

Research with UASs in the Eel River Watershed

Jim Graham
Eel River Forum
June 8th, 2016

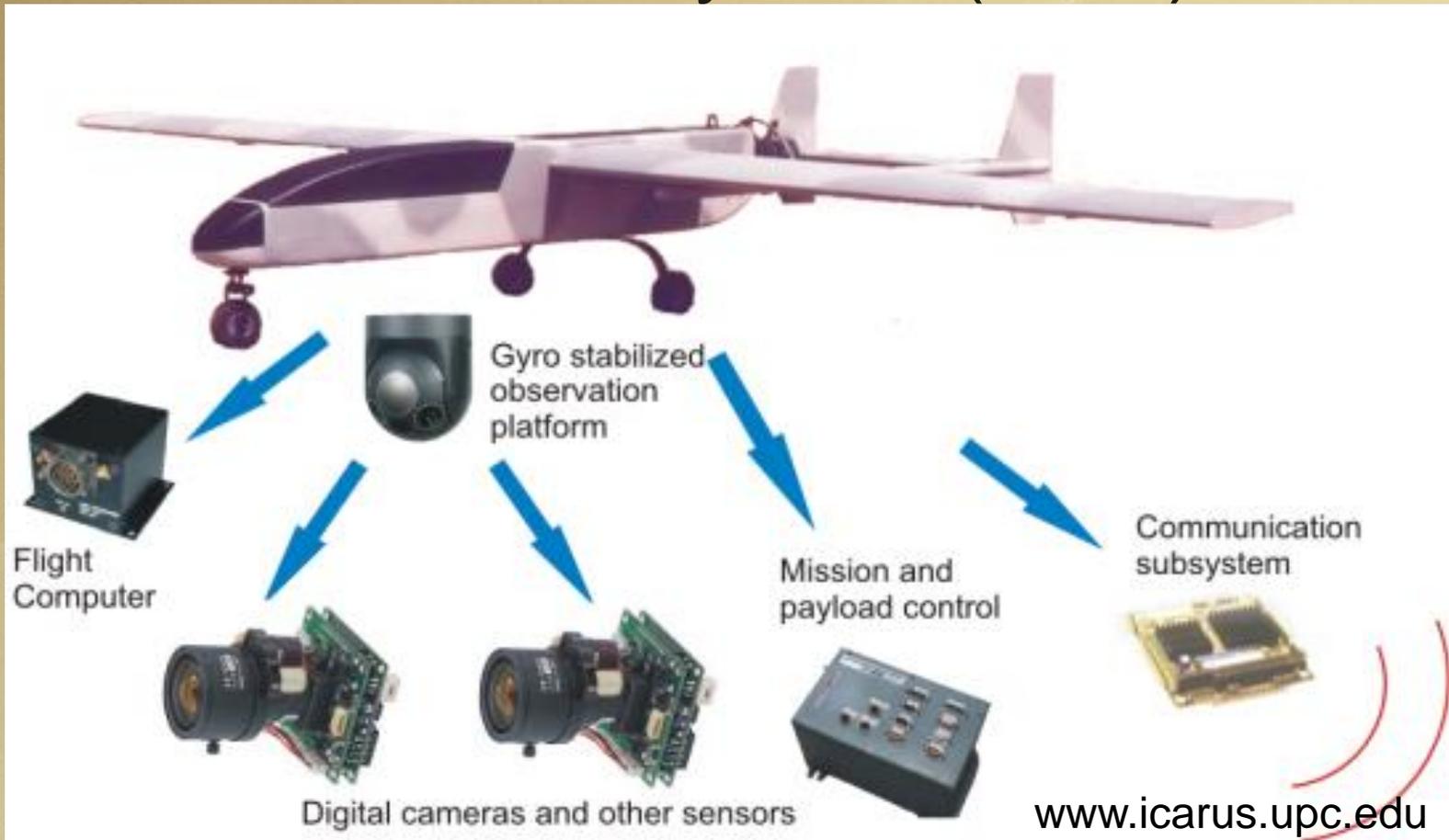
Photo by Chris Muhl

Terminology

- Drones: Military
- UAV:
 - Unmanned Aerial Vehicle
- UAS
 - Unmanned Aerial System
 - Preferred by FAA
- Also, sUAS, UA



