

<b>Fiscal Year:</b>	FY 2010	<b>Task Last Updated:</b>	FY 10/28/2010
<b>PI Name:</b>	Barger, Laura Ph.D.		
<b>Project Title:</b>	Phoenix Scout Lander: Countermeasures testbed for spaceflight ground controllers		
<b>Division Name:</b>	Human Research		
<b>Program/Discipline:</b>	HUMAN RESEARCH		
<b>Program/Discipline--Element/Subdiscipline:</b>	HUMAN RESEARCH--Behavior and performance		
<b>Joint Agency Name:</b>	<b>TechPort:</b>	No	
<b>Human Research Program Elements:</b>	(1) <b>BHP</b> :Behavioral Health & Performance (archival in 2017)		
<b>Human Research Program Risks:</b>	(1) <b>BMed</b> :Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders		
<b>Space Biology Element:</b>	None		
<b>Space Biology Cross-Element Discipline:</b>	None		
<b>Space Biology Special Category:</b>	None		
<b>PI Email:</b>	<a href="mailto:lbarger@hms.harvard.edu">lbarger@hms.harvard.edu</a>	<b>Fax:</b>	FY
<b>PI Organization Type:</b>	UNIVERSITY	<b>Phone:</b>	530-753-2876
<b>Organization Name:</b>	Brigham and Women's Hospital/Harvard Medical Center		
<b>PI Address 1:</b>	Division of Sleep Medicine		
<b>PI Address 2:</b>	221 Longwood Ave, BLI438		
<b>PI Web Page:</b>			
<b>City:</b>	Boston	<b>State:</b>	MA
<b>Zip Code:</b>	02115-5817	<b>Congressional District:</b>	7
<b>Comments:</b>			
<b>Project Type:</b>	GROUND	<b>Solicitation / Funding Source:</b>	Directed Research
<b>Start Date:</b>	12/17/2007	<b>End Date:</b>	04/16/2010
<b>No. of Post Docs:</b>		<b>No. of PhD Degrees:</b>	1
<b>No. of PhD Candidates:</b>	1	<b>No. of Master' Degrees:</b>	1
<b>No. of Master's Candidates:</b>	1	<b>No. of Bachelor's Degrees:</b>	
<b>No. of Bachelor's Candidates:</b>		<b>Monitoring Center:</b>	NASA JSC
<b>Contact Monitor:</b>	Shea, Camile	<b>Contact Phone:</b>	281-244-2017
<b>Contact Email:</b>	<a href="mailto:shea@dsls.usra.edu">shea@dsls.usra.edu</a>		
<b>Flight Program:</b>			
<b>Flight Assignment:</b>	NOTE: Project extended to April 2010, per PI (12/2009)		
<b>Key Personnel Changes/Previous PI:</b>			
<b>COI Name (Institution):</b>	Sipes, Walter ( NASA Johnson Space Center ) Brainard, George ( Thomas Jefferson University ) Gilliland, Kirby ( Oklahoma University ) Lockley, Steven ( Brigham and Women's Hospital ) Andrea, Vincent ( University of Oklahoma )		
<b>Grant/Contract No.:</b>	NNX08AD66A		
<b>Performance Goal No.:</b>			
<b>Performance Goal Text:</b>			

