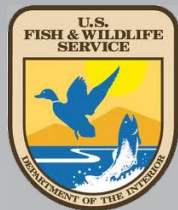


Experimental Use of a UAV Camera Platform for Remote Early Detection of Aquatic Invasive Species



This conservation project was made possible in part with a research grant from the US Fish and Wildlife Service, the Coastal Impact Assistance Program, US Department of the Interior and Mississippi Department of Marine Resources with technical assistance from ISR Group.





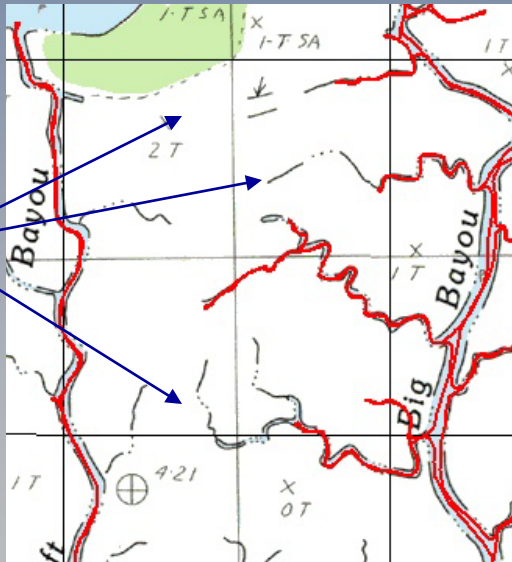
Situation

- Post-Katrina salvinia eradication efforts ongoing
- 1,000's of acres of inaccessible marsh habitat possibly harboring giant salvinia
- This infestation emerged into waterway in 2011
- A plant or small number of plants was able to remain nearly dormant from 2005-2011

Problem

- Other small patches of giant salvinia may remain hidden in Pascagoula River marsh.
- Conventional watercraft surveys cannot access all salvinia habitat

Areas Not
Surveyed



Small infestations not visible during manned aircraft photo flights



Possible Solution?



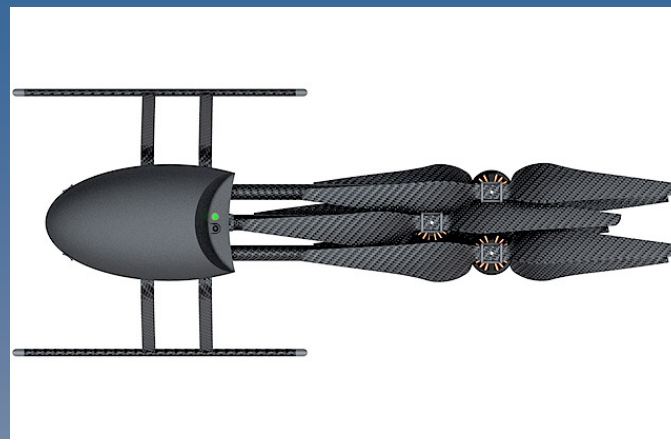
**Extend marsh searches with very low altitude
boat-launched R/C aerial photography**

Draganflyer X6

- Remote control helicopter video platform
- Operator sees live feed from camera
- Takes 10MP georeferenced images
- Rechargeable, stable, easy to fly



