Fiscal Year:	FY 2012	**Task Last Updated:**	FY 09/20/2011
PI Name:	Olson, Sandra Ph.D.		
Project Title:	Oxygen Delivery System		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Operational and clinical research		
Joint Agency Name:		**TechPort:**	Yes
Human Research Program Elements:	(1) **ExMC**:Exploration Medical Capabilities		
Human Research Program Risks:	(1) **Medical Conditions**:Risk of Adverse Health Outcomes and Decrements in Performance Due to Medical Conditions that occur in Mission, as well as Long Term Health Outcomes Due to Mission Exposures		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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PI Organization Type:	NASA CENTER	**Phone:**	216-433-2859
Organization Name:	NASA Glenn Research Center		
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City:	Cleveland	**State:**	OH
Zip Code:	44135	**Congressional District:**	9
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	Directed Research
Start Date:	10/02/2008	**End Date:**	12/20/2013
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:	Watkins, Sharmi1a	**Contact Phone:**	281.483.0395
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Flight Program:			
Flight Assignment:	NOTE: Title change to Oxygen Delivery System (previously Medical Oxygen Fire Safety), per M. Covington/JSC via S. Watkins/ExMC/JSC (Ed., 9/23/13)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):			
Grant/Contract No.:	Directed Research		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	The goal of the Medical Oxygen Concentrator for Spacecraft Emergencies (MOCSE) Project is to develop an oxygen concentrator that provides a reliable source of enriched oxygen from spacecraft cabin air for use in medical contingency operations for current and future spaceflight programs. The current medical oxygen requirement aboard ISS is being met using 100% oxygen from high pressure oxygen tanks, but the problem with this system is that it elevates the cabin oxygen concentration so that extended use will increase the fire hazard in an already contingency operation. The objective of the technology development is to produce a robust system that concentrates the air in the cabin and delivers that to the patient without adding oxygen to the cabin air and thus without increasing the fire hazard in the cabin. Work on this project contains three thrusts as defined below: CONCENTRATOR TECHNOLOGY THRUST While oxygen concentrators are available commercially, they do not meet NASA spaceflight requirements. Accordingly, NASA has undertaken steps to correct that situation. First, in the Fall of 2009, NASA selected Lynntech, Inc. for a Phase II SBIR award to develop electrochemical membrane technology for use as an oxygen concentrator. This promising concept could dramatically reduce the size from what is currently commercially available. In a second technology thrust, the National Space Biomedical Research Institute awarded a grant to Professor James Ritter of the University of South Carolina is developing techniques to modify commercial oxygen concentrators so that they are compatible with spaceflight. NASA's role in this effort is to act as a collaborator: providing information on constraints associated with spaceflight hardware, particularly for oxygen systems, communicating requirements, and as a developer of ancillary technologies, such as batteries. FIRE SAFETY THRUST While the fire hazard associated with an oxygen concentrator is unquestionably lower than that present when oxygen from a storage bottle is released into the closed spacecraft environment, local fire hazards still exist around the patient and the concentrator equipment. NASA Glenn personnel analyzed the hazards associated with this medical treatment, and will continue to analyze the hazards associated with the hardware under development. BATTERY TECHNOLOGY THRUST Given the requirement for 24 hours of operation independent of vehicle power, commercially available batteries may not be able to meet the power requirements of these devices. Given their joint expertise in battery technology, a partnership of NASA GRC and industry personnel will advance the state of the art in metal-air batteries to be compatible with NASA requirements. A Phase I SBIR call was issued in 2010 for advanced battery technology to address this need, and 8 response proposals have been received and are under review.
Rationale for HRP Directed Research:	This research is directed because it contains highly constrained research, which requires focused and constrained data gathering and analysis that is more appropriately obtained through a non-competitive proposal.
Research Impact/Earth Benefits:	The development of a small, portable oxygen concentrator and batteries that can be used to run the oxygen concentrator would have widespread application for use in personal medical oxygen applications, providing patients with significant mobility improvements.
Task Progress:	Task Book Summary 2011 Work on this project for the three thrusts are described below. CONCENTRATOR TECHNOLOGY THRUST While oxygen concentrators are available commercially, they do not meet NASA spaceflight requirements. Accordingly, NASA has undertaken steps to correct that situation. A commercial oxygen concentrator trade study was completed so that new technology oxygen concentrators can be better compared to commercial units. Based on this study, the best rated commercial concentrator was purchased to be used as a baseline unit with which to compare the new technology prototypes. Lynntech is progressing on its SBIR Phase II award, and we expect a prototype unit deliverable for testing and evaluation at the end of the Phase II contract in early 2012. On the NSBRI work, we have toured Ritter Collaborator SeQual's plant in San Diego, CA, and have purchased their most advanced unit for testing and evaluation since it had the highest score in the trade study. Dr. Olson presented the status of the oxygen concentrator work at the 18th International Academy of Astronautics Humans in Space Symposium (HISS), April 11-15, 2011 in Houston, TX. The ExMC medical oxygen use gap report was completed. FIRE SAFETY THRUST A laboratory is being set up to analyze the performance of new technology oxygen concentrators in exploration atmospheres. The laboratory has a vacuum chamber so that the oxygen concentrators can be tested under normoxic conditions that have been proposed for future spacecraft. Dr. Olson described the risk and present mitigation options for "Medical Oxygen Fire Safety in Space" at the The 82nd Annual Scientific Meeting of the Aerospace Medical Association, May 8-12, 2011, at the Hilton and Capt. Cook Hotels in Anchorage, AK. BATTERY TECHNOLOGY THRUST Three SBIR Phase I awards have been made to develop a primary metal-air battery that will be adequate to power the flight oxygen concentrator for the required 24 hours. The awardees are Bettergy, Corp., Ionova, and Yarney. Two of these have deliverable battery cells due at the end of Phase I at the end of September, 2011.

Bibliography Type:	Description: (Last Updated: 02/26/2025)
Abstracts for Journals and Proceedings	Olson SL. "Modeling oxygen buildup in spacecraft and around crewmembers during oxygen therapy." 18th IAA Humans in Space Symposium, Houston, TX, April 11-15, 2011. 18th IAA Humans in Space Symposium, Houston, TX, April 11-15, 2011. , Apr-2011
Abstracts for Journals and Proceedings	Olson SL. "Medical Oxygen Fire Safety in Space." 82nd Annual Scientific Meeting of the Aerospace Medical Association, Anchorage, AK, May 8-12, 2011. Aviat Space Environ Med. 2011 Mar;82(3):345. http://www.ingentaconnect.com/content/asma/asem/2011/00000082/00000003 , Mar-2011