

## **Wearables At The Canyon for Health (WATCH) Study: Early Predictive Indicators of Fatigue and Performance**

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Performing physical tasks in extreme environments can be both mentally and physically taxing. In some circumstances, individuals face fatigue that they overcome to successfully complete a task. In other situations, individuals face fatigue that lead to health events that range in severity, from unsuccessful completion of the task all the way to near death or fatal outcomes. The Wearables At The Canyon for Health (WATCH) study is led by Sandia National Laboratories and funded by DTRA. WATCH collects physiological and cognitive data through wearable devices. Study participants wear these devices while hiking the Rim to Rim trail at the Grand Canyon. The purpose of the study is threefold: to identify which physiological and cognitive markers are most related to fatigue and performance; to determine how a variety of commercial-off-the-shelf (COTS) devices perform in extreme environments; and to use advanced statistical analytics to move towards real-time data processing. Sandia partners with the University of New Mexico Emergency Medicine group to analyze relationships physiological and cognitive wearable data have with bloodwork and survey data collected by UNM. Sandia also partners with another Sandia study, sponsored by DTRA, which collects and analyses interstitial fluid through microneedle devices. Finally, Sandia collaborates with a specialized military population. Military personnel participate in the Rim-to-Rim hike while wearing wearable devices to generate a military-based dataset. Data is downloaded from wearable devices after study participants have completed the Rim-to-Rim hike. Cognitive data is generated from a cognitive battery that participants complete every 3 hours during the Rim-to-Rim hike. The cognitive battery is on an iPod Touch that each hiker carries with them while hiking; the iPod Touch alarms every 3 hours to remind hikers to take the cognitive battery. Preliminary findings have found that there is a relationship between physiological and cognitive markers as well as with performance and fatigue. Initial findings have also found that there is a difference in cognitive performance between civilian and military hikers as both groups become more physically fatigued. Our overall goal is to quantify fatigue and the importance of cognitive function in military contexts to better identify early predictors of fatigue, performance decrement, and ultimately prevent health events before they have negative mission impact.

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