



**CESU Final Report Summary for
Georeferencing Capabilities and Operational Missions of
the Nova 2 Small Unmanned Aircraft System - W912HZ-09-2-0025**

Purpose:

Four Nova 2 small unmanned aircraft systems (sUAS) were delivered to the U.S. Army Corps of Engineers, Jacksonville District (USACE) in early 2009. Study objectives relative to the sUAS included:

- To further advance the Nova 2 sUAS platform through structural airframe changes, and potentially integrating new imaging sensors.
- To define the georeferencing capabilities of the Nova 2 sUAS, and report on specific aquatic invasive operational missions for the USACE at the Indian Prairie Canal area of Lake Okeechobee.
- To further refine the georeferencing capabilities of the Nova 2 sUAS and its processing algorithm solutions. Additionally, we plan to report on individual sources of georeferencing error, and potential resolutions to these limitations.
- To use computer-aided feature-recognition algorithms to assist in identification of specific targets within images. Development of sampling protocols is anticipated to reveal a measure of variance such that statistical inferences might be made on changes observed.
- To generate an operational flight planning manual for conducting Nova 2 sUAS missions over invasive vegetation infestations in Lake Okeechobee using the Procerus® Technologies autopilot system.

Location: Lake Okeechobee, Florida

Methods: Testing on the design of the Nova and subsequent design improvements were undertaken. During the fall of 2009, the majority of the project's efforts were focused on the design and construction of the Nova 2.1 airframe. Templates and molds were fabricated to help in the production of Nova 2.1 aircraft in-house; improving the speed and efficiency of future airframe construction efforts. The new wing design is much lighter, and more efficient through all phases of flight. The new fuselage was designed with redundant waterproofing techniques, and fewer places for water to potentially enter. Changes were also made to the optics and

Results: The Nova 2 was able to repeatedly deliver 45-minute sustained operational missions over Lake Okeechobee, while gathering high resolution imagery and data for post processing. Improvements in the georeferencing hardware and software also helped position the Nova 2 substantially above any of its competitors. The imaging platform was equipped with its own

inertial measurement unit (IMU), increasing both the accuracy and precision of the imagery data collected. The Nova 2 proved to be a durable airframe for repeated takeoffs and landings, including several repeatable safe water landings. Missions included mapping invasive aquatic plant species and nesting wading bird colonies.

Researchers: University of Florida, Gainesville: H. Franklin Percival, Department of Wildlife Ecology and Conservation; Co-Principal Investigators: Peter G. Ifju, Mechanical and Aeronautical Engineering, Scot E. Smith, Geomatics Program, School of Forest Resources and Conservation, Matthew A. Burgess, Department of Wildlife Ecology and Conservation

Prepared For: Jacksonville District, USACE, U.S. Army Engineer Research and Development Center.

CESU: Gulf Coast