Topic: N182-114

Luna Innovations Incorporated

Real-Time, Effective Measurement of Dehydration Levels in Naval Aircrew

Inconvenient urine-relief mechanisms for fast jet aircrew have led to an increase in mission-ending dehydration-induced “physiological episodes”. The Wearable Aircrew Hydration Tracking and Extended Recording (WAHTER) System provides real-time, non-invasive hydration measurements. WAHTER is designed for 8+ hour use and consists of a small, forearm-worn sensor and a small electronics package. As no commercial wearable hydration monitoring system is available, WAHTER’s use extends to multiple venues. Luna Labs provides innovative solutions for non-invasive condition monitoring to multiple Department of Defense agencies. WAHTER increases mission readiness and lethality, and reduces cost by ensuring aircrew can complete their mission. Phase I trials demonstrated technical feasibility, and Phase II is focused on functionality studies and device refinement. The goal for WAHTER is deployment into multiple DoD venues.

Technology Category Alignment:

Air Platforms
Human Systems
Biomedical (ASBREM)

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SYSCOM: NAVAIR
Contract: N68335-20-C-0015

Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-20-C-0015

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-723

Topic # N182-114

WAHTER Wearable Aircrew Hydration Tracking and Extended Recording

Luna Innovations Incorporated

WHO

SYSCOM: NAVAIR

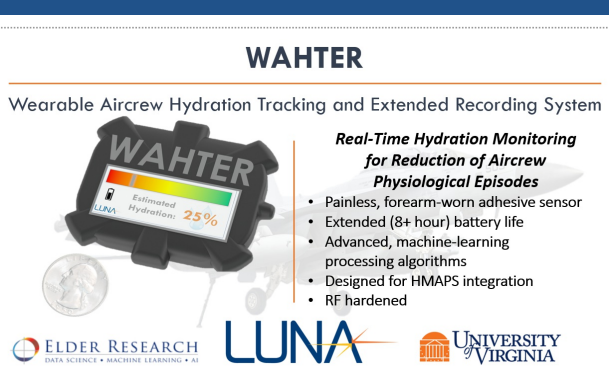
Sponsoring Program: PMA-202, PMA-265

Transition Target: F/A-18, EA-18G

TPOC:
(301)342-9261

Other transition opportunities: Navy, Air Force, and Army fast jets and rotorcraft would all be excellent targets for WAHTER transition. Other groups such as Special Forces, infantry, and ground personnel would also benefit from this technology.

Notes: The Wearable Aircrew Hydration Tracking and Extended Recording (WAHTER) System is designed as a non-invasive system to monitor systemic hydration levels in naval fast jet aircrew. WAHTER is designed for integration with additional physiological monitoring systems. Technical feasibility has been demonstrated by measurement of changing hydration in ex vivo human skin samples. WAHTER operates using state of the art measurement and processing algorithms ensuring durability for extreme-environment use. Real-time hydration monitoring capability will reduce cost, improve mission readiness, and increase lethality across a wide spectrum of personnel applications.



WHAT

Operational Need and Improvement: The rise of both the incidence and prevalence of physiological episodes that result in mission termination has prompted the naval aviation community to explore new ways of monitoring the health status of aircrew. Inconvenient urine relief mechanisms, coupled with increased mission durations for fast jet aircrew means that dehydration is a high-profile concern in naval aviation. Dehydration causes significant cognitive deficits that can contribute to physiological episodes. A system that measures and reports real-time aviator hydration levels would be valuable to the Navy.

Specifications Required: The designed solution must be non-invasive, accurately measure hydration levels, and function in a naval aviation flight environment. This environment includes high levels of motion (-3 to +7 g-forces), reduced pressure (up to 20,000 feet), a wide humidity range (5% to 95%), and extreme temperature variations (<32 °F to 150 °F). The proposed solution must be wearable alongside an existing flight suit (CWU-27/P) and other flight gear. Limb placement is recommended to mitigate gear interference. The hardware solution must have an open communication interface to allow integration with other physiological monitoring suites.

Technology Developed: The Wearable Aircrew Hydration Tracking and Extended Recording System (WAHTER) is a forearm-worn system optimized for measuring systemic hydration in aircrew. WAHTER uses novel measurement and machine-learning techniques to continuously monitor hydration levels. WAHTER uses low-power methodology to ensure a continuous runtime of greater than eight hours. Wired and wireless data transfer modalities allow WAHTER to integrate with other physiological monitors and for data to be exported for post-hoc analysis. Technical feasibility has been demonstrated through detecting changing hydration of porcine and human skin samples.

Warfighter Value: Dehydration is a significant issue that can seriously reduce performance. The reduction in human performance associated with dehydration has implications ranging from small inefficiencies to significant loss of human life. In the complex military environment, with mission success often relying on individuals performing their jobs optimally, dehydration-induced performance reductions may have national security implications. WAHTER will help reduce the incidence of missions impaired by physiological episodes, thus reducing cost, improving mission readiness, and increasing lethality.

WHEN

Contract Number: N68335-20-C-0015 **Ending on:** March 16, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Develop first-generation prototype	N/A	Refine operational principles	3	April 2019
Verify function on excised human skin samples	N/A	Demonstrate technical feasibility	4	January 2020
If Option Excercised, Perform human subjects validation	Low	Verify device function in controlled environment	5	January 2021
If Option Exercised, Perform environmentally-relevant human subjects trials	Med	Validate function in simulated operational environment	6	March 2023

HOW

Projected Business Model: There are several potential paths to commercializing this technology. Luna can meet demands for in-house LRIP, but will most likely eventually license WAHTER for manufacture by a partner organization. During Phase II, Luna will perform comprehensive market analysis, as well as identifying potential commercialization partners. Luna will also work with regulatory strategists to finalize partners and strategies for the transition to Phase III, approval testing, and transition to fleet deployment.

Company Objectives: WAHTER is being developed in the Health Sciences of Luna Innovation's R&D division; Luna Labs. Luna Labs has developed several non-invasive embedded monitoring systems for DoD and commercial use. Luna desires to connect with primes, program managers, and individuals who have an interest in equipping their personnel with real-time hydration monitoring capability. This is applicable to both DoD and commercial sectors. Additionally, Luna desires to contact management from PMA-265 to discuss testing necessary for flight clearance.

Potential Commercial Applications: The global popularity of devices such as the Fitbit has proven that the general public wants to stay informed as to their current health status. According to Wearable Technology Market (Consumer Electronics, Healthcare, Enterprise & Industrial, and Others) the global demand for wearable technology and health apps is expected to reach $31.27 billion by 2020, with mean annual growth predicted at roughly 17%. The WAHTER system fits squarely into this market segment, and the development and marketing of this device would place Luna well in the forefront of this growing technology segment. Athletes and coaches could use the WAHTER System to ensure peak performance on the field. In another commercial iteration, nursing home staff or clinicians could monitor hydration status of patients who lack the physical or mental means to maintain it.

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