Unmanned Aerial System (UAS)



- Plus Processing

Types

Fixed wing

- Fly longer

Rotary

- Carry more



Why are UASs Important

- Less expensive than aerial imagery
 - Thousands of dollars
- Higher resolution
 - 1cm possible
- More flexible
 - Fly when you want!
- Can be automated





Lakemaid Beer Delivery



Poaching in Africa



1,092
Elephants killed
in Kenya since 2010

Agricultural Applications

- UAS for crop dusting



Applications in Natural Resources

Passive

- Monitoring & Mapping
 - Poaching
 - Search & Rescue
 - Fires
 - Invasive Species
 - Endangered Species
 - Land cover
 - Disasters

Active

- Sampling
- Fire Fighting
- Treatments
 - Herbicides, fertilizer
- Delivering supplies



Flying with the regulations

- Hobby Law: non-commercial
- Certificate of Authorization:
 - Fly a specified: area, date range, platform
- 333 Exemption
 - Allows organizations to fly without COA
- New regulations are expected this month!



Hobby Rules



- Fly within line of sight
- Can't fly within 5 miles of an airport
- Can't fly near other aircraft, buildings or people
- Aircraft < 55 lbs.
- Can't fly for commercial purposes
- For additional rules:
 - http://www.faa.gov/uas/publications/model_aircraft_operators/



What HSU Is Doing

- HSU has been issued a blanket COA
 - Fly, with restrictions (basically the hobby rules), any time and anywhere with an approved platform



Eel River Goals

- Improve accuracy of habitat estimates with higher spatial and temporal resolution data.
- Need:
 - High resolution digital elevation models (DEMs)
 - Investigating LiDAR and “Structure from Motion”
 - High resolution, frequent photos



Eel River

- Current data:
 - 10 Meter Elevation (DEM)
 - 1 Meter Aerial Photos once a year
 - Limits our ability to model the watershed
- Goals:
 - 1 meter or better elevation
 - 10 cm or better photos, monthly



TheStudentUASGroup.com

- While HSU was applying for our COA
- Students were flying under the Hobby Law to develop expertise and applications with UASs.
 - See thestudentuasgroup.com





SPATIAL RESOLUTION

- UAS resolution: 9 cm
- NAIP resolution: 1 meter

TEMPORAL RESOLUTION

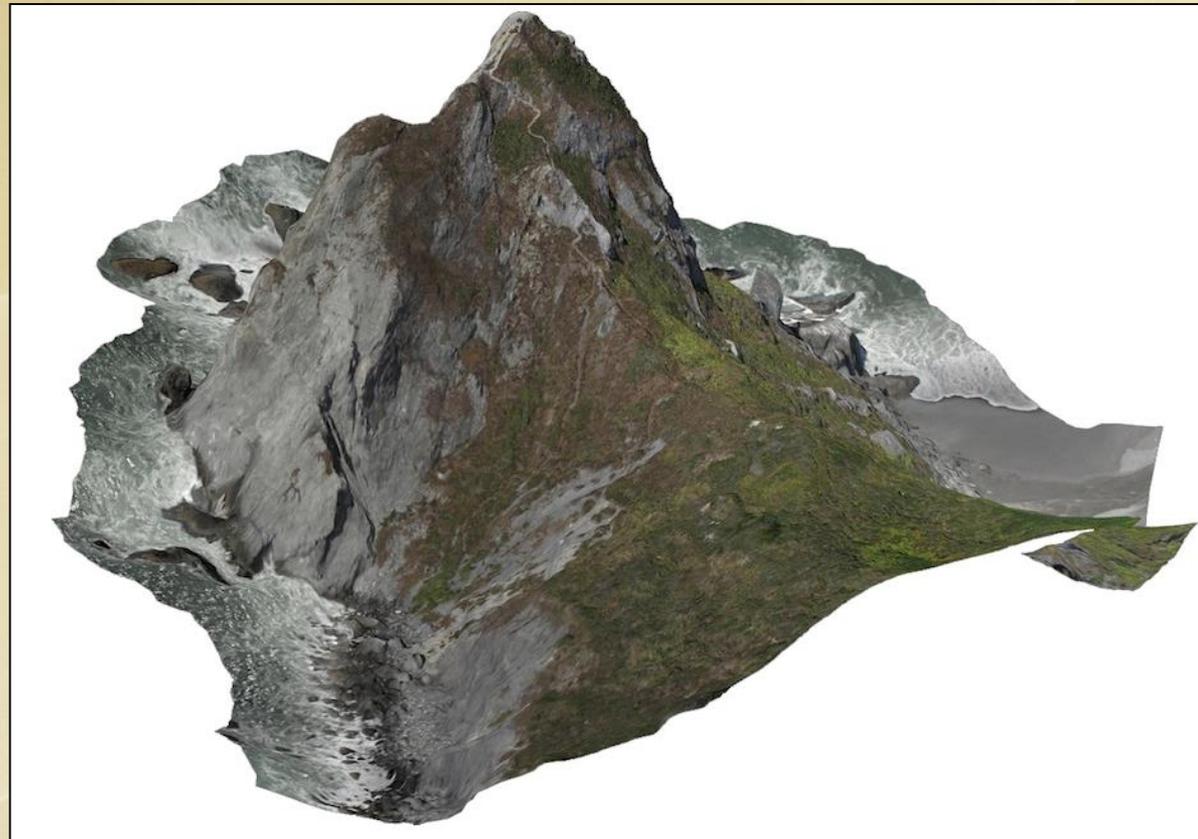
- Repeat visits, day after day, month after month, or year after year can provide a clear picture of changes occurring on the landscape.

