



STIC Note

Wearable Sensors



BACKGROUND/PROBLEM

Several USCG units operate in high stress environments and could benefit from real time monitoring of their personnel. Miniaturization of electronics is a continuing trend that allows small sensors to be worn on users to monitor several health and safety parameters. Maritime Security Response Team (MSRT) requested STIC to assist in evaluating a wearable sensor system for health and safety monitoring of their members during training and mission execution.

METHODS

During a joint Navy and USCG exercise, MSRT West evaluated the Sentinel Safeguard system. The exercise included the MSRT-W members wearing non-breathable CBRNE suits and facemasks to conduct a ship inspection. Throughout the exercise the Command staff was able to monitor the member's health data and environmental exposures in real time. This ensured that each member wearing the systems were not exceeding health and safety limits while conducting the stressful exercise in the restrictive personnel protective equipment. After the demonstration on the west coast, STIC acquired eight Sentinel sensors and a yearlong software license to conduct a long-term evaluation at MSRT East. MSRT-E identified several use cases where they thought monitoring the health and environmental data of their operators would be beneficial. MSRT-E conducts much of their training in the mid-Atlantic region where heat and humidity

combined with strenuous exercises while wearing a large amount of equipment can result in heat stress injuries. They also conduct training and operations in extremely cold environments, often with members exposed to wet conditions where hypothermia is a concern. For these missions and training events it would be ideal to have real time operator health monitoring system available to assist in determining when an operator's core temperature or other indicators determine that the member is outside of safe health parameters.



Figure 1. Sentinel Safeguard System. (Source: Sentinel webpage)

EVALUATION

The STIC Team developed a Test Plan based on these use cases that included a user survey to capture the users experience with the system. In July of 2022, Sentinel representatives provided user training and set up of the Sentinel Safeguard system during a training event in North Carolina. STIC observed the exercises performed, data collected and gathered feedback from the users.

Initial feedback is that the Sentinel Safeguard software is useful, intuitive, and well developed. The Sentinel sensors had a few usability problems and needs to be more robust to remain against the body during strenuous exercises. Additional product development is recommended.

The Sentinel Safeguard system has the capability to integrate with other sensors that can monitor numerous other parameters like noise exposure and Chemical, Biological, Radiological, Nuclear, and Explosives elements presence in the area. The software performed extremely well when paired with existing sensors from other manufacturers during the evaluation.

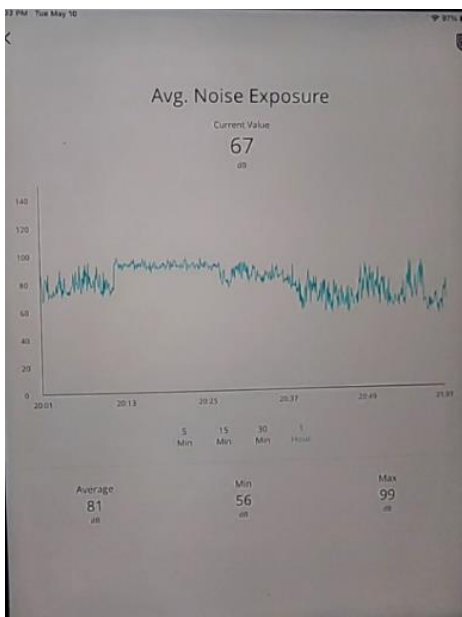


Figure 2. Tablet display of Sentinel Safeguard noise exposure monitoring during a USCG exercise. (Source: US Coast Guard)

CONCLUSIONS

The ability to monitor the health and safety of operators in real time provides great benefits to USCG members. Health & Safety staff can

monitor the members during training exercises to ensure they are not exceeding safe parameters for stressful operations.

All users that wore the systems provided overall positive feedback. It is recommended that the USCG incorporate health and safety monitoring systems into units that require their members to work in hazardous environments or conduct strenuous missions.

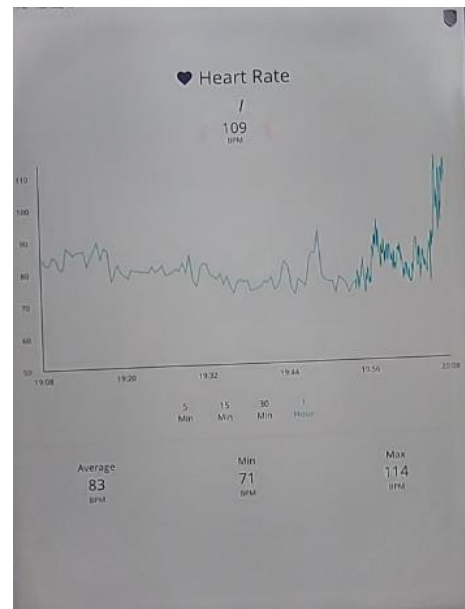


Figure 3. Tablet display of Sentinel Safeguard heart rate monitoring of a USCG member during an exercise. (Source: US Coast Guard)

FUTURE WORK

MSRT-E continues to use the Safeguard Sentinel system to assist with the Health and Safety monitoring of their personnel during stressful training and operations.

The Science and Technology Innovation Center (STIC) is a DHS S&T and USCG collaboration.