2007)5/2009	
Key Personnel Changes/Previous PI:			
COI Name (Institution):			
Grant/Contract No.:			
Performance Goal No.:			
Performance Goal Text:			
Task Description:	The Advanced Food Technology (AFT) project is currently working to provide crews with a food system that will maintain safety and ensure performance throughout NASA exploration missions. Part of this task involves the development of a nutrition delivery system for use in suited survival operations. This task seeks to define requirements for such a system, develop the system, and allow delivery of the system to the stakeholders. In addition to the constraints of mass, volume, and crew resources that influence the development of all spaceflight systems, design of the contingency food system is also affected by other constraints. The designed delivery system must have adequate interface with mission pressure suits and vehicle hardware, and must function in the hypobaric and microgravity contingency environment. Additionally, it must meet other requirements relevant to other Space Life Sciences stake-holding disciplines. In light of these challenges, a two-stage development process has been initiated. The progress		

made with respect to this process is summarized herein.

Rationale for HRP Directed Research:		
Research Impact/Earth Benefits:	The study seeks to define a nutrition delivery system for in-suit use. The results have immediate relevance to the Constellation and future manned spaceflight programs, but may also prove useful for pharmaceutical, medical, and performance foods industries.	
Task Progress:	Advanced Food Technology (AFT) has worked throughout the period to assemble representatives from Space Life Sciences Directorate (SLSD) disciplines, in order to ensure effective consideration of their input in the first stage of requirements definition. As of early FY10, 12 disciplines were identified as stake-holding and integrating groups for this task. These groups collaborated frequently throughout the period to identify and document their concerns, including but not limited to their ownership of existing requirements, individual working assumptions, watch items, and risks. An agreement was made between these disciplines, whereby development of a contingency nutrition capability would address a conservative scenario of delivering a diet of nominal nutritive composition to crew in contingency scenarios. In light of the conservative design reference scenario identified by integrating disciplines, initial recommendations were provided during the period to EVA hardware design teams on the expected physical properties of a contingency nutrition provision. Top-level assessment and in-house laboratory evaluations of physical properties were conducted on a broad range of commercial nutritional beverages. Upon completion of the in-house evaluation, design input was provided to the EVA T&E hardware team. The input included confirmation that a fluid beverage would be identified or designed to provide at maximum nominal nutrient and kilocalorie levels to suited crew in contingency events. The estimated kinematic and dynamic viscosity ranges for a suited contingency liquid beverage were also provided to the suit and vehicle design teams.	
	To further aid in designing delivery system hardware, a review of heritage aviation and spaceflight feeding systems was conducted by the Principle Investigator. The review identified several design concepts and open issues that may assist in the design of future contingency feeding capability. A summary of the identified heritage feeding systems and open issues identified in the review was provided to Constellation Program stakeholders. The open issues generally address gaps in an understanding of the food system behavior in (1) the absence of pressure and (2) after exposure to differential pressure, such as that of a spacesuit. To address these issues, the following activities have been performed to date: in-house vacuum testing of packaging materials and glove box assessment of contingency design concepts. Several key findings were confirmed in these efforts.	
	Integrating disciplines also worked throughout the period to develop detailed schedules for collaboration on this task. A main element of the Space Life Sciences input in the integrated schedule is that of the multi-phased development process for the beverage. By working to the conservative design scenario referenced above, nutritional requirements will be identified by the Nutritional Biochemistry Laboratory and commercial products that meet a majority of the requirements will be scoped by AFT. Upon completion of each market survey assessment, SLSD stakeholders would be informed and have the opportunity to modify their initial recommendations, if necessary. This iterative process is to continue until the most appropriate and technologically feasible beverage requirements have been identified.	
	The first set of nutritional recommendations for contingency events was received by the PI from SK/Nutritional Biochemistry Laboratory in January 2010. The PI has used these recommendations to conduct commercial product scoping and identify products that may be appropriate for contingency scenarios. During the period, over 300 beverages were considered against the contingency recommendations, including both Ready-to-Drink (RTD) aseptically packaged liquid and Ready-to-Use (RTU) soluble, dry powder formulas. None of the commercial options considered were found to meet the recommendations in full. The results of this scoping will be provided for consideration to SLSD stakeholders, and allow an opportunity for further refinement of the requirements.	
Bibliography Type:	Description: (Last Updated: 03/22/2018)	