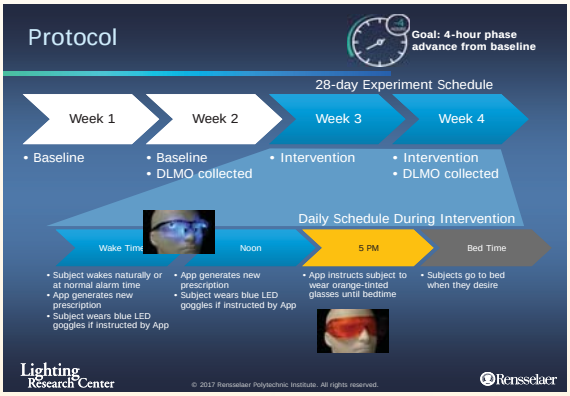
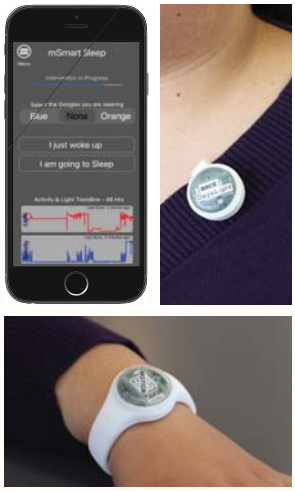
Circadian Monitoring and Regulation Device

The LRC is working with Intelligent Automation, Inc. (IAI) to develop and validate an integrated wireless circadian monitoring and regulation (CMR) device that can monitor circadian stimulus (CS) and physiological signals, and compute suitable light treatments to phase shift U.S. warfighters during mission deployment in order to combat jet lag and to increase alertness and performance.

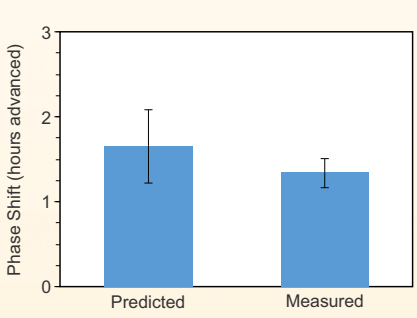
In Phase I, the project team prototyped a bluetooth low energy (BLE) adaptation of the LRC's Daysimeter, created an iPhone app to interface with the BLE Daysimeter and calculate treatment schedules, and prototyped BLE treatment goggles with integrated light delivery and removal. In Phase II, the project team improved upon the original CMR design with optimized BLE light and motion sensors, an updated iPhone app adapted for experimental use, and extended sensor battery life.



The LRC then performed testing aimed at validating the measurement accuracy of the CMR light sensing and light treatment devices, and to validate the CMR system's ability to prescribe suitable light treatments. The primary goal of the most recent trials was to test the ability of the system to predict dim light melatonin onset (DLMO) phase shift after a light treatment intervention designed to phase advance subjects by 4 hours. In this 4-week experiment, participants (n = 8) experienced 2 weeks of baseline, followed by 2 weeks of intervention. On each day of the intervention, participants woke naturally or at their normal time. Upon waking, the app generated a new prescription and the participant wore blue LED goggles if instructed by the app. At noon, the app again generated a new prescription and the participant wore blue LED goggles if instructed by the app. At 5 p.m., the app instructed the participant to wear orange-tinted glasses until bedtime. Participants were allowed the flexibility to sleep at their desired bedtime.



An iPhone app was developed to interface with either a collar-worn or wrist-worn Daysimeter.



Mean predicted and measured phase shift ± SEM in participants following prescribed light intervention (n=8).

Preliminary results show that the mean ± SEM (standard error of the mean) phase advance in DLMO was 1 h: 20 min ± 10 min, while the estimated phase shift calculated using the model was 1 h: 40 min ± 26 min.

Sponsor

U.S. Army Research Office via
Intelligent Automation, Inc.

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