Fiscal Year:	FY 2010	**Task Last Updated:**	FY 11/19/2009
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:**	04/30/2012
No. of Post Docs:	0	**No. of PhD Degrees:**	0
No. of PhD Candidates:	1	**No. of Master' Degrees:**	0
No. of Master's Candidates:	1	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
Contact Monitor:	Shea, Cami1e	**Contact Phone:**	281-244-2017
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Flight Program:	Shuttle/ISS		
Flight Assignment:	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		
Key Personnel Changes/Previous PI:	Laura K. Barger, Ph.D. is assigned as Co-Principal Investigator (1/2008 report).		
COI Name (Institution):	Co-PI: Barger, Laura (Harvard Medical School) Wright, Kenneth Ph.D. (University of Colorado) Ronda, Joseph M.S. (Harvard Medical School) Evans, Erin (Brigham and Women's Hospital)		
Grant/Contract No.:	NCC9-119		

Performance Goal No.:	
Performance Goal Text:	NOTE--end date should be around 4/30/2012 per JSC (11/08)
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:	In the past year (January 1, 2009- November 19, 2009), 12 subjects on 4 Space Shuttle flights (STS-125, STS-119, STS-127 and STS-128) completed the protocol. Five crewmembers on STS-129 are expected to complete the protocol in Dec, 2009. Ten additional crewmembers assigned to STS-130, STS-131, and STS-132 have volunteered to participate in this protocol. Additionally, 5 ISS crewmembers have completed this experiment and data collection is ongoing for 4 additional ISS crewmembers. Actigraphy data continue to be scored and are undergoing interpretation and analysis. Computer programming continues that will allow direct input of Actiwatch data into our Computer Performance Simulation Software. This will allow us to estimate the circadian phase of each subject pre-launch, inflight and post-flight. Through the FAS Science Challenge Internship Program, a Ph.D. student from Ireland was assigned the Division of Sleep Medicine; he devoted a portion of his efforts to data analysis on this project for approximately 6 months (September 2008 until April 2009). Protocol. Our data collection protocol remains the same. Equipment. Crewmembers continue to use the recently designed neoprene bands for the Actiwatch and the reduced-in-size sleep logs. Based on feedback from the crewmembers, we also offer a choice to use the old Velcro bands. Recruitment of Subjects. STS-129, STS-130, STS-131 and STS-132 crewmembers were given an informed consent briefing in this past year. At least 3 crewmembers on each Shuttle mission volunteered to participate. All U.S. crewmembers (primary and back-up) scheduled for ISS missions were also briefed. All of the ISS crewmembers volunteered to participate. We also briefed and had volunteers from ESA ISS crewmembers. Training. FAM training sessions were conducted with volunteer participants from STS-127, STS-128, STS-129, STS-130, STS-131 and STS-132.. Increments 21-24 were trained as well. Baseline Data Collection. Baseline (L-90) data were collected for STS-119, STS-127, STS-128 and STS-129 crewmembers. Baseline (L-90) data were also collected for ISS crewmembers. Preflight (L-11 until launch) data were collected for STS-119, STS-127, STS-128 and STS-129 crewmembers and ISS crewmembers. Postflight data (landing until R+7) were collected for STS-125, STS-119, STS-127 and STS-128 crewmembers and for ISS crewmembers assigned to Increments 18 and 19. Additonal postflight debriefs are expected in December 2009 for STS-129 and ESA ISS crewmembers. [Both prime and back-up ISS crewmembers participated in BDC data collection]. Inflight Data Collection. In flight data were collected for STS-125 (4), STS-119 (2), STS-127 (2) and STS-128 (4) crewmembers and five ISS crewmembers assigned to Increments 18 and 19. Data collection is onging for 4 ISS crewmembers. Flight Assignment Description: STS 104, STS 109, STS 111, STS 112, STS 113, STS 114, STS-115, STS-116, STS-118 STS-120, STS-121, STS 122, STS 123, STS 124, STS 125, STS 126, STS-127, STS-128, STS-129, STS-130, STS-131, STS-132. ISS Increments 14, 15, 16, 17, 18, 19, 20, 21.22, 23, 24

Bibliography Type:	Description: (Last Updated: 12/13/2023)
Abstracts for Journals and Proceedings	Barger LK, Wright KP Jr, Walsh L, Benedix S, Kubey A, Czeisler CA. "Sleep on Multiple Space Shuttle and International Space Station Missions." Presented at the NASA Human Research Program Investigators' Workshop, South Shore Harbour Resort and Conference Center, League City, Texas, February 2009. Conference proceedings, NASA Human Research Program Investigators' Workshop, February 2009. , Feb-2009