



NASA SBIR 2014 Phase I Solicitation

H12.03 Objective Sleep Measures for Spaceflight Operations

Lead Center: JSC

Currently in spaceflight, crewmembers report their sleep duration as requested by their crew surgeon. This approach has several limitations, including the burden it places on the crew and the tendency for subjective over-reporting of sleep (Lauderdale et al., 2008; Van Den Berg et al., 2008; Silva et al., 2007). Given evidence that demonstrates the relationship between sleep and circadian phase and performance, sleep-activity data should be collected as unobtrusively possible during long duration spaceflight. Wrist-worn actigraphy has been implemented as a successful, validated research tool in spaceflight but lacks features to render it a useful tool operationally, such as real-time feedback and minimal crew time requirements. Hence, there is a need for a minimally obtrusive or unobtrusive measure that evaluates sleep-wake activity plus light exposure; is acceptable for continuous wear; minimizes crew time by allowing for automatic downloads; provides immediate feedback to the user; incorporates the constraints of spaceflight hardware, such as extended battery life; and potentially incorporates other features, including other physiological sensors. The proposed technology should build on existing technologies with a focus on enhancing the product to ensure spaceflight readiness.

Requirements - Phase I should concentrate on the enhancement of a prototype device providing minimally obtrusive data collection that objectively measures sleep duration and other relevant characteristics in the spaceflight environment. Phase II should also yield a plan for continued development (if needed) and for validation of the device prior to spaceflight implementation.

NASA Deliverables - An objective, validated measure of sleep that is feasible and acceptable in the spaceflight environment.

HRP IRP Risk - Risk of Performance Errors Due to Fatigue Resulting from Sleep Loss, Circadian Desynchronization, Extended Wakefulness and Work Overload.

A TRL Start of 3-4 with a TRL End of 7-8 (at the end of Phase II) is desired for this project.