Unmanned Aircraft Systems for Mapping: Aerial Information System Lab Oregon State University

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Overview

- Regulatory climate of UAS
- OSU Aerial Information System (AIS) Laboratory capabilities and platforms
- UAS project examples

UAS Regulatory Environment

- FAA Modernization Act
  - Signed into law in 2013
  - “Integrate UAS into the NAS system” or else
- National Test Site Competition
  - 25 proposals from 24 states
  - Oregon teams with Alaska and scores!
  - Pan-Pacific UAS Test Range Complex
    - Oregon: Pendleton, Tillamook, and Warm Springs
- FAA UAS Center of Excellence Competition
- UAS flights require FAA agreement
  - Certificate of Authorization

Certificate of Authorization

- Only public entities can file
  - OSU was the first in Oregon
- An exhaustive description of
  - Platform
  - Communications
  - Safety procedures
  - Flight ops
- Tied to a single platform and specific area
- Good for one year with the possibility of a second year

OSU AIS Laboratory

- OSU has:
  - 29 active COAs
  - 5 pending COAs
  - Oregon, Washington, Arizona, Montana, Oklahoma
  - Flown UAS in Turkey, Indonesia, and Mexico
- Dedicated to UAS flights for remote sensing
  - Forestry
  - Agriculture
  - Fish and Wildlife
  - Search and Rescue
- http://ais.forestry.oregonstate.edu/

AIS Laboratory Flights – 2014

- Salmon Surveys – South Umpqua River, OR
- Burn Severity Mapping – Corvallis, OR
- Biomass Grinding Estimation – Eugene, OR
- Digital Modeling of Forest Canopy Structure – Trimble UH – *International (Indonesia)*
- Biomass Volume Measurements– Frasier, CO
- Swiss Needle Cast Detection – Blodgett, OR
- Wildfire Burn Severity – Warm Springs, OR
- Vineyard Vigor Mapping – Amity, OR
- Golden Eagle Carcass Detection – Warm Springs, OR
- Forest Regeneration Survey – Oregon
- Fiber Optic Cable Measurements – Oregon

AIS Laboratory Sensors

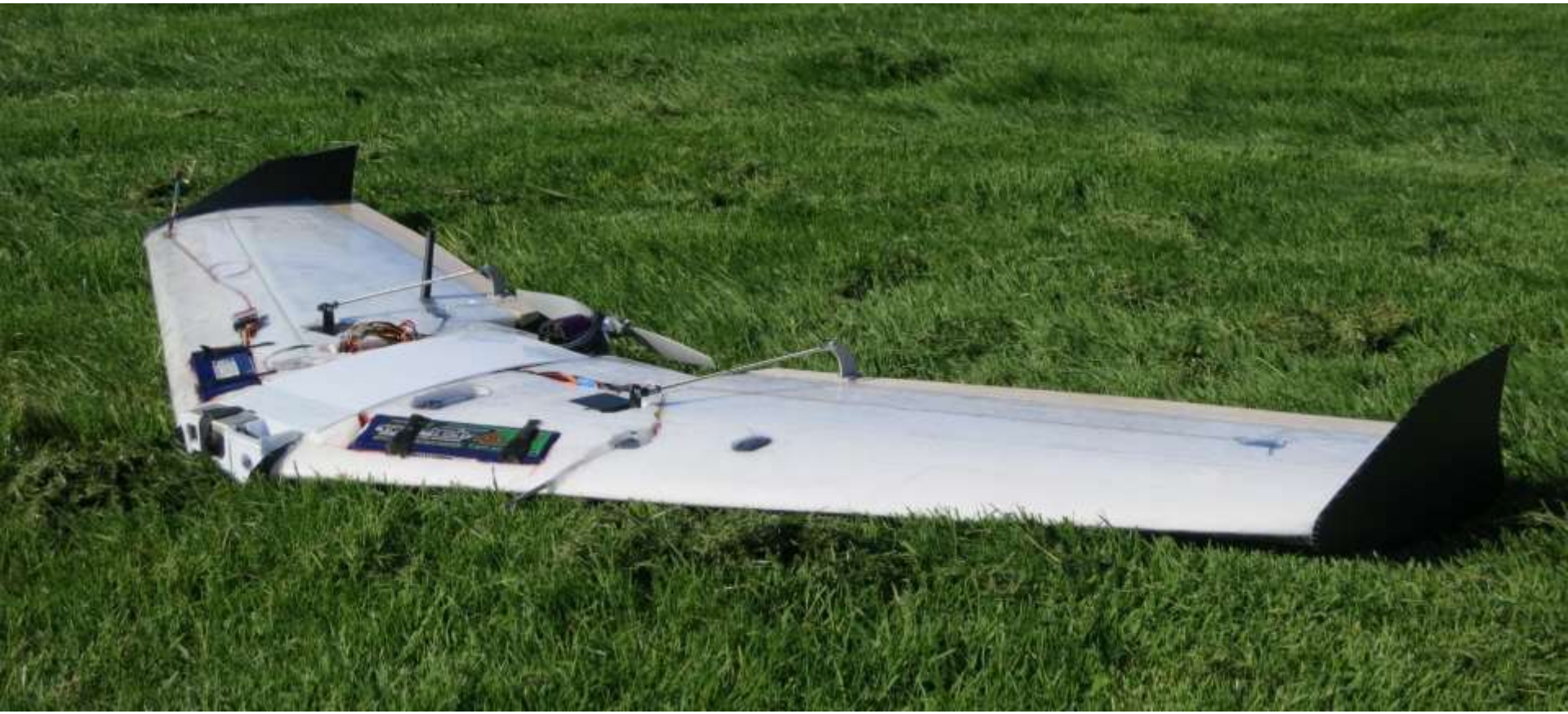
- Advanced Navigations Spatial Dual Inertial Measurement Unit (IMU)
- Canon S100/S110
- Canon S100/S110 IR Converted
- Canon G15 NIR Converted
- GoPro Hero 3+
- Sony Nex 5T
- Sony Nex 5T NIR Converted
- Velodyne HDL-32E LIDAR

