Fiscal Year:	FY 2016	**Task Last Updated:**	FY 08/18/2016
PI Name:	Barger, Laura Ph.D.		
Project Title:	Environmental Factors Associated with Sleep Deficiency During Spaceflight		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	NSBRI--Human Factors and Performance Team		
Joint Agency Name:		**TechPort:**	No
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) **Hypoxia**:Risk of Reduced Crew Health and Performance Due to Hypoxia [inactive]		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	02115-5817	**Congressional District:**	7
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2015-16 HERO NNJ15ZSA001N-Crew Health (FLAGSHIP, NSBRI, OMNIBUS). Appendix A-Crew Health, Appendix B-NSBRI, Appendix C-Omnibus
Start Date:	06/01/2016	**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:	NOTE: Element change to Human Factors & Behavioral Performance; previously Behavioral Health & Performance (Ed., 1/18/17)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Abercromby, Andrew Ph.D. (NASA Johnson Space Center) Alexander, David M.D. (NASA Johnson Space Center) Czeisler, Charles M.D., Ph.D. (Brigham And Women's Hospita) Flynn-Evans, Erin Ph.D. (NASA Ames Research Center) Limardo, Jose M.S. (NASA Johnson Space Center) Wang, Wei Ph.D. (Brigham And Women's Hospital)		
Grant/Contract No.:	NCC 9-58-HFP04502		
Performance Goal No.:			

Performance Goal Text:	
Task Description:	After landing on the moon in 1969, Astronaut Neil Armstrong was reportedly unable to sleep all night and Astronaut Buzz Aldrin managed only “a couple of hours of fitful drowsing” during their 21.6 hours on the moon, reportedly because they could not escape from light and noise in the small cabin of their spacecraft and the spacesuit’s cooling system made it too cold for sleeping. Environmental factors continue to impact sleep in the modern era of spaceflight. During a ten-year study of sleep aboard Shuttle and International Space Station (ISS) missions, crewmembers reported sleep disturbances via a daily log. Shuttle crewmembers reported sleep disturbance on 58 percent of inflight nights and ISS crewmembers reported sleep disturbance on 35 percent of inflight nights. There are numerous stressors that are unique to the spaceflight environment that might account for sleep disturbances and prompt use of sleep-promoting medications. Noise, which can disrupt slow wave and REM sleep, both of which are critical to the restorative function of sleep, remains a major source of sleep disruption in modern spaceflight. Both shuttle and ISS crewmembers attributed 1 in 5 inflight disruptions to noise. Operational demands of space missions often result in the continuous noise levels in the range of 56-69 dBA and often higher within habitable areas of the ISS. Dosimetry measurements during ISS Increments 2-14 reveal noise levels during sleep episodes as high as 72 decibels. Researchers conducting laboratory-based studies have reported that noise levels similar to those experienced by astronauts during space missions could lead to sleep disruption and subsequently impaired cognitive functioning. Uncomfortable temperatures (too hot or too cold) were also attributed to disturbed sleep more than 20 percent of the time. Although not included in the daily diary of the previous study due to its insidious nature, low levels of oxygen and high levels of carbon dioxide have been hypothesized to account for sleep disturbances during spaceflight. We propose to incorporate the existing extensive sleep database to search for associations between environmental factors that NASA routinely records (i.e., hypoxia, noise, hypercapnia) and sleep. Over the past ten years, we objectively assessed, via wrist actigraphy and daily logs, sleep-wake timing of 64 astronauts on 80 Space Shuttle missions, encompassing 26 Space Transportation System flights (1,063 inflight days), and 21 astronauts on the International Space Station (ISS) (3,248 inflight days). Thus, we have a database of over 4,000 sleep episodes which provides a unique opportunity to objectively analyze other environmental factors that may influence sleep during spaceflight. We plan to team with other NASA investigators or operational personnel who have collected time-stamped environmental data during spaceflight (e.g., noise levels, oxygen and carbon dioxide levels). We will statistically evaluate the association among objective and subjective measures of sleep quantity and quality with varying levels of these environmental factors. The proposed study will impart knowledge on the impact of environmental factors on sleep during spaceflight. NASA will be able to use the knowledge gained to inform the planning and design of future spacecraft environments to optimize sleep and behavioral health of crewmembers on future exploration class space missions.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2016.
Bibliography Type:	Description: (Last Updated: 04/11/2021)