<b>Task Description:</b>	A multi-institutional team of investigators (PI: Laura K. Barger, Ph.D, Brigham and Women's Hospital/Harvard Med. School) provided fatigue management education to the scientists and engineers working on the Mars Phoenix Lander project. The investigators also recruited 19 subjects to participate in a research study to investigate the work hours, sleep, circadian rhythmicity and performance of individuals living on a Mars sol schedule in an operational environment. This project was funded by NASA/JSC Behavioral Health and Performance (BHP) research program element and provided an operational opportunity, in a Mars Time Analog, to evaluate countermeasures in a real-time, field setting. Investigators sought to evaluate the acceptability, feasibility, and efficacy of a photic countermeasure used to treat fatigue, circadian misalignment, and sleep loss associated with the Phoenix Mars Lander mission.
<b>Rationale for HRP Directed Research:</b>	
<b>Research Impact/Earth Benefits:</b>	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 missions, where crewmembers, mission controllers, and support personnel are scheduled to live on non-24 hour days, which could enable these individuals to avoid the decrements in alertness and performance associated with sleep deprivation. Moreover, this work could have a profound impact not only on the health, productivity, and safety of those associated with space flight, but also of other groups with a high prevalence of insomnia, such as shift workers, who work unusual and non-24 hour schedules, and older people.
<b>Task Progress:</b>	<p>The Phoenix spacecraft landed on Mars on May 25, 2008 and the scientists and engineers supporting the Phoenix Mars Lander worked on a Mars sol schedule until August 11, 2008 when the official schedule reverted to an Earth schedule. A multi-institutional team of investigators provided fatigue management education to the scientists and engineers working on the Mars Phoenix Lander project. The investigators also recruited 19 subjects to participate in a research study to investigate the work hours, sleep, circadian rhythmicity and performance of individuals living on a Mars sol schedule in an operational environment. Investigators sought to evaluate the acceptability, feasibility, and efficacy of countermeasures used to treat fatigue, circadian misalignment, and sleep loss associated with the Phoenix Mars Lander mission.</p> <p>We provided 3 educational sessions to the scientists, engineers and support personnel working on the Phoenix Mars Lander project in the week prior to the mission. During those 1-hour sessions, our scientific team provided information on sleep, circadian rhythms and appropriate countermeasures to facilitate entrainment to a Mars sol schedule and to maximize alertness and performance during work hours.</p> <p>Investigators provided a blue light box to research subjects as well as instructions for when to seek and avoid light to facilitate entrainment to the Mars sol schedule. Ocular light exposure of a specific narrowband wavelength (<math>\pm 30</math> nm half-peak bandwidths) was encouraged using a light delivery system developed by Apollo Light Systems Inc., (American Fork, UT).</p> <p>Research subjects continuously wore actigraphs on their wrists to monitor sleep and light exposure. They completed daily logs indicating work times and the fatigue countermeasures they used, and provided subjective evaluations of sleep and alertness. Subjects also accomplished daily performance testing and completed 48-hour urine collections about every two weeks to permit analysis of a melatonin conjugate to estimate circadian timing.</p> <p>Subjects wore a Motionlogger (Ambulatory Monitoring, Inc., Ardsley, NY) on their wrists throughout the study period to provide sleep/wake activity and light exposure information. Each subject was given a personal digital assistant (PDA; Ambulatory Monitoring, Inc., Ardsley, NY) that contained two programs: a sleep-work log that was completed each day and a 5-minute version of the Psychomotor Vigilance Test (PVT)/ Karolinska Sleepiness Scale (KSS) that was completed twice per day. Subjects were requested to complete the Automated Neuropsychological Assessment Metrics (ANAM4) at the beginning and end of each work shift. The ANAM battery also included a mood scale.</p> <p>Nineteen subjects completed the study, although data collection was abbreviated in some subjects who traveled throughout the data collection period. The Mars Phoenix Lander project provided an operational opportunity, in a Mars Time Analog, to evaluate countermeasures in a real-time, field setting.</p>
<b>Bibliography Type:</b>	Description: (Last Updated: 04/11/2021)
<b>Abstracts for Journals and Proceedings</b>	<p>Barger LK, Brainard GC, Sipes W, Gilliland K, Schlegel R, Smith P. "Phoenix Scout Lander: Countermeasures tested for spaceflight ground controllers." NASA Human Research Program Investigators' Workshop, League City, Texas, February 2008.</p> <p>NASA Human Research Program Investigators' Workshop, League City, Texas, February 2008. , Feb-2008</p>
<b>Abstracts for Journals and Proceedings</b>	<p>Barger LK, Brainard GC, Evans EE, Fiedler E, Gilliland K, Sipes W, Smith P, Sullivan JP, Vincent A, Lockley SW. "Acceptability, Feasibility and Effectiveness of Fatigue Countermeasures for Ground Controllers During Phoenix Mars Lander Mission." NASA Human Research Program Investigators' Workshop, League City, TX, February 2009.</p> <p>NASA Human Research Program Investigators' Workshop, League City, TX, February 2009. Poster Number 55, Abstract Number 1128. , Feb-2009</p>
<b>Abstracts for Journals and Proceedings</b>	<p>Barger LK, Brainard GC, Evans EE, Fiedler E, Gilliland K, Sipes W, Sullivan JP, Vincent A, Lockley SW. "Sleep, Circadian Rhythms and Performance of Ground Controllers During the Phoenix Mars Lander Mission." NASA Human Research Program Investigators' Workshop, Houston, TX, February 2010.</p> <p>NASA Human Research Program Investigators' Workshop, Houston, TX, February 2010. Abstrtact #1086. , Feb-2010</p>
<b>Abstracts for Journals and Proceedings</b>	<p>Barger LK, Brainard GC, Evans EE, Fiedler E, Gilliland K, Sipes W, Sullivan JP, Vincent A, Lockley SW. "The Use of the Phoenix Mars Lander Mission as an Operational Analog." 81st Annual Scientific Meeting of the Aerospace Medical Association, Phoenix, AZ, May 9-13,2010.</p> <p>Aviation, Space, and Environmental Medicine. 2010 Mar;81(3):247. , Mar-2010</p>
<b>Articles in Peer-reviewed Journals</b>	<p>Brainard GC, Barger LK, Soler RR, Hanifin JP. "The development of lighting countermeasures for sleep disruption and circadian misalignment during spaceflight." Curr Opin Pulm Med. 2016 Nov;22(6):535-44.</p> <p><a href="https://doi.org/10.1097/MCP.0000000000000329">https://doi.org/10.1097/MCP.0000000000000329</a> ; PubMed PMID: 27607152 , Nov-2016</p>

Significant Media Coverage	Thompson A. "Living on Mars Time: Scientists Suffer Perpetual Jet Lag." Space.com, posted 29 July 2008. <a href="http://www.space.com/scienceastronomy/080729-st-mars-time.html">http://www.space.com/scienceastronomy/080729-st-mars-time.html</a> , Jul-2008
Significant Media Coverage	Schafer Horton R. "UA Mars scientists are time/fatigue guinea pigs." Tucson Citizen, July 12, 2008. <a href="http://tucsoncitizen.com/morgue/2008/07/12/90802-ua-mars-scientists-are-time-fatigue-guinea-pigs/">http://tucsoncitizen.com/morgue/2008/07/12/90802-ua-mars-scientists-are-time-fatigue-guinea-pigs/</a> , Jul-2008
Significant Media Coverage	Dalenberg A. "Living on Mars time." Arizona Daily Wildcat, July 19, 2008 and updated July 25, 2009. <a href="http://wildcat.arizona.edu/2.2257/living-on-mars-time-1.165518">http://wildcat.arizona.edu/2.2257/living-on-mars-time-1.165518</a> , Jul-2008