STIC Note

Trillium HD80 EO/IR Sensor

BACKGROUND/PROBLEM

The R&D Center's aviation branch required a high quality Electro-Optical/Infrared (EO/IR) sensor to conduct automatic target identification and slewing as a part of its larger Beyond Visual Line of Sight (BVLOS) project. The goals of the BVLOS project are: to explore detect and avoid capabilities for Coast Guard Uncrewed Aircraft Systems (UAS), establish a BVLOS Certificate of Authorization for Coast Guard operations, and conduct a land based Medium Range UAS (MR-UAS) Search and Rescue (SAR) demonstration, followed by a Limited User Evaluation (LUE) onboard a CG cutter. The use of a highly capable EO/IR sensor is essential to ensure the capabilities of a MR-UAS meets the needs of CG operators in all weather and light conditions. In addition, the team needs to determine if these sensors can also be used as a part of the detect and avoid systems.

METHODS

This project was selected by the RDC's STIC Branch due to the high number of Commercial Off-The-Shelf (COTS) sensors available. The project was initiated in the Spring of 2020, and at that time there were numerous EO/IR sensors that met the needs of the BVLOS project. The Trillium HD80-MV 36X was chosen due to its balance of cost, performance, feature set, and availability. The HD80 is an 8" diameter gimballed sensor payload with a 720p, 36x optical zoom visible camera, a 15x optical zoom cooled Mid-Wave Infrared (MWIR) camera, and a NVG compatible laser pointer (Figure 1).

The sensor was purchased via the Defense Logistics Agency (DLA), Tailored Logistics Support Program (TLSP) for Special Operations Equipment.

Figure 1. HD80-MV 36X mounted on L3Harris FVR-90. (Source: U.S. Coast Guard)

EVALUATION

Due to various delays in manufacturing, delivery and testing caused by the COVID-19 pandemic, the first opportunity to test the sensor was in the Summer of 2021. This initial test consisted of mounting the sensor on a custom bench test mount and conducting ground tests to verify its many features. Bench testing was accomplished using a hard-wired connection to a dedicated Ground Control Station (GCS) (Figure 2). This testing demonstrated:

- Full mechanical and networking functionality.
- Moving target tracking.
- Generation of geopoints in Trillium's Graphical User Interface (GUI) that could be

shared with multiple command and control systems and displays, including the Windows Team Awareness Kit (WinTAK).

- Geopoints generated in WinTAK, sent to sensor, displayed as an overlay on Full Motion Video (with slewing cues in FMV).

Figure 2. The sensor temporarily mounted for ground testing. (Source: U.S. Coast Guard)

After this initial test, the sensor was mounted temporarily on the RDC's 29' RBS; however, due to lack of marinization of the sensor and close proximity to sea spray it was decided that the sensor should be tested on UAS platforms. Various integration work was completed on multiple UAS platforms until L3Harris' FVR-90 was selected in December of 2022. Due to a hardware failure encountered during integration, the sensor needed to be shipped back to Trillium's facility in Oregon for repair. Within days of discovering the problem, the sensor was repaired and returned to L3Harris' facility in Arizona.

After full integration onto the FVR-90 was achieved, the HD80 was operationally tested in controlled military airspace at altitudes up to 9500' Above Ground Level (AGL). Initial flight verification testing, completed in southern AZ in optimum conditions, with the daytime camera, revealed capability of detecting and classifying human sized targets of interest at this altitude at slant ranges up 10K'. Although the IR modes were used, daytime testing did not fully optimize the sensor's capabilities. Night testing will be required to fully evaluate the IR modes.

Figure 3. Targets of interest at 9661' AGL and 9672' slant range. (Source: U.S. Coast Guard)

CONCLUSIONS

The HD80 MV 36X combines all environment operability, image stabilization, daytime and nighttime optical modes, and object tracking functions which provide the operator a very capable advanced sensor which can greatly increase operational commanders' situational awareness in the maritime area of operations.

FUTURE WORK

RDC will continue to test the HD80 with the L3 Harris' FVR-90 and launch from an operational 270' WMEC in January of 2024.

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