Bucking Tradition

Classification of drone imagery eases burden of coastal wetlands mapping to create efficient, meaningful vegetation maps

Solution

- Trimble® UX5 Aerial Imaging Solution
- Trimble eCognition® Software
- Trimble Inpho® UASMaster Software

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overview

Coastal wetlands are notoriously devilish to survey, both from the ground and from the air. Louisiana environmental authorities have routinely used 1-meter aerial imagery and ground surveys to map and monitor their coastal marshland. But that traditional approach is time consuming and vulnerable to inaccuracies. One scientist at a Louisiana environmental and geotechnical services company set out to improve traditional survey methodologies by combining unmanned aerial system (UAS) data with eCognition object-based imagery analysis (OBIA) technology. The integrated approach has not only proven its viability for vegetation mapping, it has yielded new business revenue streams for the company.

Location
LOUISIANA

In August 2016, Jennings, Louisiana-based JESCO, Inc., was contracted to fly its UX5 UAS over a restoration site in Terrebonne Parish, a dense, marshland region near the Gulf of Mexico. Whitney Broussard, a senior scientist at JESCO, used that opportunity to test his UAS-OBIA proof-of-concept application.

"I thought the UAS hyperspatial imagery would be a natural fit for developing an OBIA-based technique," said Broussard. "Unlike traditional image-processing methodologies, OBIA software can handle the high spectral variance and subtleties of the hyperspatial data. I wanted to test the feasibility of combining the two technologies to produce meaningful coastal vegetation maps that could supplement the state's traditional monitoring programs."

To ensure the reliability and accuracy of the UAS data over the one-square-kilometer site, Broussard and his team set out five ground control points (GCPs) for each flight block. Carrying a handheld GPS, they navigated to each pre-defined location, laid down the elevated target and used a Trimble Geo 7X GNSS handheld unit to record the GCP's position via RTK corrections from a VRS network.

Since collecting imagery over patches of open water is a photogrammetry challenge, Broussard outfitted the UAS with a Sony Alpha 5100 sensor for natural color (RGB)

imagery and a Sony NEX5 with a near infrared (NIR) sensor. Launching the UAS off their boat about 4 km from the landing site, the UAS flew three flights with the RGB sensor and one with the NIR sensor. In three hours of total flight time, the UX5 had collected 4,106 images over the entire AOI at a ground sample distance of 2.5 centimeters.

Taking the overlapping RGB and NIR flights—totaling 1,984 images—as his test-case imagery sources, Broussard used Trimble's Inpho UASMaster software to generate two digital surface models (DSM), one from the RGB data and one from the NIR data, and then used the DSMs to produce orthomosaics of each. The orthomosaics and DSMs had horizontal and vertical accuracies of 2.4 cm. All of those products were used as source data for eCognition.

Broussard developed a two-tiered eCognition rule set with three separate processes to both delineate and map the land/water interface and classify the vegetation into three types. Relying predominantly on the NIR information, eCognition first identified and classified all water objects and defined the land/water boundary. It then classified the land cover. Combining height thresholds, spectral algorithms and normalized vegetation indices, the software separated the vegetation into three classes: Spartina Patens (grass), Phragmites Australis (reed) and Other.

Top: Broussard drives the boat used to launch and monitor the UX5's flight.

Lower left to right: Broussard uses a Trimble Yuma with Trimble Aerial Imaging software for flight planning and to communicate with and to control the UX5.

Broussard keeps an eye on the UX5 in the distance. The UAS flew at 80 kph at an altitude of 75 meters.

Broussard uses a Trimble Geo7x with a Zephyr antenna and VRS real time corrections to survey the "marsh elevation," a height measurement on the surface of the marsh soil.

Broussard exported the classifications as shapefiles and used ArcGIS to finalize the cartography and perform a spatial analysis, calculating the percent coverage for each of the vegetation types and for land versus water. Based on a comparative analysis with local authority data, he identified 100 percent of the vegetation types, calculated plant heights to within 80-90 percent, and produced a "strikingly more detailed" land-water interface map.

In the spring of 2017, Broussard presented the maps to local authorities who expressed interest in incorporating a UAS-based method into their traditional monitoring campaigns.

More validation of the new approach came only a few months after completing the Terrebonne Parish project, when JESCO was tasked to use their UAS-OBIA solution to survey and classify a wetlands mitigation bank at Louisiana's Rockefeller Wildlife Refuge. More combined UAS-OBIA survey assignments have followed.

Based on the successes of this integrated application, it appears that a new vegetation-mapping business has taken flight.
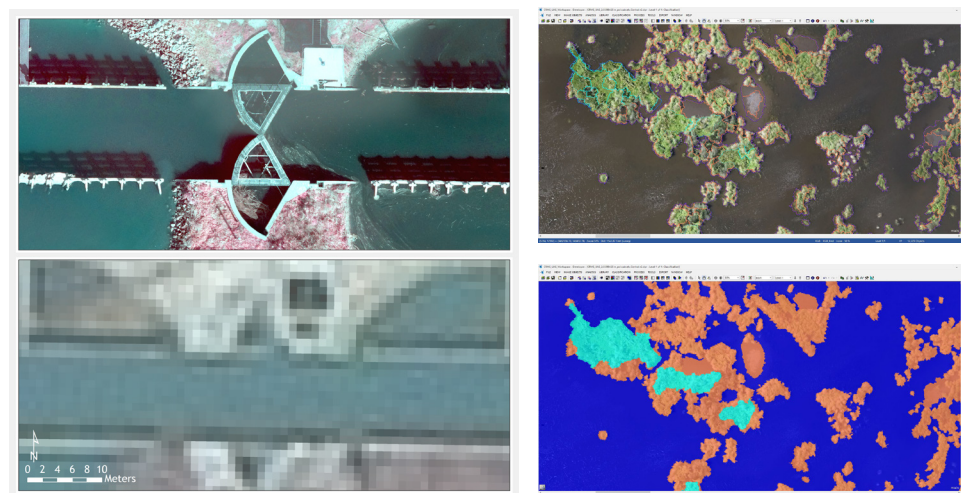
Left: A comparison of the hyperspatial resolution of UAS data (above) and the traditional 1-m aerial imagery over the exact same sight at the RWR.

Right: Using Trimble's InphoUAS Master software, Broussard first segments the data stack into meaningful objects (above), then classifies the objects by dominant species (bottom).

"Combining these technologies opens up tremendous possibilities for monitoring changes in coastal environments. With this integrated approach, we can not only supplement traditional monitoring methodologies, we can produce precise vegetation maps at scales and speeds that we couldn't ever imagine or do as human interpreters."

— *Whitney Broussard, Senior Scientist, JESCO*

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