STIC Note

Thermal Clip-Ons and NVD Integration

BACKGROUND/PROBLEM

Hand-held night vision devices (NVDs) are frequently used by Coast Guard (CG) units that are required to conduct search and rescue (SAR) and law enforcement operations. However, NVDs work by enhancing ambient light and are not as effective if there are weak natural or man-made illumination sources. Thermal imagers overcome this deficiency by using a target's thermal signature as a means of detection, allowing visibility in total darkness.

The intent of this effort was to enhance situational awareness during nighttime operations by integrating NVDs and thermal imagers, which will allow units to see in both night vision and infrared (IR) simultaneously. This is accomplished using various types of thermal clip-on devices, which can be attached to the objective lenses of NVDs.

METHODS

This task was initiated following a request from STA Ketchikan for new night vision technology. The Science and Technology Innovation Center (STIC) contacted the National Urban Security Technology Laboratory (NUSTL), which had previously evaluated integrating night vision and thermal imagers. NUSTL provided documentation from the System Assessment and Validation for Emergency Responders (SAVER) Program, which assessed various models of NVDs, including a clip-on thermal accessory: the Enhanced Clip-On Thermal Imager (ECOTI). However, the ECOTI had not been evaluated in a maritime environment, or by CG units. Therefore, the ECOTI was purchased alongside a cheaper thermal clip-on for comparison: the InfiRay Jerry C2 (Table 1).

Both clip-ons work by projecting a thermal image onto the objective lens of an NVD. Each clip-on offers three modes of operation: a full thermal mode that shows all thermal signature information possible, a patrol mode that only shows large differences in temperature between a target and the ambient temperature, and an outline mode which adds a thermal outline around targets. Additionally, each clip-on offers unique features: the ECOTI has the ability to take pictures, which can be exported using a 7-pin cable, and the InfiRay Jerry C2 includes a pulse mode which flashes the thermal overlay on and off.

Attaching the clip-ons to the NVDs requires a mounting bracket that secures the clip-ons to the NVD's objective lens. The dimensions of a NVD's objective lens (i.e., it's circumference) depend on the model of the NVD, and each NVD model used by the CG will require a different bracket (see Table 1 for a list of which NVDs each clip-on is compatible with).

Table 1. ECOTI vs InfiRay Jerry C2 specs.

		
Model	ECOTI	InfiRay Jerry C2
Price	$8,999	$2,300
FOV	30°	20°
Battery	CR123	18650
Compatible NVDs	PVS-14, PVS-15/18, PVS-31A/GPNVG, PVS-31D, BNVD-1531	PVS-14, PVS-31A, BNVD-1531*
Range	1,400 meters	1,000 meters
Weight	3.81 ounces	3.88 ounces

Three brackets were purchased for the ECOTI ($349 per bracket), and the Jerry C2 ($90 per bracket) to allow usage with the PVS-14, PVS-31A/GPNVG, and BNVD-1531 NVDs. The asterisk in column 3 of Table 1 indicates that InfiRay does not sell brackets compatible with the BNVD-1531 NVD, and 3D printed brackets were purchased from an independent vendor ($55 per bracket).

Feedback was collected from field units via survey and personal communication. The survey requested the evaluators to rate the clip-ons performance and provide feedback on scenarios where the clip-ons could be useful.

EVALUATION

The ECOTI was initially evaluated locally by RDC personnel during night flights at Joint Base Cape Cod using GPNVGs and BNVD-1531 NVDs. The ECOTI allowed users to see in both night vision and IR. However, the night of the evaluation was clear, and the light supplied by the moon and stars allowed the NVDs to work sufficiently on their own.

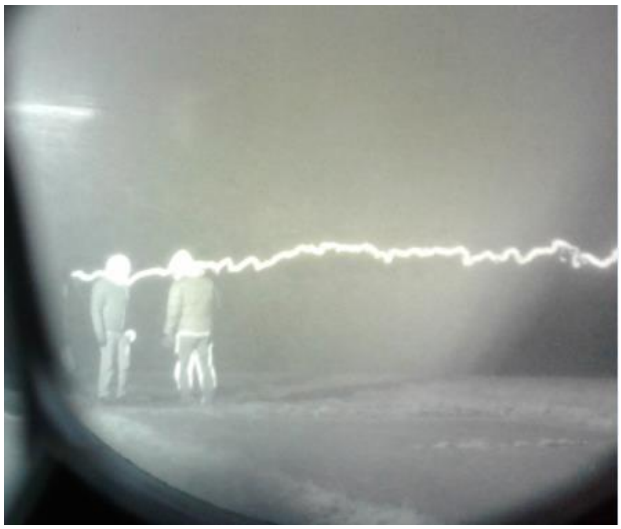

Figure 1. ECOTI in outline mode at Cape Cod. ECOTI is paired with GPNVG (Source: USCG).

The thermal clip-ons were also sent to two units for evaluation: Maritime Security Response Team – East (MSRT-E) and STA Ketchikan. MSRT-E evaluated the clip-ons while conducting shoot-house exercises and combat training on maritime platforms and paired them with their BNVD-1531 NVDs. STA Ketchikan used the devices for SAR operations and attached the clip-ons to their PVS-14 NVDs.

Feedback from MSRT-E indicated that neither of the clip-ons were useful for their training exercises. The clip-ons excel when there is low ambient light, and the training conducted by MSRT-E was either close to shore (where docks and marinas produced sufficient back lighting), or early enough in the day for there to be enough light for NVDs to operate alone. While it was noted that the clip-ons did not interfere with their training, there was also not sufficient enhancement to justify using the clip-ons.

STA Ketchikan used the clip-ons during a simulated and actual SAR cases involving disabled vessels. The unit found that the clip-ons were useful to initially locate the vessel since they did not have a GPS position or communications with the vessel (just a general location). It was also noted that the devices were useful for adjusting the towline and being able to see people onboard the vessel. STA Ketchikan also stated that the clip-ons could be useful when looking for a person in water (PIW).

The InfiRay Jerry C2 was considered the preferable clip-on device by STA Ketchikan because it was more user friendly and provided a clearer thermal signature. An evaluator stated that they had no issues operating the device with only about 5 minutes of training.

Figure 2. Simulated disabled vessel using ECOTI in outline mode (Source: USCG).

Figure 3. Disabled sailing vessel during actual SAR case using Jerry C2 (Source: USCG).

CONCLUSIONS

Given the initial feedback from MSRT-E, RDC will continue to test the technology in various environmental and operational conditions.

The clip-ons were evaluated during the month of August at STA Ketchikan, and the feedback was generally positive. There will likely be even more opportunities to use the technology during the winter due to the long nights.

While the InfiRay Jerry C2 was the preferred solution, it should be noted that this model's vendors supply mounting brackets for a limited number of NVD models. Purchasing 3D printed mounting brackets from independent vendors is an alternative.

FUTURE WORK

The clip-ons will be sent to STA Ketchikan permanently for continued use. Given this station is located at a northern latitude, they may see better utility for this technology in the winter months.

Figure 4. ECOTI installed on BNVD-1531 (Source: USCG).

Figure 5. RDC personnel in RDC light lab. ECOTI is paired with GPNVGs. All lights in light lab are turned off to show clip-on utility in total darkness (Source: USCG).

Figure 6. STA Ketchikan crew posing for picture using Jerry C2 (Source: USCG).

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