Photo Credit: Draganfly Innovations

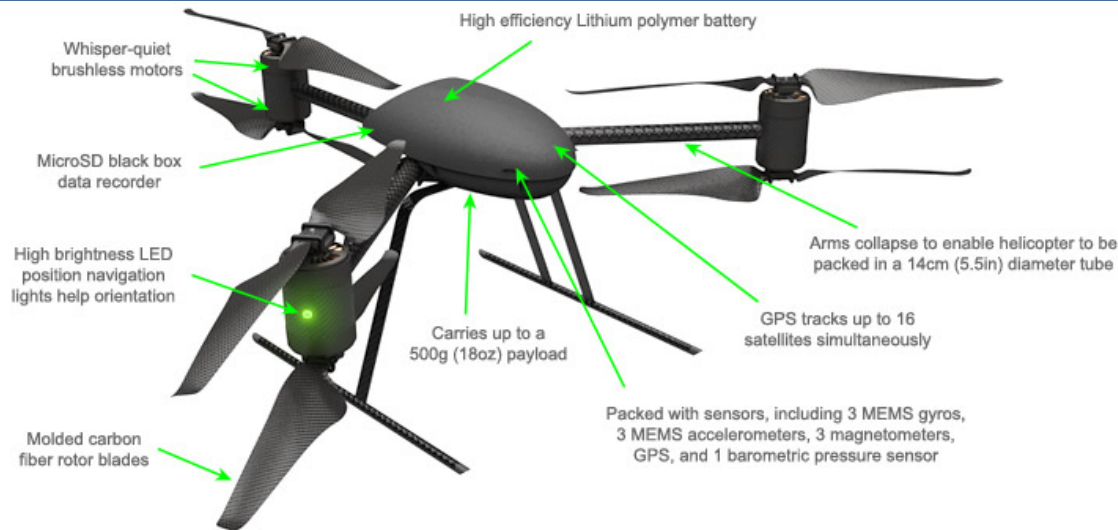


Wrap 1200

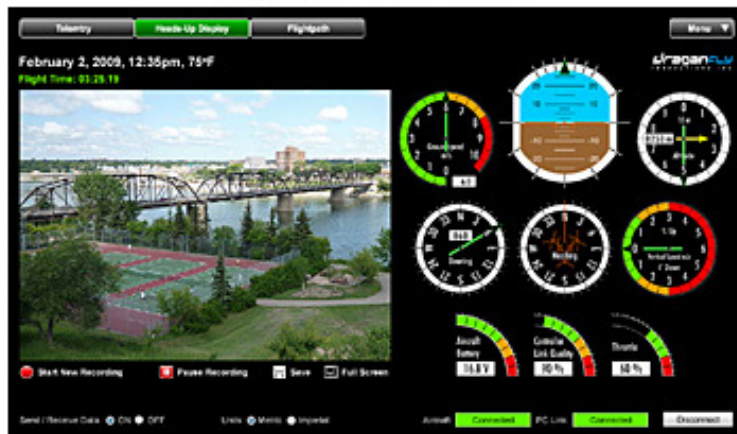
DraganFlyer™ X6

Photos Credit: Draganfly Innovations

Features:



