Fiscal Year:	FY 2014	**Task Last Updated:**	FY 07/06/2015
PI Name:	Sherman, Paul M.D.		
Project Title:	Potential Subclinical Neurologic Changes in Astronauts Due to Repeated Hypobaric Exposures		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Biomedical countermeasures		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	(1) **DCS**:Risk of Decompression Sickness [inactive]		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	78236	**Congressional District:**	20
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	Directed Research
Start Date:	09/20/2014	**End Date:**	07/31/2015
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
Contact Monitor:	Norsk, Peter	**Contact Phone:**	
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Flight Program:			
Flight Assignment:	NOTE: Change in start date to reflect start of the project, per CoI J. Norcross (Ed., 5/23/16)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	McGuire, Steven M.D. (United States Air Force) Norcross, Jason M.S. (Wyle Science, Technology and Engineering Group)		
Grant/Contract No.:	Directed Research		
Performance Goal No.:			
Performance Goal Text:			
	Recent evidence has revealed that neurologic changes occur due to repeated hypobaric exposures. Specifically, the US Air Force (USAF) has reported an increased number and increased total volume of white matter hyperintensities (WMH) on MRI (magnetic resonance imaging) in high-altitude pilots. This is important because WMH on MRI are indicators of neurocognitive changes including decreased cognitive speed and dementia. These pilots are exposed to similar occupational environmental conditions as astronauts and those who display these WMH changes also suffer from acute neurocognitive deficits as a result of hypobaric conditions. WMH changes and neurocognitive deficits in USAF pilots have been found to be independent of clinical symptoms. Pilots with an increased number of WMH on MRI and neurocognitive deficits due to hypobaric exposure have been found in both those who deny any clinical symptoms of decompression sickness (DCS) as well as those pilots with DCS.		

Task Description:	The goal of this data mining effort is to identify if any evidence of this potential risk exists in the NASA astronaut population. Our central hypothesis is that NASA has successfully mitigated this potential threat of subclinical neurologic DCS linked to WMH and neurocognitive deficits in past and present missions but may encounter it in the future. We have based this hypothesis on the fact that NASA has no reported incidents of DCS during operational EVAs (extravehicular activity) and no apparent signs of neurocognitive deficits amongst its astronauts. However, NASA plans on increasing the number of hypobaric exposures of its astronauts by several orders of magnitude in the future. Successful completion of this data mining effort will enable NASA to make an informed decision on the need for proper mission monitoring and occupational surveillance for past, present, and future astronauts. Aims: Aim #1: Determine if cumulative hypobaric exposures including EVAs are a risk factor for WMH increase on MRI amongst NASA astronauts during past operations. Hypothesis: NASA's risk-mitigation measures sufficiently minimize the risk of DCS over repeated hypobaric exposures. We will execute a retrospective study on existing MRIs of astronauts' brains compared with those of USAF U-2 pilots, hypobaric technicians, and an age-, health-, and intelligence-matched control population. Aim #2: Develop new measures to estimate the future risk of DCS for astronauts and missions based on newly revealed data of subclinical neurologic DCS. Hypothesis: NASA is underestimating the risk of subclinical DCS for future astronauts and missions because of the paucity of clinical DCS during past operations. We will estimate the risk of subclinical DCS effects based on the current evidence, the anticipated increase in projected number, time, and frequency of EVAs per astronaut and a prolonged hypobaric exposure based on the ambient environment of future expeditionary space vehicles.
Rationale for HRP Directed Research:	This study is highly constrained research that is needed near term to help quantify the potential risk to the astronaut population and to ensure proper surveillance is initiated to quantify the risk in the future. This is a joint effort with the United States Air Force ensuring cost sharing of resources and neuroimaging analysis performed by the same personnel.
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2015.
Bibliography Type:	Description: (Last Updated: 05/24/2016)