



STIC Note

Unmanned Surface Vessel



BACKGROUND/PROBLEM

There is constant advancement in Unmanned Surface Vessel (USV) technology and capabilities and great potential to apply them across the USCG mission spectrum. To further evaluate the applicability of USVs to Coast Guard operations, the STIC transformed an operational 25ft RBS (25417) into an optionally manned vessel.



Figure 1. 25417 converted to USV with message sign and LRAD.

METHODS

To evaluate a security zone enforcement scenario, 25417 was outfitted with a remotely programmable LED message sign and a Long Range Acoustic Device (LRAD) as a loud hailer. STIC partnered with the Navy to leverage their substantial investment and experience with USV construction and operation. The Naval Air Systems Command (NAVAIR) installed the SEACAN unmanned control system on the 25417 consisting of command and control components necessary to interface with the vessel's standard control systems. The STIC provided funds to the Office of Naval Research (ONR) to have their autonomous system installed by their

contractor, Spatial Integrated Systems (SIS). SIS installed the Control Architecture for Robotic Agent Command and Sensing (CARACaS) on the 25417 at TRACEN Yorktown, VA, enabling the boat to operate autonomously.

EVALUATION

Extensive testing and verification occurred once the SEACAN and CARACaS components were integrated into the 25417. The boat's control systems were tuned to ensure smooth control and responsiveness. Once system verification was complete, the testing moved to the York River to verify the sensors were correctly identifying targets and providing the correct information for safe navigation. The final stage of the install testing was to ensure compliance with the Navigation Rules (COLREGS) by having another vessel interact with the USV.



Figure 2. Joint autonomous testing with the US Navy at Ft. Story, VA.

EVALUATION (CONT.)

In January 2021 the 25417 was transported to USCG Station Little Creek, VA (Figure 2) to participate in a joint autonomous High Value Asset (HVA) protection demonstration with the US Navy. The 25417 and Navy vessel were able to communicate without human intervention, make navigation decisions and determining the collective behaviors needed to protect the HVA.

The 25417 was transported to Station Kings Point, NY to further understand how a USV can be applied to USCG missions. The boat was operated and evaluated by the station for 6 months. The Station evaluated several USV mission applications in support of their typical duties and Concepts of Operation including security zone monitoring and HVA escorts.



Figure 3. Remotely operating the 25417 at Station Kings Point.

CONCLUSIONS

Numerous lessons were learned about the USV capabilities and limitations. One omnipresent issue was limited ability to provide a reliable data connection capable of transmitting a large amount of video and other data. This limitation will only get more challenging as sensor technology improves. It will be challenging to transmit the increased amount of data from ship to shore and back. In addition, integrating data

into existing USCG information systems was identified as a significant issue preventing wider application of unmanned systems.

The main benefit of remotely operated vessels is that the crew can conduct dangerous missions without exposing them self to hazards like fire, airborne chemicals, or extreme weather. Another benefit identified during testing was the USV's ability to conduct long duration missions. A remotely operated vessel is capable of maintaining a presence in an operating area and even swapping the crew without having to leave the area. Additionally, USVs could allow personnel onboard to focus on other mission aspects (like Search and Rescue) while an ashore crew handled the vessel's operations. The complete analysis is covered in the 'USCG 25417 Autonomous Vessel Project Report' that is available upon request.

FUTURE WORK

After the STIC effort was completed, the 25417 was transferred from operational status to that of a research vessel at the RDC to support further testing. All future work will be conducted by the RDC Surface Branch. The STIC team continues to monitor the advancements in USV technology and will provide input for decision makers on how this technology can be applied to USCG missions.

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