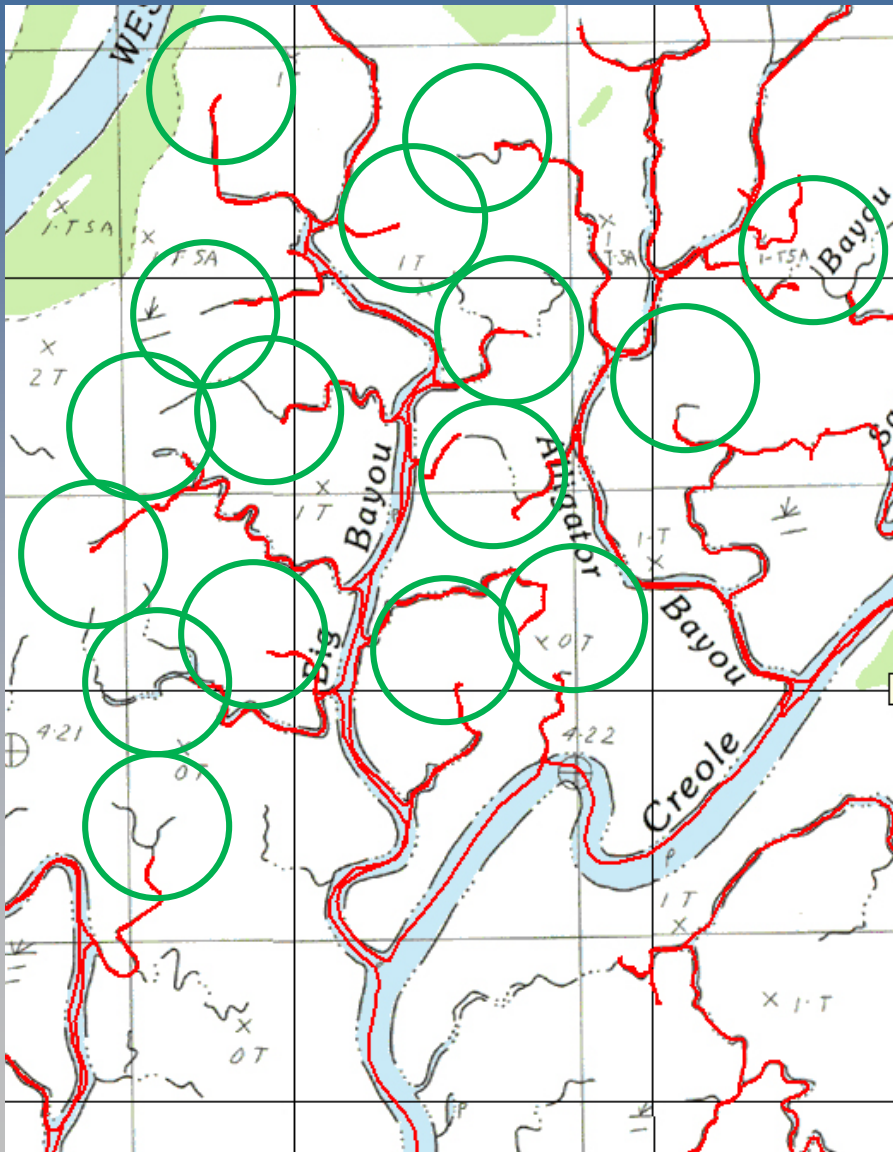
Heads-up Video Screen



Telemetry Screen



Extend Range of Boat Surveys:

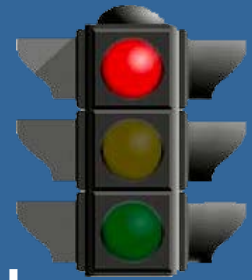


Red Lines – Boat GPS Tracks

Green Circles – Range of R/C Heli



Unanticipated Setback:



- State and Federal Agency use in NAS is regulated. Commercial use is prohibited. Private hobby use **not** regulated. DOD use self-regulated
- Learned of FAA regulations AFTER placing order for R/C aircraft
- Regulations same regardless of size of aircraft or altitude
- Requires COA (Certificate of Authorization)
Cost to hire contractor to apply for COA > **\$20,000**

Plan B: How Hard Can It Be?

Obtain Advice on COA:

Brian Miller – MESA County Sherriff's Office



- Scale Down Study Area:
 - Increase Chances of Approval
 - Reduce Complexity of COA
- Create Airworthiness Certificate
- Establish “Lost Link” and Emergency Procedures
- X6 requires training and skill to fly. Learn to fly using indoor toy 4-channel helicopter



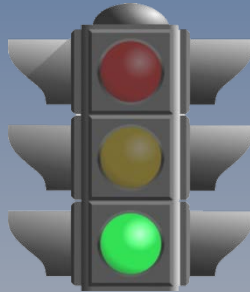
Photos Credit: Dragonfly Innovations

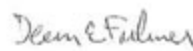
Condensed Study Area - 6 Sq. Miles to 50 Acres:

- Pascagoula River- marsh area just North of I-10
- Small clusters of giant salvinia remained undetected in this marsh until Spring 2011
- Following period of heavy rainfall, giant salvinia was starting to flush out of area and re-infest river

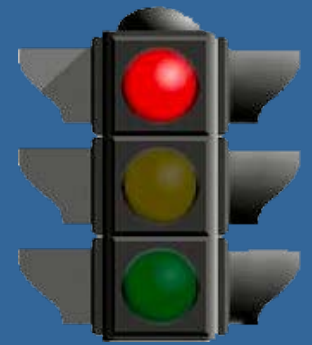


Six Months Later.....



DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION	
CERTIFICATE OF WAIVER OR AUTHORIZATION	
ISSUED TO	
Mississippi Department of Marine Resources	
Attn: Michael Pursley, 1141 Bayview Ave, Suite 101, Biloxi, MS 39530	
This certificate is issued for the operations specifically described hereinafter. No person shall conduct any operation pursuant to the authority of this certificate except in accordance with the standard and special provisions contained in this certificate, and such other requirements of the Federal Aviation Regulations not specifically waived by this certificate.	
OPERATIONS AUTHORIZED	
Operation of the Draganflyer X6 Helicopter Unmanned Aircraft System (UAS) in Class G airspace at and below 50 feet MSL within a .16NM radius around a point defined as Lat. 30-26-39.26N, Long. 88-37-25.20W under the jurisdiction of Mobile Approach Control.	
LIST OF WAIVED REGULATIONS BY SECTION AND TITLE	
N/A	
STANDARD PROVISIONS	
1. A copy of the application made for this certificate shall be attached and become a part hereof. 2. This certificate shall be presented for inspection upon the request of any authorized representative of the Federal Aviation Administration, or of any State or municipal official charged with the duty of enforcing local laws or regulations. 3. The holder of this certificate shall be responsible for the strict observance of the terms and provisions contained herein. 4. This certificate is nontransferable.	
Note-This certificate constitutes a waiver of those Federal rules or regulations specifically referred to above. It does not constitute a waiver of any State law or local ordinance.	
SPECIAL PROVISIONS	
Special Provisions are set forth and attached.	
This certificate 2011-ESA-47-COA is effective from September 1, 2011 to August 31, 2012 and is subject to cancellation at any time upon notice by the Administrator or his/her authorized representative.	
BY DIRECTION OF THE ADMINISTRATOR	
	
FAA Headquarters, AJV-13 (Region)	Dean E. Fulmer (Signature)
31 August 2011 (Date)	Acting Manager, Unmanned Aircraft Systems (Title)

Conditions of Permit:



- Pilot and observer must attend ground school, pass the pilot's exam and have all the credentials of a licensed pilot except the flight time
- Pilot and observer must have Class 2 or higher Airman Medical Certificates (\$350/person)
- NOTAMs must be filed between 48 and 72 hours before every flight
- Monthly detailed reporting requirement