sUAS are currently being used to monitor the spread of palm oil farms in south east Asia.



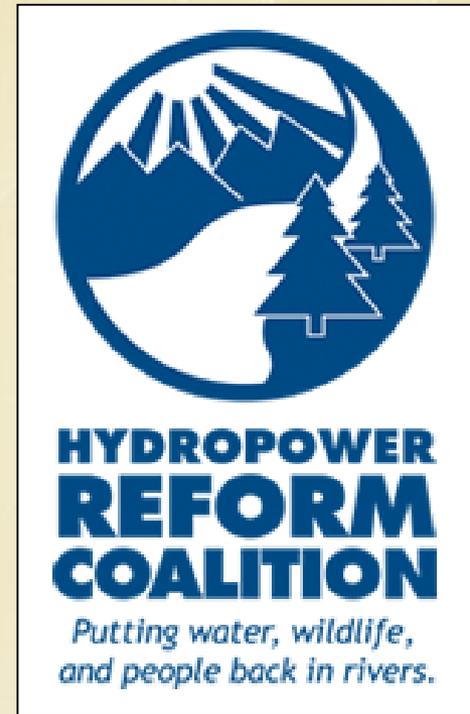
3D Models

- <http://thestudentuasgroup.com/3dmodels.html>



Acknowledgements

- The Student UAS Group: Chris Muhl, Erik Kenas, Whitney Newcomb, Christina Perez,...
- HSU UAS Review Committee
- Funding from:
 - Hydropower Reform Coalition
 - CalTrout



Pocket Slides



UAV Issues

- They are hard to fly!
- The data processing is challenging
- Purchase “pre-built” UAVs

- Others:

https://www.youtube.com/watch?v=AhDG_WBIQgc

[US intel worker blamed for White House drone crash](#)



Thank you and: Dave Marshal, Chris Muhl

- How Santa really delivers all those presents
- Raptor attacks UAV



Old and New

Aerial Photos

- Six figures to get started
- \$30,000 per day
- 1 meter typical
- Tasked
- Hundreds of square miles per day
- Risks human lives

UAV

- \$3000 to get started
- \$3000 per day (or less)
- 1 cm possible
- Can be opportunistic
- A few square miles a day
- Less risk to humans



UAV Situation

- There is interest in HSU (and other CSU campuses) to fly UAVs for research and management in cooperation with other organizations.
- We are developing expertise and will be developing classes
- We cannot fly outdoors because of the current FAA regulations



- Rhode Island Fire Drone
 - <https://www.facebook.com/RIFireDrone>



The Potential

- Sensors:
 - Elevation (LiDAR)
 - Light:
 - Visual
 - IR
 - Hyperspectral?
 - <http://thestudentuasgroup.com>



UAVs Monitoring Harvard Forest

