STIC Note

Heated Diving Vests

BACKGROUND/PROBLEM

USCG units in the Great Lakes regions frequently conduct ice rescues during the winter. Personnel responsible for performing the rescues are dressed to endure frigid water and air, but reduced core body temperature remains an issue. In an effort to maintain core body temperature and increase the safety and comfort of personnel that perform ice rescues, the National Ice Rescue School (NIRS) requested the STIC Branch of the Research & Development Center (RDC) to assist in evaluating various types of heated diving vests.

EQUIPMENT

Market research showed that there are many heated diving vests commercially available, and after consulting with the NIRS, three models were purchased at different price points for operational evaluation: the Venture Heat, the SmartTex, and the Electracore.

The Venture Heat is fully submersible up to 100 meters and is compatible with wet and dry suits. It is powered via two Li-ion batteries which can be controlled remotely with a wristband. The SmartTex and Electracore are not waterproof and are designed to be used beneath a dry suit. The SmartTex is powered by one Li-ion battery, which is controlled by a piezoelectric, handheld button, and the Electracore is powered by one Li-ion battery which is controlled by a button on the front of the vest. All three diving vets have three heating settings.

Table 1. Vest model, vendor, and price.

Model	Vendor	Price (USD)
Venture Heat	Ocean Quest Dive Center	$812
SmartTex	Smart Textiles	$408[1]
Electracore	Northern Diver	$72

Figure 1. Venture Heat Diving Vest. (Source: Ocean Quest Dive Center webpage)

METHODS

During the months of January and February the National Ice Rescue School conducts training at STA Saginaw River in Michigan. The training includes demonstrations where the students perform mock ice rescues, which require the students to get into the icy waters. During these exercises, the students incorporated the heated diving vests into their protective equipment (between layers 1 and 2) and evaluated their utility using comfort, ease of use, and functionality as metrics.

[1] This is the total price for the vest ($143) and the battery ($265), which are sold separately.

EVALUATION

Feedback from the units indicated that the Venture Heat diving vest provided the best results out of the those evaluated.

The Electracore was given the worst feedback. The students tested the vests while outside on the ice for ~4 hours and the battery for the Electracore failed early and forced some of the students to return inside to warm up. Additionally, some of the training involved the students crawling on their stomachs to approach a mock survivor (see Figure 2), and due to the location of the power button, the vest would turn off by accident. While wearing the gear required to conduct ice rescues, it was difficult to turn the vest back on.

The SmartTex received some positive feedback and some negative feedback. The positive feedback was that the battery lasted the full four hours and the vest kept the students warm. However, the battery was large and cumbersome and is installed on the front of the vest. While conducting the same maneuvers on the student's stomachs described above, the battery would cause discomfort. Additionally, the SmartTex has a crotch strap which some evaluators described as uncomfortable.

The Venture Heat received the most positive feedback. The battery of the Venture Heat lasted the entire four hours and there was no major discomfort. The evaluators also liked that the wristband showed which power level was currently activated. Furthermore, the vest is waterproof, which is useful in the case of accidental water intrusion.

Figure 2. Rescuer approaching mock survivor with rescue sling. (Source: U.S. Coast Guard)

CONCLUSIONS

The ability to maintain ice rescuer's body temperature will increase comfort and safety during risky ice rescue events. The SmartTex and the Venture Heat heated vests were both able to elevate the student's body temperature, with the Venture Heat being the preferred solution due to its comfort and functionality. It is recommended the USCG incorporate this vest into ice rescue operations.

FUTURE WORK

The heated diving vests will continue to be used during ice rescue training and operations. Core body temperature sensors may be used in the future to more objectively evaluate the effectiveness of the various diving vests.

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