Plan C: Get Some Help

Find Qualified and Experienced UAV Crew

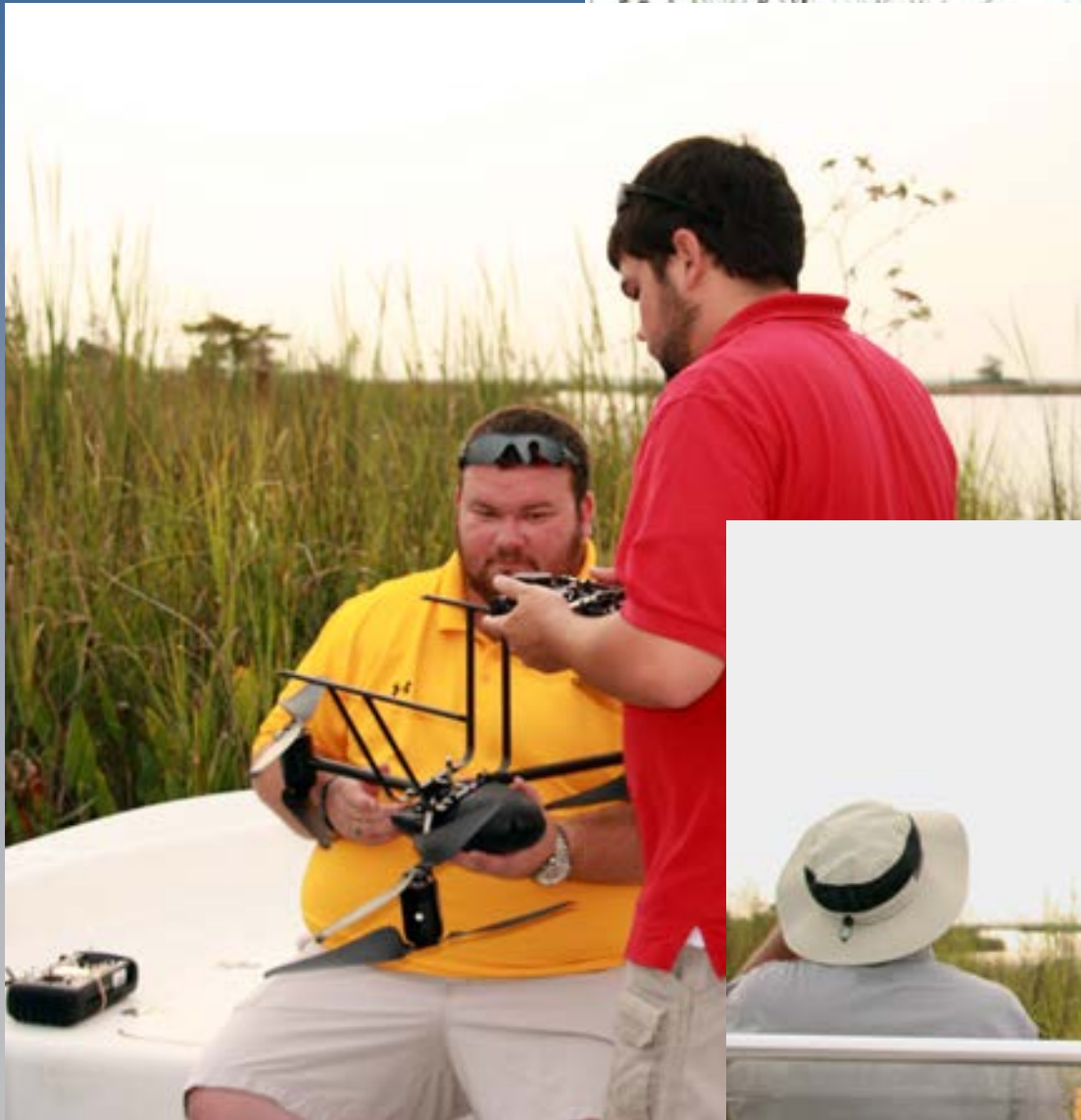


ISR
GROUP
MISSION ESSENTIAL SERVICES

Flight Day:



Flight Day:



Flight Day:



**Marker lights help
maintain correct
orientation**

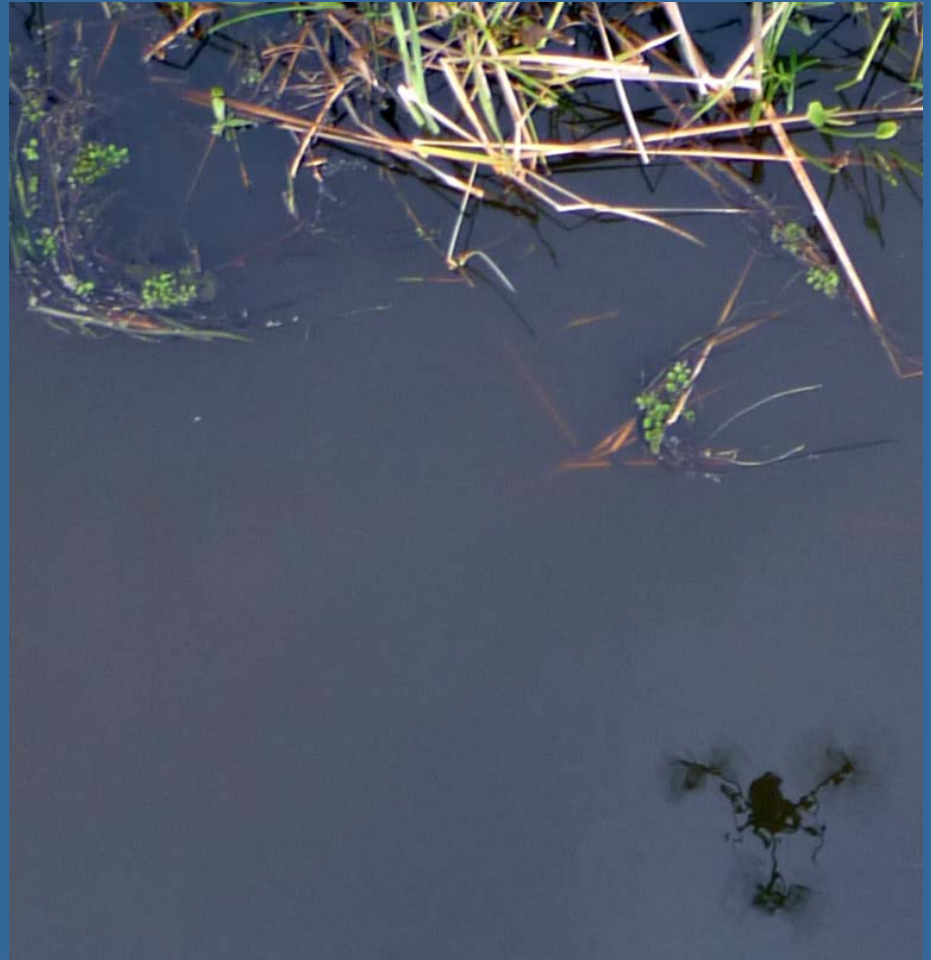


Salvinia not present



Results:

- Performed two flights of about 12 min/each
- GPS would not calibrate presumably due to cloud cover
- Tall marsh vegetation requires increased altitude as distance from pilot increases
- Small clusters of *Salvinia* sp. Could be detected at altitudes of 20-30 feet
- Wind a large factor when landing on a small boat deck



Lessons Learned:

- Include in budget hours and funding needed for permitting and compliance
- Provide detailed information up front about any UAV monitoring project to public and media to prevent headlines like the following:
 - “The Pentagon is launching drones and spy planes from at least 63 locations within the United States” – Business Insider April 24, 2012
 - “FAA grounds state agency’s toy helicopter” – Associated Press March 19, 2013

MDMR now labeled one of the 63 “drone sites”



Privacy concerns
FOIA requests

Future Plans:

- Get Private Pilots License and Med. Certificate
- Increase size of area covered by next COA. New FAA regulations anticipated in 2014-2015
- Use R/C heli for photographing herbicide and biological control project results

New Technology - Nova Block III

Unmanned Data Acquisition Platform

- Hand Launched
- Land or Water Landing
- Electric Propulsion
- Electronic Line of Sight (15+ km)
- Optimized for National Airspace Operations
- Next-gen FAA Compliance with ADS-B Option

Specifications

- Linear Range: 50 mi
- Endurance: 1.5 hr
- Cruise Speed: 35 mph
- Max Speed: 70 mph
- Wing Span: 10 ft
- Length: 5 ft
- Weight: 15 lbs

