Fiscal Year:	FY 2015	**Task Last Updated:**	FY 06/18/2015
PI Name:	Strangman, Gary E Ph.D.		
Project Title:	Testing Mechanical Countermeasures for Cephalad Fluid Shifts		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	NSBRI--Smart Medical Systems and Technology Team		
Joint Agency Name:		**TechPort:**	Yes
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	(1) **SANS**:Risk of Spaceflight Associated Neuro-ocular Syndrome (IRP Rev I)		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	strang@mgh.harvard.edu	**Fax:**	FY 617-726-4078
PI Organization Type:	NON-PROFIT	**Phone:**	617-724-0662
Organization Name:	Massachusetts General Hospital		
PI Address 1:	Department of Psychiatry		
PI Address 2:	149 13th Street		
PI Web Page:			
City:	Charlestown	**State:**	MA
Zip Code:	02129-2020	**Congressional District:**	7
Comments:			
Project Type:	GROUND	**Solicitation:**	2014-15 HERO NNJ14ZSA001N-Crew Health (FLAGSHIP & NSBRI)
Start Date:	06/01/2015	**End Date:**	05/31/2017
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:**	NSBRI
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Baggish, Aaron M.D., Ph.D. (Self) Cohen, Adam M.D. (Massachusetts General Hospital) Rosenthal, Eric M.D. (Massachusetts General Hospital) Rao, Chethan Venkatasubba M.D. (Baylor College of Medicine) Zhang, Quan Ph.D. (Massachusetts General Hospital) Bershad, Eric M.D. (Baylor College of Medicine) Dentinger, Aaron Ph.D. (General Electric Company)		
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Task Description:	Current evidence suggests that NASA's visual impairment and intracranial pressure (VIIP) risk is caused by an elevation in intracranial pressure (ICP) that occurs during spaceflight, consequent to (or aggravated by) cephalad fluid shifts in microgravity. From recent data, it occurs in >50% of astronauts, to varying degrees, and can lead to long term visual changes. Although its cause is unknown, its importance is high enough to motivate studies of potential countermeasures. The key objectives of this proposal are therefore: (1) to test and help validate mechanical countermeasures for cephalad fluid shifts as a potential treatment of elevated ICP, (2) identify any potential adverse consequences during use or following release of such countermeasures, and (3) optimize deployment procedures for such countermeasures. The Russians currently use Braslet, an elastic thigh band, to help sequester blood in the legs and alleviate symptoms resulting from cephalad fluid shifts. While promising, this device has not been tested as a VIIP countermeasure. Lower body negative pressure (LBNP) is an alternative approach, which draws fluid into the legs using vacuum mechanism. Both have drawbacks, however. Braslet devices are only made in Russia and have limited calibration options. LBNP is bulky and hence only one such device would be available in-flight at a time, limiting the number of astronauts who could use it, or the duration of use, each day. In place of the Braslet, we will test the Kaatsu thigh cuff system, which is used for enhanced muscle training on Earth. Instead of the LBNP alternative, we will investigate use of a LymphaPress compression garment configured to progressively compress fluids from the lower ribcage towards the knee. In Experiment 1, we will conduct tests using both potential countermeasures in healthy subjects undergoing head-down tilt (HDT) to elevate ICP by +10 mmHg, and in neurointensive care unit (NeuroICU) patients with invasive ICP devices implanted to monitor and treat elevated ICP. We will establish the ICP, cerebral blood flow, intraocular pressure, structural eye parameters, and cerebral vascular parameter changes associated with application and release of each countermeasure. This will also involve calibration of our non-invasive versus invasive cerebral measurements. In Experiment 2, we will determine if gradual discontinuation of device use may be safer than abrupt discontinuation. In Experiment 3, we will seek to quantify the relationship between exposure time to the countermeasure and cerebral responses during exposure as well as post-release. Together, these studies will help identify which countermeasure is the most promising treatment for, or mitigator of, cephalad fluid shifts and elevated ICP. This project will increase the technology readiness level of mechanical countermeasures for VIIP from Countermeasure Readiness Level (CRL) 4 to CRL 7.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2015.
Bibliography Type:	Description: (Last Updated: 10/23/2019)