Fiscal Year:	FY 2010	**Task Last Updated:**	FY 11/15/2010
PI Name:	Mollicone, Daniel Ph.D.		
Project Title:	Individualized Fatigue Meter for Space Exploration		
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) **BHP**:Behavioral Health & Performance (archival in 2017)		
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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Zip Code:	19104	**Congressional District:**	2
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	SBIR Phase II
Start Date:	12/24/2009	**End Date:**	12/23/2011
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:**	NASA JSC
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):			
Grant/Contract No.:	NNX10CA99C		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	To ensure mission success, astronauts must maintain a high level of performance even when work-rest schedules result in chronic sleep restriction and circadian misalignment, both of which contribute to fatigue and performance deficits unless effective countermeasures are used. We are proposing to build an Individualized Fatigue Meter that incorporates light inputs, sleep history, work schedule information, and brief performance tests (e.g. PVT SelfTest) to provide immediate individualized feedback about alertness. For the past 8 years, we have been actively developing many of the system components (funded by NASA, DOD, and NIH) that can be leveraged in this project. The result of this project will be a system prototype that can be evaluated using data already being collected in space flight analog expeditions (e.g., NEEMO, HMP) and on ISS. The critical need for an Individualized Fatigue Meter has been identified as a priority outlined in the Behavioral Health and Performance Integrated Research Plan GAP 1.1.1. During Phase 2 we will build a prototype Individualized Fatigue Meter by developing: (1) an interactive graphical console; (2) a model-independent computational architecture; (3) a hybrid biomathematical fatigue model; and (4) a data fusion algorithm that statistically combines multiple inputs (Phase 2 TRL of 5-6). POTENTIAL NASA COMMERCIAL APPLICATIONS: The Individualized Fatigue Meter will meet the specific requirements of space exploration to provide astronauts with feedback about alertness and fatigue levels as well as select fatigue countermeasures. It will be designed to be unobtrusive, transparent to crews, and require minimal crew time or effort to operate. The resulting product will be primarily relevant to NASA's Behavioral Health and Performance (BHP) research Gap 1.1.1 (What are the best measures and tools to use for assessing decrements in cognitive function due to fatigue and other aspects of spaceflight?). When validated, the Individualized Fatigue Meter will be deployed in the constellation program, lunar and Mars missions. The individualized Fatigue Meter will also be adapted for use by mission control personnel (e.g., working long duty schedules or on Mars sol), and for use during training and activities overseas (i.e., launch/recovery in Russia).
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Given the large inter-individual differences in performance vulnerability to fatigue that have been scientifically documented, an Individualized Fatigue Meter has potential commercial applications in industries where human performance is required 24/7, with precise operational constraints and important safety implications. Examples of this relevance include but are not limited to military operations, first responders, transportation workers, power plant operators, hospital personnel, manufacturing work forces, etc. Military operations, for example, involve sleep deprivation and circadian misalignment, particularly during sustained operations and/or when multiple time zones are crossed during deployment. The Army has an estimated 238,000 soldiers deployed overseas in 120 countries (source: US Army) coordinating to provide continuous global 24-7 operations. An individualized fatigue meter has the potential to provide biologically optimized work schedules and recommendations for fatigue countermeasures such as power naps, caffeine, light exposure, that will increase safety and the likelihood of successful operations.
Task Progress:	New project for FY2010. Reporting not required for this SBIR Phase 2 project. (Note: task added to Task Book in November 2010 when received information.)
Bibliography Type:	Description: (Last Updated: 02/23/2015)