AIS Laboratory Platforms

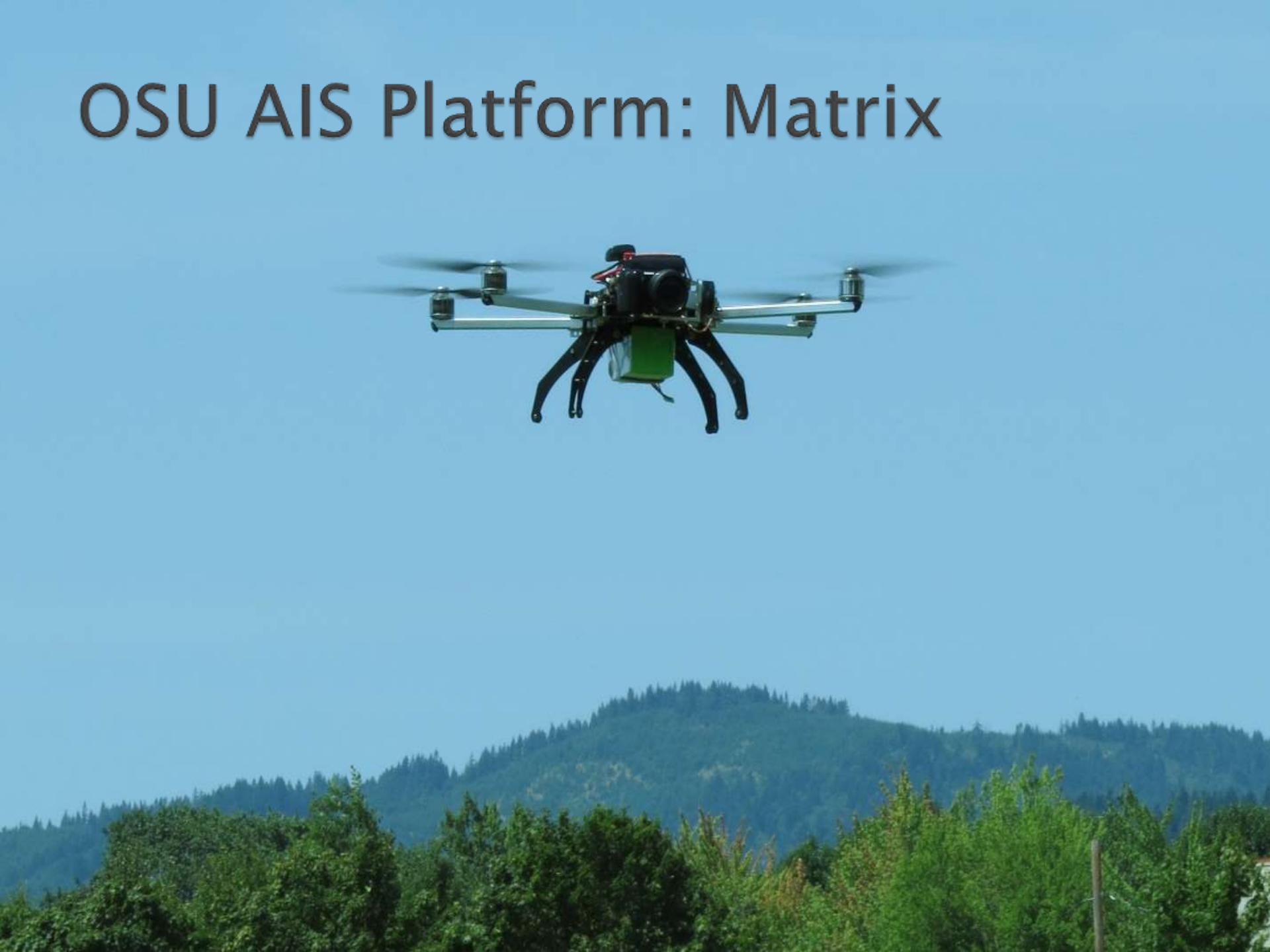
- Albatross (1)
- Beaver (4)
- Bixler (2)
- Gwaihir (1)
- Matrix (2)
- Phantom (1)
- Volitare (2)

