Fiscal Year:	FY 2017	**Task Last Updated:**	FY 03/10/2017
PI Name:	Burns, Vanessa B.S.		
Project Title:	LumosTech Smart Sleep Mask for Circadian Realignment in Space and on Earth		
Division Name:	Human Research		
Program/Discipline:	NSBRI		
Program/Discipline--Element/Subdiscipline:	NSBRI--Human Factors and Performance Team		
Joint Agency Name:		**TechPort:**	Yes
Human Research Program Elements:	(1) **HFBP**:Human Factors & Behavioral Performance (IRP Rev H)		
Human Research Program Risks:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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City:	San Francisco	**State:**	CA
Zip Code:	94131	**Congressional District:**	12
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	NSBRI-RFA-SMARTCAP
Start Date:	12/01/2015	**End Date:**	11/30/2016
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:**	NSBRI
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
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COI Name (Institution):			
Grant/Contract No.:	NCC 9-58-HFP00005		
Performance Goal No.:			
Performance Goal Text:			
	With National Space Biomedical Research Institute (NSBRI) SMARTCAP funding, LumosTech is building a smart, wearable eye mask that can improve sleep by adjusting circadian rhythm. Based on proof-of-concept research from Stanford University, the LumosTech smart sleep mask uses advanced light therapy while the user is sleeping. With this technology, we can help astronauts optimize their sleep schedules in the absence of natural light, assist ground crew adjusting to work-related sleep changes, and increase alertness after wake-up. On Earth, misalignment of the circadian system is common and regularly observed during travel across time zones (jet lag), in shift work, and with teenagers, elderly individuals, and infants. The use of continuous bright light to shift circadian rhythm is well established, but is disruptive to daily activities and misses the circadian clock's peak sensitivity, which most often occurs during sleeping hours. Our technology is effective during sleep without causing sleep		

Task Description:	disruptions and uses short light pulses, reducing side effects from continuous bright light therapy, such as headaches and strained eyes. Our primary objective for this project was to develop a portable and personalizable smart mask prototype able to be easily programmed with our companion smartphone app. During the course of this project, we investigated and optimized the mask form factor through feedback from over 400 potential users via in-person interviews and surveys. Specifically, we targeted frequent travelers journeying at least 2000 miles, which results in approximately three hours of circadian misalignment. We found high willingness to pay for the technology, but comfort during sleep was paramount. This finding was further supported during our testing of commercially available sleep masks augmented with light flash technology. Most masks were uncomfortable and fell off during the night. We modified existing sleep masks and determined the most optimal sleep mask design. We also tested light therapy efficacy and user interactions with the companion smartphone app. Working with an industrial designer, we produced several concept mock-ups of a sleep mask that was both comfortable and able to incorporate our hardware. Finally, we began production of prototype units based on our new sleep mask design. Synchronously, we iterated on our companion phone app based on regular user feedback. During the upcoming year, our team will continue to validate the technology in additional markets and refine the sleep mask concept. With our device, we will be able to easily shift sleep cycles in multiple environments, including on the space station.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Sleep disruption frequently occurs as a result of circadian rhythm misalignment -- after traveling several time zones (e.g., jet lag), with shift-work, or other lack of synchrony between the circadian biological clock to daily work/school schedules (social jet lag). Approximately 80% of people have work or school schedules that are out of sync with their biological circadian rhythms. Current light therapy requires sitting in front of a continuous bright light for 1-3 daytime hours. People often use sleeping pills (addictive and numerous side effects) or melatonin supplements (ineffective) because current light therapy options are so inconvenient. The LumosTech smart sleep mask is superior in that it is effective during sleep without causing sleep disruptions, and uses millisecond light pulses, reducing side effects from continuous bright light therapy, such as headaches and strained eyes. Until now, there has been no convenient and effective solution to help people take control of their sleep.
Task Progress:	With SMARTCAP funding, LumosTech developed a smart sleep mask capable of rapidly realigning circadian phase during sleep. Based on technology exclusively licensed from Stanford University, the mask delivers short light pulses during the night to advance or delay the biological clock. During the course of this project, LumosTech developed a custom sleep mask form factor capable of supporting the light flash technology. Additionally, the team developed a companion smartphone app and light timing algorithm to enable at-home, easy use of the device for both advancing and delaying circadian phase. The mask was tested in frequent travelers with overwhelmingly positive results. Future work will focus on improving the comfort of the textile components and expanding into additional market segments.
Bibliography Type:	Description: (Last Updated:)