

Physiological Monitoring of the Warfighter

Colonel Karl Friedl, Ph.D.

Modern battlefield conditions and technologies are becoming increasingly complex. In this current military environment, the need to remotely monitor each warfighter's physical and mental condition has become an essential component of the health, safety, and optimal effectiveness of a military unit.

Colonel Karl E. Friedl, Ph.D., and Mr. Martin Buller of the U.S. Army Institute of Environmental Medicine, in Natick, Mass., presented an overview of Warfighter Physiologic Status Monitoring (WPSM), a research program that is focused on collecting, transmitting, storing, and interpreting physiologic data from soldiers, sailors, and pilots.

Current WPSM research is focused on developing a set of wearable, minimally-invasive sensors that monitor and collect raw data on five elements of a warfighter's physical and mental function: core body temperature, hydration, cognition, injury, and life signs (heart, respiratory, and activity rates). Sensors would also collect data on variables that affect physical and mental function, such as ambient temperature, light, and humidity. WPSM's current set of sensors includes a chest belt that monitors life signs, an ingestible core temperature pill, a fluid intake monitor, a sleep/activity monitor, and a ballistic impact detection device.

Because huge amounts of raw data cannot be transmitted on the battlefield, and because collecting and interpreting the data for each individual would be an impossible human task, WPSM is also developing algorithms that distill data into risk models and usable information. These algorithms

are applied by a wearable hub device that stores an individual's baseline physiologic profile and collects data from physiologic and other sensors.

The hub would transmit information that could be used by a commander, medic, or warfighter to assess the individual's risk of a debilitating event. WPSM envisions a series of five colored lights that would indicate a warfighter's overall health status: green for good to go, amber for trouble, red for an imminent event, and gray for absence of life signs; a fifth light would indicate the absence of information. Each status light would initiate additional sensor and communications software that would help commanders, medics, and warfighters take steps to prevent an event, triage multiple events, and allocate human and material resources in the field.

This cutting-edge technology is being developed to monitor normal individuals in battlefield situations, but will both foster and benefit from research into similar technologies that will help people with chronic illnesses live more normal lives. For instance, the Juvenile Diabetes Research Foundation (JDRF) has partnered with the Department of Defense, the National Aeronautics and Space Administration (NASA), and the National Institutes of Health (NIH) to develop technologies for minimally invasive continuous glucose and lactate monitoring. The JDRF hopes that supporting this type of research for military use will expedite development of a similar monitoring system for people with diabetes. We believe that, thanks to this collaboration, that goal is much closer.

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Abbreviations: WPSM (Warfighter Physiologic Status Monitoring)

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