Fiscal Year:	FY 2015	**Task Last Updated:**	FY 02/25/2015
PI Name:	Brainard, George C. Ph.D.		
Project Title:	Testing Solid State Lighting Countermeasures to Improve Circadian Adaptation, Sleep, and Performance During High Fidelity Analog and Flight Studies for the International Space Station		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Behavior and performance		
Joint Agency Name:		**TechPort:**	Yes
Human Research Program Elements:	(1) **HFBP**:Human Factors & Behavioral Performance (IRP Rev H)		
Human Research Program Risks:	(1) **BMed**:Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders (2) **Sleep**:Risk of Performance Decrements and Adverse Health Outcomes Resulting from Sleep Loss, Circadian Desynchronization, and Work Overload		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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City:	Philadelphia	**State:**	PA
Zip Code:	19107-5083	**Congressional District:**	1
Comments:			
Project Type:	FLIGHT	**Solicitation / Funding Source:**	2013-14 HERO NNJ13ZSA002N-BMED Behavioral Health & Performance
Start Date:	12/01/2014	**End Date:**	11/30/2017
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:**	NASA JSC
Contact Monitor:	Leveton, Lauren	**Contact Phone:**	
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Flight Program:	ISS		
Flight Assignment:	Flight Definition		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Barger, Laura Ph.D. (Brigham and Women's Hospital/Harvard Med Ctr) Clark, Toni B.S. (NASA Johnson Space Center) Czeisler, Charles M.D., Ph.D. (Brigham and Women's Hospital/Harvard Medical Center) Johnston, Smith M.D. (NASA Johnson Space Center) Moomaw, Ronald O.D. (NASA Johnson Space Center) Lockley, Steven Ph.D. (Brigham and Women's Hospital)		
Grant/Contract No.:	NNX15AC14G		
Performance Goal No.:			

Performance Goal Text:	
Task Description:	This proposed research addresses the NASA Research Announcement (NRA) NNJ13ZSA002N-BMED: Behavioral Health and Human Performance: “Evaluation of the Neurobehavioral Effects of a Dynamic Lighting System on the ISS”. This NRA solicits both “Ground Based and Flight-Definition” research with the specific instructions that the “ground study serves as a precursor to the flight study, therefore the ground study should take place in an analog with high fidelity to the ISS. The SSLAs should be studied in a high fidelity ground analog environment, then implemented on ISS to evaluate individual crewmember outcomes related to circadian physiology, sleep, behavioral health and performance using sensitive and validated measures that are feasible in the space flight environment.” Currently, the International Space Station (ISS) uses General Luminaire Assemblies (GLAs) that house fluorescent lamps for illuminating the astronauts’ working and living environments. NASA has determined that, beginning in 2016, the GLAs will be replaced with Solid-State Light Assemblies (SSLAs) containing Light Emitting Diodes (LEDs). Engineers at Kennedy Space Center developed a prototype Solid-State Lighting Assembly (SSLA) that was successfully installed onboard the ISS during ISS Expedition 18. The Principal Investigator and Co-Principal Investigator of the intended research worked with engineers, scientists, and managers from Johnson Space Center (JSC) to revise the SSLA specifications so that the new lighting units would have dual capacity to: 1) provide illumination for crew members’ working and living quarters, and 2) serve as a lighting countermeasure for crewmembers’ circadian and sleep disruption. NASA has now placed an order for a set of SSLAs to be manufactured that will have this dual capacity. This research is comprised of a multidisciplinary collaboration between Thomas Jefferson University, Brigham and Women’s Hospital, and JSC to complete a ground-based study in a high fidelity analog of the crew sleeping quarters and daily living environment of the ISS. Specifically, standardized psychometric, physiological, and neurobehavioral measures will test the efficacy of light from the SSLAs to improve vision, circadian regulation, sleep, and performance in healthy astronaut-aged subjects. In addition, once the new SSLAs are deployed on ISS in 2016, the investigators plan to assess the acceptability, use, and impact of deployment of a dynamic lighting schedule aboard the ISS during operational flight missions on astronaut vision, sleep, alertness, circadian rhythms, and general well-being. Sleep, performance, and circadian rhythm data will be compared to those collected by their team and others during previous flight missions aboard ISS, in addition to surveillance of medical and psychological health in collaboration with mission flight surgeons. This project will generate quantitative data and knowledge for the benefit of crew health, habitability, environment, and human factors in the design of future human space flight vehicles and habitats. The project also will provide guidance for flight surgeons, flight psychologists, and astronauts to help optimize sleep and circadian regulation during space exploration missions. The proposed research addresses NASA’s Program Requirements Document (PRD) Risk: “Risk of Performance Errors due to Fatigue Resulting from Sleep Loss, Circadian Desynchronization, Extended Wakefulness and Work Overload” and Integrated Research Plan (IRP) Gap Sleep5: “We need to identify environmental specifications and operational regimens for using light to prevent and mitigate health and performance decrements due to sleep, circadian, and neurobehavioral disruption, for flight, surface, and ground crews, during all phases of spaceflight operations.” Importantly, this work will lead to advances in new lighting systems for civilian applications in work places and homes.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Importantly, this work will lead to advances in new lighting systems for civilian applications in work places and homes.
Task Progress:	New project for FY2015.
Bibliography Type:	Description: (Last Updated: 10/30/2023)