Fiscal Year:	FY 2010	**Task Last Updated:**	FY 09/04/2009
PI Name:	Oziomek, Thomas B.S.		
Project Title:	Bulk Overwrap Packaging		
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)		
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		
PI Email:	thomas.oziomek-1@nasa.gov	**Fax:**	FY
PI Organization Type:	INDUSTRY	**Phone:**	281-483-2006
Organization Name:	MEI Technologies Inc.		
PI Address 1:	2525 Bay Area Blvd, Suite 300		
PI Address 2:			
PI Web Page:			
City:	Houston	**State:**	TX
Zip Code:	77058	**Congressional District:**	22
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	Directed Research
Start Date:	10/01/2008	**End Date:**	02/28/2010
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:	Woolford, Barbara	**Contact Phone:**	218-483-3701
Contact Email:	barbara.j.woolford@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: PI change in March 2010 to Catauro, per JSC. Project continues to 9/30/2010 but not with Oziomek (09/2010)		
Key Personnel Changes/Previous PI:	NOTE: PI change to Catauro in March 2010, per J. Marsack/JSC. See Catauro for FY2010 final reporting (Ed., 9/30/2010)		
COI Name (Institution):	Catauro, Patricia (Lockheed Martin)		
Grant/Contract No.:			
Performance Goal No.:			
Performance Goal Text:			

Task Description:	NASA has established the goal of returning human expeditions to the moon and extending exploration to Mars. Extended manned missions of these types require massive quantities of food to be flown into space. This presents two challenges when dealing with a food system. The first challenge is in maintaining the quality of the food throughout its shelf life which may be in excess of five years, and to assure the mass and volume of the food system are minimized. The purpose of this project is to identify a low mass, flexible bulk overwrap system intended to maximize shelf life of food by preventing oxygen and moisture ingress, while minimizing volume and mass of the total system. The research will involve the identification of materials, scavenger systems, and various packaging configurations to meet all of the above requirements. The current packaging and stowage system is adequate for the current, short duration missions involving high payload vehicles such as the Shuttle Transportation System (STS) and Russian Progress vehicles. Payload for long duration missions (years rather than months) will require a greater quantity of food in proportion to other supplies than do the missions of today, like the International Space Station (ISS) missions. Thus, the need for reduced stowage mass and volume becomes critical in order to execute future missions. The key elements of the bulk overwrap system development and evaluation are identified below. - Select and evaluate overwrap materials - Evaluate various flexible pouch configurations - Evaluate re-sealable systems - Evaluate scavenger systems - Develop efficient method for packaging, by optimizing: -- Vacuum packaging parameters -- Gas flushing parameters -- Heat Sealing parameters -- Rigid fixtures to manipulate shape - Compare mass of bulk overwrap system vs. individual overwrap - Compare mass of bulk overwrap system vs. current ISS rigid container system - Identify and document possible improvements to the existing system - Make recommendations for future work
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	0
Task Progress:	During the stowage part of the evaluation, it was determined that the flexibility differences of the three material types did not have an impact on ease of stowage or vacuum sealability. The clear materials were desirable to see how the food looked inside the bulk overwrap package throughout the evaluation, but the foil laminate would be the recommended material for its superior barrier properties. The smaller fixture that was originally built did not allow for easy stowage of the foods because the pouches were slightly wider than the fixture. The larger fixture solved the stowage problem and worked very well with the gusseted pouches. The current Accu-Seal sealer had trouble sealing the gusseted pouch because it is designed for sealing through only two layers of film, rather than the four layers in the gusseted pouches. Therefore, it is recommended that a more appropriate sealer be purchased for improved sealability and vacuum sealing of the gusseted pouches. The pie shaped fixture did not yield desirable results. The two side pouch formed to the pie shape well but it created a lot of waste material in certain areas because it had to be folded to conform to the shape. Also, the shape did not allow for optimal stowage since most of the packages are rectangular, so there was considerable wasted volume. There were a lot of issues with sealing the pouch because it created a large and an almost round diameter, opening that was hard to lay flat inside the seal bar without creating any fold in the material. Folds in the seal area were unavoidable without having to seal the pouch at least one foot above the food, which created additional material and volume waste. Any folds in the seal caused the pouch to lose its vacuum. A large two sided pouch formed to an odd shape is not recommended for this application. The foil bulk overwrap pouch provides significant food packaging time savings versus the individual overwrap system and considerable volume and mass savings. By using the bulk overwrap system the time required for packaging of food is reduced by about 50% because the primary food package no longer has to be inserted and sealed in a secondary package. The time required to stow and seal the food in the bulk overwrap package may increase slightly due to the vacuum and gas flushing of the package versus stowing the food directly into the Collapsible US Food Container (CUFC). The CUFC has internal dimensions of about 14.75”x 11.75”x 4.75”, which is approximately 825 in3 in volume. The removal of the individual overwrap pouches and vacuum packaging of the bulk overwrap from the Sweets Snacks and Yogurts (SSY) container reduced the volume inside the CUFC by 154 in3, which is approximately 18.7% of the total volume of the container. This is very significant because it would allow for increased food supply in the same amount of volume. The foil bulk overwrap pouch weighs 65g after being cut down to 4 inches above the food, the shortest allowed distance due to equipment constraints. There are currently a total of eight different standard menu containers, six of which contain overwrapped foods. The current ISS stowage system consists of the use of rigid aluminum food containers that collapses to approximately 1/6 of its assembled configuration. The containers weigh 700g each and are not typically used post food consumption,

	yielding a considerable amount of wasted volume and mass. The bulk overwrap system could potentially be used as the primary containment system and significantly reduce the upmass. The bulk pouches could be reused for trash or other storage post food consumption. Typically, a resupply flight consists of at least 40 containers of food, which would mean a savings of 28 kg of upmass per flight. The disadvantage to using the bulk overwrap as a stowage container would be that the food would have less protection against impact or sharp objects. Other means of protection could be incorporated into the vehicle stowage to minimize damage to the food. One issue that was discovered during bulk sealing of containers that included MRE pouches, was that the sharp corners of the tear notch on the pouch could pierce through the bulk overwrap package. This caused the package to lose vacuum and its cuboid shape. Also, a loss of packaging integrity would open the contents to the external environment substantially decreasing the shelf life of the food. The recommended solution to this issue would be to research a more robust bulk overwrap material or to purchase MRE type pouches that exclude the tear notch, to prevent piercing. A new Accu-Seal sealer with biactive sealer bars, that seal from both sides, and improved mechanism for vacuum/gas flushing has been ordered to improve the testing capabilities. The new sealer will be used for further optimization of the vacuum and gas flush parameters to reduce the oxygen content in the headspace to the lowest level possible while retaining the cuboid shape. Once the final vacuum level and oxygen content are determined, the proper oxygen scavenger system will be selected. Additionally, samples of various reclosable systems will be researched and acquired during the annual Pack Expo conference in October 2009.
Bibliography Type:	Description: (Last Updated:)