Fiscal Year:	FY 2014	**Task Last Updated:**	FY 12/04/2013
PI Name:	Czeisler, Charles A. M.D., Ph.D.		
Project Title:	Sleep-Wake Actigraphy and Light Exposure During Spaceflight		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Behavior and performance		
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) **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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PI Web Page:			
City:	Boston	**State:**	MA
Zip Code:	02115-5804	**Congressional District:**	8
Comments:			
Project Type:	Flight	**Solicitation / Funding Source:**	98-HEDS-02
Start Date:	01/24/2001	**End Date:**	03/31/2017
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:	Leveton, Lauren	**Contact Phone:**	
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Flight Program:	Shuttle/ISS		
Flight Assignment:	ISS-12 (added 12/5/13 per PI/CoI information) STS-133, STS-134, STS-135 (addt'l flight info per PI report 11/2011) STS 129, 130, 131, 132 ; ISS increments 22-24 (addt'l flight info per PI 11/2009) STS 126, STS 127, STS 128 ; ISS Increments 18-21 (addt'l flight info per PI office, 11/2008) STS 122, STS 123, STS 124, STS 125; ISS Increment 17 (add'l flight info per PI office, 1/2008) STS 116, STS 118, STS 120; ISS Increments 14, 15, 16 (add'l flight info provided 11/06) STS 121, STS 115; ISS Increments 13-14 STS 104, STS 109, STS 111, STS 112, STS 113, STS 114 NOTE: New end date is 3/31/2017 per CoI L. Barger (Ed., 12/5/13) NOTE: Expected to be extended to 4/30/2017 per CoI L. Barger (Ed., 8/31/13) NOTE: End date changed to 4/30/2013 per CoPI Barger (Ed., 9/10/2012) NOTE: End date is not firm per CoI/PI (Ed., 11/18/2011)		

	NOTE: End date is 7/31/2012 per PI/CoI (Ed., 10/27/11) NOTE--end date should be around 4/30/2012 per JSC (11/08)
Key Personnel Changes/Previous PI:	Laura K. Barger, Ph.D. is assigned as Co-Principal Investigator (1/2008 report).
COI Name (Institution):	Barger, Laura Ph.D. (Co-PI: Harvard Medical School) Wright, Kenneth Ph.D. (University of Colorado) Ronda, Joseph M.S. (Harvard Medical School) Evans, Erin Ph.D. (NASA Ames Research Center)
Grant/Contract No.:	NCC9-119
Performance Goal No.:	
Performance Goal Text:	
Task Description:	Subjects will wear a small light-weight activity and light recording device for the entire duration of their mission. They will complete a sleep log each day on Shuttle flights and for three 1-week periods during an ISS mission. The sleep-wake activity and light exposure patterns obtained in-flight will be compared with baseline data collected for two weeks at L-90 and from L-11 through L-0. Recovery from space flight will also be assessed from R+0 through R+7. These data should help us better understand the effects of space flight on sleep as well as aid in the development of effective countermeasures for both short and long-duration space flight. See also http://www.nasa.gov/
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The success and effectiveness of manned space flight depends on the ability of crew members to maintain a high level of cognitive performance and vigilance while operating and monitoring sophisticated instrumentation. Astronauts, however, commonly experience sleep disruption and may experience misalignment of circadian phase during space flight. Both of these conditions are associated with impairment of alertness and cognitive performance. A survey of 58 crew members from 9 shuttle missions revealed that most suffered from sleep disruption and were unable to sleep more than six hours per day of flight as compared to 7.9 hours per day on the ground. Ground-based studies have revealed that chronic exposure to such partial sleep loss results in progressive decrements in neurobehavioral performance during waking hours. In fact, nineteen percent of crew members on single shift missions and 50 percent of the crew members in dual shift operations have resorted to sleeping pill usage (principally benzodiazepines) during their missions, which represents more than 40% of all medication used by shuttle crew. Although benzodiazepines are effective hypnotics, their adverse next-day side effects include sedation, performance decrements, amnesia, and distortions in the sleep EEG. Relatively little is known of the severity or cause of space flight-induced insomnia in short duration mission, and less is know about the effect of long-duration space flight on sleep and circadian rhythm organization. This experiment will use state-of-the-art ambulatory technology to monitor sleep-wake activity patterns and light exposure in crew members aboard Space Shuttle and ISS missions. The proposed research could have significant implications for both sleep disorders medicine and space life sciences. The results of the proposed research could lead to the development of a new treatment regimen for sleep disturbances of various etiologies during space flight, which could enable crew members to avoid the decrements in alertness and performance associated with sleep deprivation. This work could therefore have a profound impact on the health, productivity and safety not only of astronauts during space flight, but also of other groups with a high prevalence of insomnia, such as shift workers and older people.
Task Progress:	We objectively assessed, via wrist actigraphy and daily logs, the sleep-wake timing of 64 astronauts on 80 Space Shuttle missions, encompassing 26 Space Transportation System flights (1,066 inflight days), and 21 astronauts on the International Space Station (ISS) (3,201 inflight days). Each astronaut also participated in three Earth-based data-collection intervals (4,013 ground-based days). The final report describing the results of the Shuttle astronauts and the first 21 ISS astronauts was submitted to NASA. A manuscript (Barger, LK, Flynn-Evans, EE, Kubey, A, Walsh, L, Ronda, JM, Wang, W, Wright, KP, Czeisler, CA, High prevalence of sleep deficiency and hypnotic use among astronauts before and during spaceflight) was submitted to a high impact medical journal. A second manuscript is in preparation (Flynn-Evans, EE, Barger, K, Kubey, A, Sullivan, J, Wright, KP, Czeisler, CA. Sleep and circadian rhythms among 21 astronauts during long-duration missions on the International Space Station). The study has been assigned to the ISS-12 mission, scheduled to launch in March 2015. One US astronaut and one Russian cosmonaut plan to take part in this one-year ISS mission. Given that the duration of this mission will be essentially twice as long as the nominal ISS missions, it is unknown how the mind and body, including sleep and the circadian system, will respond or adapt to that much time in space. We plan to estimate sleep and circadian alignment throughout the mission via the previously employed protocol. Findings from this long duration mission are crucial to inform future exploration class missions. We have prepared the timelines and budgets for the new mission and conducted the informed consent briefing for the US astronaut. We are also working on other required NASA documentation for the new mission, including the experiment document and payload summary.
Bibliography Type:	Description: (Last Updated: 12/13/2023)