



# STIC Note

## Unmanned Aerial System Mapping Software



### BACKGROUND/PROBLEM

In 2018, the Coast Guard started the Group 1 UAS Prototype Program Initiative (GUPPI) to evaluate the applications of Short Range Unmanned Aerial Systems (SR-UAS) to various missions. Three different SR-UAS systems were identified that met GUPPI's initial requirements. Of the three systems, the Yuneec H-520 is the largest GUPPI platform capable of long flight times and has swappable camera payloads, which make it a good candidate for aerial mapping.

SR-UAS mapping software requires the camera to take multiple pictures from various points along the flight path and then stitches them together to make one large image. Although this sounds simple, in order to develop an accurate depiction of the area being mapped the mapping software must have very accurate position, camera angle, and altitude information.

The request for mapping capability came from GUPPI operators who are required to document USCG infrastructure and respond to natural disasters. GUPPI operators could use this capability to conduct inspections on antenna towers, building roofs, and other facilities to document the conditions and record any changes. Natural disasters typically create a substantial change in the environment and responders would benefit from having an up-to-date map of the affected area.



Figure 1. Yuneec H-520 conducting a mapping mission. (Source: USCG)

### METHODS

STIC staff conducted market research to determine which mapping software would best meet the request from the GUPPI operators. Pix4DReact was selected because it indicated that it could quickly develop two dimensional maps that would meet the needs of the identified missions. The software also listed the Yuneec H-520 and its camera as a supported equipment. Additionally, the product is marketed specifically as a tool for first responders. The STIC purchased several PIX4DReact licenses and provided them to various units operating SR-UAS for the GUPPI effort. The GUPPI operators were asked to use the mapping software for actual USCG missions and provide feedback on its capabilities and ease of use.

## EVALUATION

The mapping software is not approved for use on CGOne workstations and requires installation on a non-standard laptop. The evaluators quickly encountered difficulty with the software installation and mapping operations. Despite some indications during the market research phase that the Yuneec H-520 was supported by the PIX4D software, it was discovered that a camera calibration file was needed for the H-520 camera. The required calibration file was difficult to develop and required manual input of numerous camera parameters. Users also encountered difficulty in locating the images and transferring them to the correct location for processing. The technical difficulties encountered during the evaluation discouraged the user's enthusiasm for the mapping capability.

During the evaluation, it was learned that all US Government UAS systems would be required to meet more stringent policy requirements. This new requirement is commonly referred to as 'Blue UAS.' None of the approved BlueUAS are directly compatible with the Pix4DReact software. However, there is one approved BlueUAS with a mapping software option, but unfortunately, the system and its add-on software were determined to be cost prohibitive for further analysis at the unit level.

## CONCLUSIONS

Coast Guard SR-UAS operators still have a need to generate real time maps for infrastructure inspection and situational awareness. Currently, there are no approved UAS that can meet that need in a cost efficient manner. Furthermore, there are no approved SR-UAS that are capable of operating effectively in a maritime

environment. The technical difficulty of using a third party mapping software resulted in the evaluator's determination that the solution was not feasible.



Figure 2. Coast Guard-owned Skydio X2D, Blue sUAS. (Source: USCG)

## FUTURE WORK

The US Government continues to refine the SR-UAS policy requirements and approved platforms. Despite the difficulties in this initial effort in providing a SR-UAS mapping capability, there continues to be a need for near real-time mapping solutions for Coast Guard response units. The STIC team will continue to monitor approved platforms and their mapping capabilities.

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