STIC Note

Handheld X-Ray Backscatter Technology

BACKGROUND

As part of the Coast Guard's drug interdiction missions, boarding teams are required to search suspicious vessels for hidden drugs and contraband. The boarding officers and their teams are in a constant battle against drug smugglers who find creative new ways to hide drugs. X-ray technology has been successfully employed at land-based border crossings for years but the large machinery and cumbersome design of traditional x-ray imagers precluded its application for ship-based boarding crews. Boarding teams currently rely on: ion scanners that analyze a sample of air for traces of various substances; borescopes (tiny cameras on flexible rods which are inserted into a small hole created by the boarding officer); and their own instinct and experience.

Recently, x-ray backscatter technology has gained popularity with law enforcement agencies. Rather than use high-powered transmission x-rays which require the item of interest to be between the emitter and receiver, backscatter technology takes advantage of reflected low-power x-rays. As shown in Figure 1, a backscatter receiver can be integrated into the same device as the emitter allowing for imaging of objects which could not easily be sandwiched between the emitter and receiver like building walls, car doors, or ship decks.

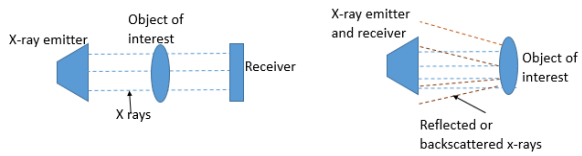

Figure 1. Transmission x-ray detection (left) vs. Backscatter x-ray detection (right).

METHODS

US Customs and Border Protection (CBP) recently entered into a contract with a US-based x-ray detection company called Viken to purchase a hand-held backscatter imager called the HBI-120 (Figure 2) for use in vehicle inspections at border crossings.

Figure 2. The HBI-120 handheld backscatter x-ray imager. The integrated touch-screen display shows the user organic anomalies.

The HBI-120 is specifically tailored to detection of organic materials including most drugs, paper currency, live animals, and people. CBP had huge success with this device and purchased hundreds of units. Due to their success, STIC investigated if this device would be useful in a maritime environment. In addition to being able to learn from CBP's experience with the HBI-120, STIC members attended training sessions at CBP border stations and gained hands-on experience with detecting various drugs. The HBI-120 can display an anomaly including drugs, contraband, unexpected metal, and more but the user must interpret the findings. Viken provides a plethora of material to assist in this interpretation and users quickly gain experience identifying various drugs. The units cost $42k each and an attachment called the Large Area Detector (LAD) which enhances the area and depth of imaging cost $10k. The STIC purchased 3 units and 2 LADs.

EVALUATION

The HBI-120s were sent to TACLET South, PAC TACLET, and Sector Boston for limited user evaluations. The STIC provided in-person, hands-on training and asked the units to use the HBI-120 in tandem with other, proven search methods. Users were asked to report on items detected, materials scanned, and ease of use. Following a six month period, the units were debriefed. While no drugs or contraband were discovered with the HBI-120, boarding teams were able to confirm the lack of drugs using the imager thus helping direct their destructive searches. Lack of more positive results with the HBI-120 was due to a variety of reasons. Foremost, the HBI-120 was developed specifically for use on cars which are, more or less, standardized by model. Viken provides a database of makes and models of cars which a user may cross reference to identify the presence of an anomaly. Customizations on maritime vessels, in comparison, are far more common than with automobiles. As such there are no standard models which a boarding officer can use for comparison when determining the existence of an anomaly. Many boarding officers also reported that intelligence and experience is often more useful than the HBI-120 proved to be. For example, if a boarding team notices that part of a deck has been freshly painted and intelligence suggests the vessel may be carrying drugs, the team does not need any further evidence to conduct a destructive search. Thus, there were many cases where the HBI-120 likely could have detected contraband but was not used because simple observation from the boarding team was sufficient.

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

Figure 3. Training on the HBI-120.

CONCLUSIONS

The limited user evaluation resulted in both pros and cons expressed by users. Two concerns that every unit expressed were the inability of the HBI-120 to image through thick steel and vulnerability to water damage. The users remarked that the HBI-120 was intuitive to learn and easy to use. They also found it to be a highly effective tool for searching for contraband hidden behind cabin walls made of wood or fiberglass. The backscatter imagers are viable for non-destructive searches for contraband.

After the initial limited user evaluation period had concluded, Viken announced a new model called the NightHawk 140 which has a more powerful x-ray emitter and a more sensitive receiver with the LAD built into the unit. Viken claims this unit can image through thin steel. STIC assessed that the improvements were significant and could address the concerns with the HBI-120. STIC purchased two NightHawk 140 units and will deploy them for another limited user evaluation. Should the new design prove superior and useful, STIC will update CG-MLE-3 with results.

Important note on safety: Safety has been a universal concern since the unit does radiate x-rays. The HBI-120 model includes a number of safety features including a 30s time-out for the emitter. Third party and CBP tests show that the radiation exposure from using the HB-120 is significantly below minimum threshold levels.