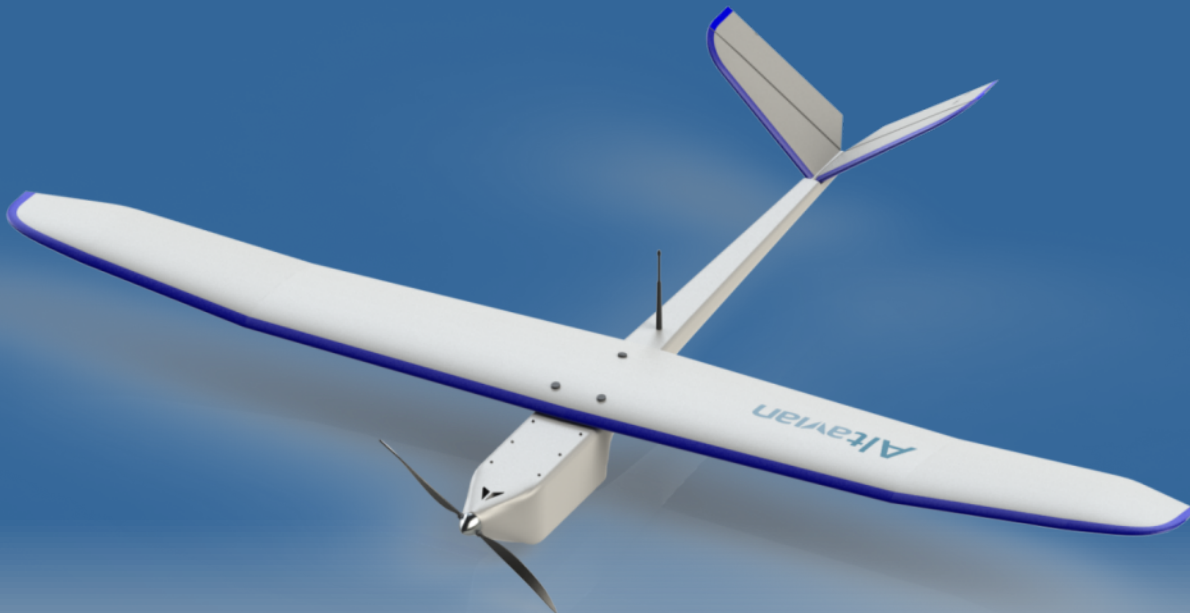


Photo Credit: ISR Group



Metric Aerial Mapping System

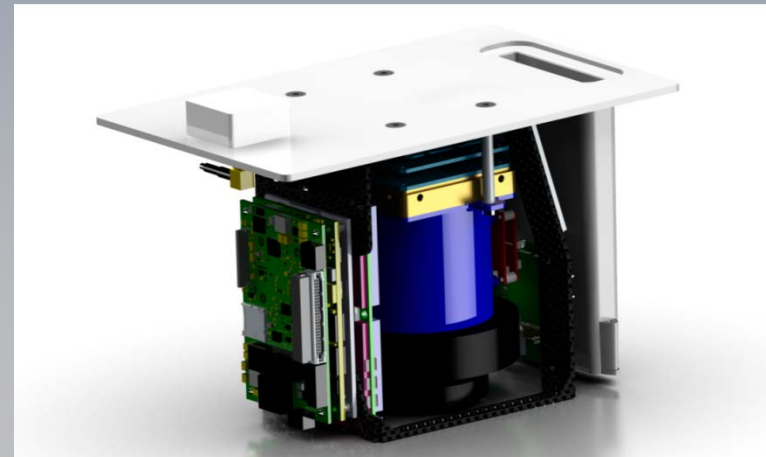
- High Precision Calibration
- Diffraction Limited Optics
- Auto/Programmable Exposure
- Industrial Operation Rated

Removable Storage Media

- 300 GB+ Capacity
- Instant Data Retrieval
- SATA III Interface

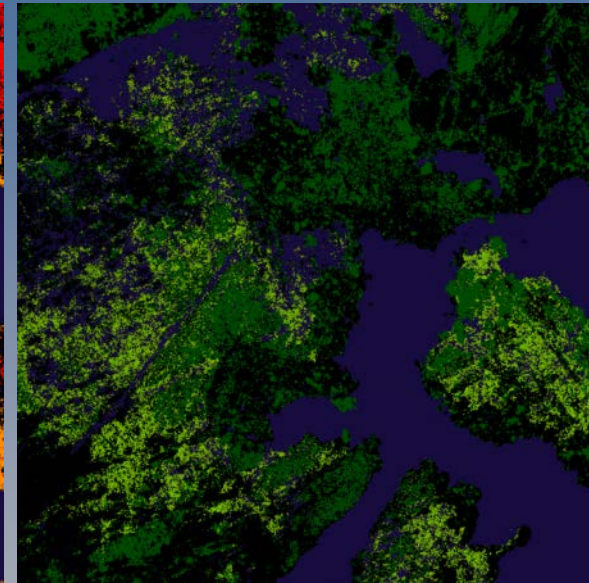
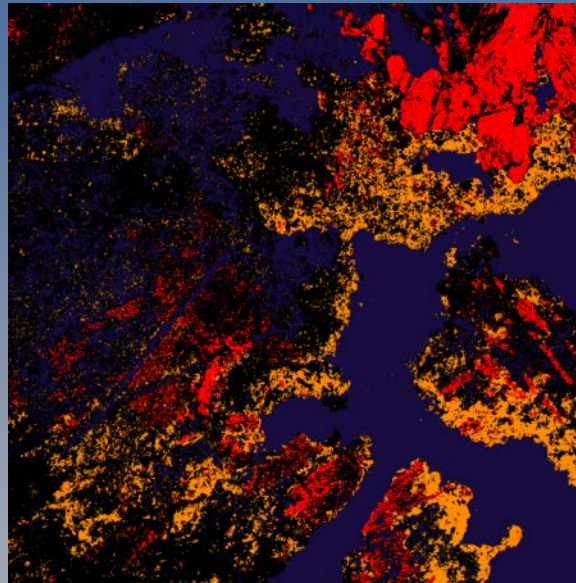
Advanced Georeferencing

- Dual Frequency GPS
- Omnistar Enabled
- 6-DoF Inertial Sensors
- Differential Post-Processing
- Real-time Integration Filter



Photos Credit: ISR Group

Invasive Vegetation Mapping - Nova Block III



Class	Subclass	Area (m ²)	% Total	% Class
Water		69,993	28%	
	Open Water	50,281	20%	72%
	Decomposing (Submerged)	19,712	8%	28%
Vegetation		180,007	72%	
	Frog's Bit, Water Hyacinth, & Cupscale	46,944	19%	26%
	Decomposing (Emergent)	45,889	18%	25%
	Water Lettuce	29,599	12%	16%
	Luziola	26,386	11%	15%
	Lotus	22,433	9%	12%
	Shadow/Unclassified	8,757	4%	5%
Total		250,000		



DMR Drone Project

You Can Run But You Can't Hide