OSU AIS LiDAR Platform: Gwaihir

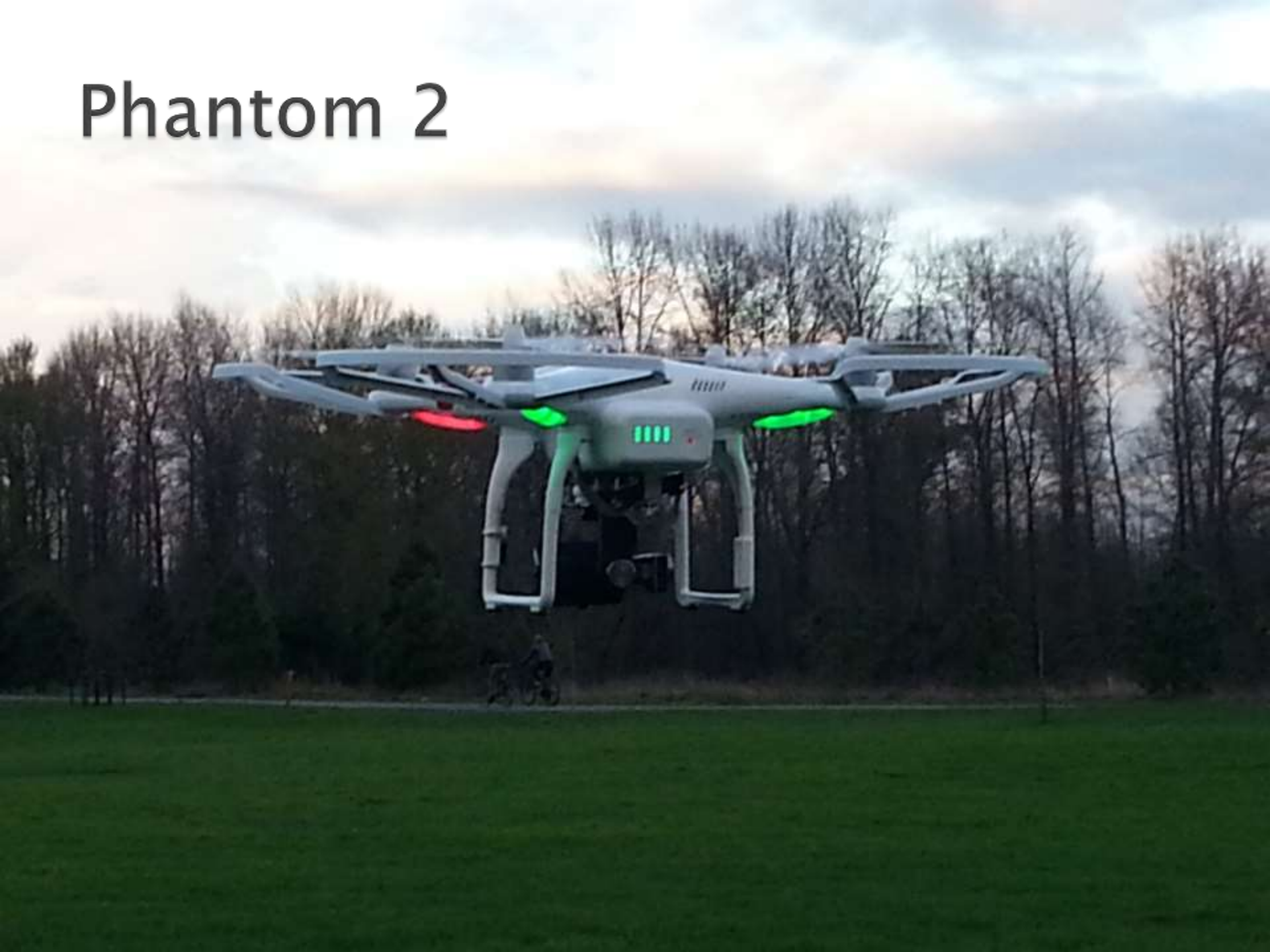
OSU AIS Platform: Beaver Series



OSU AIS Platform: Matrix

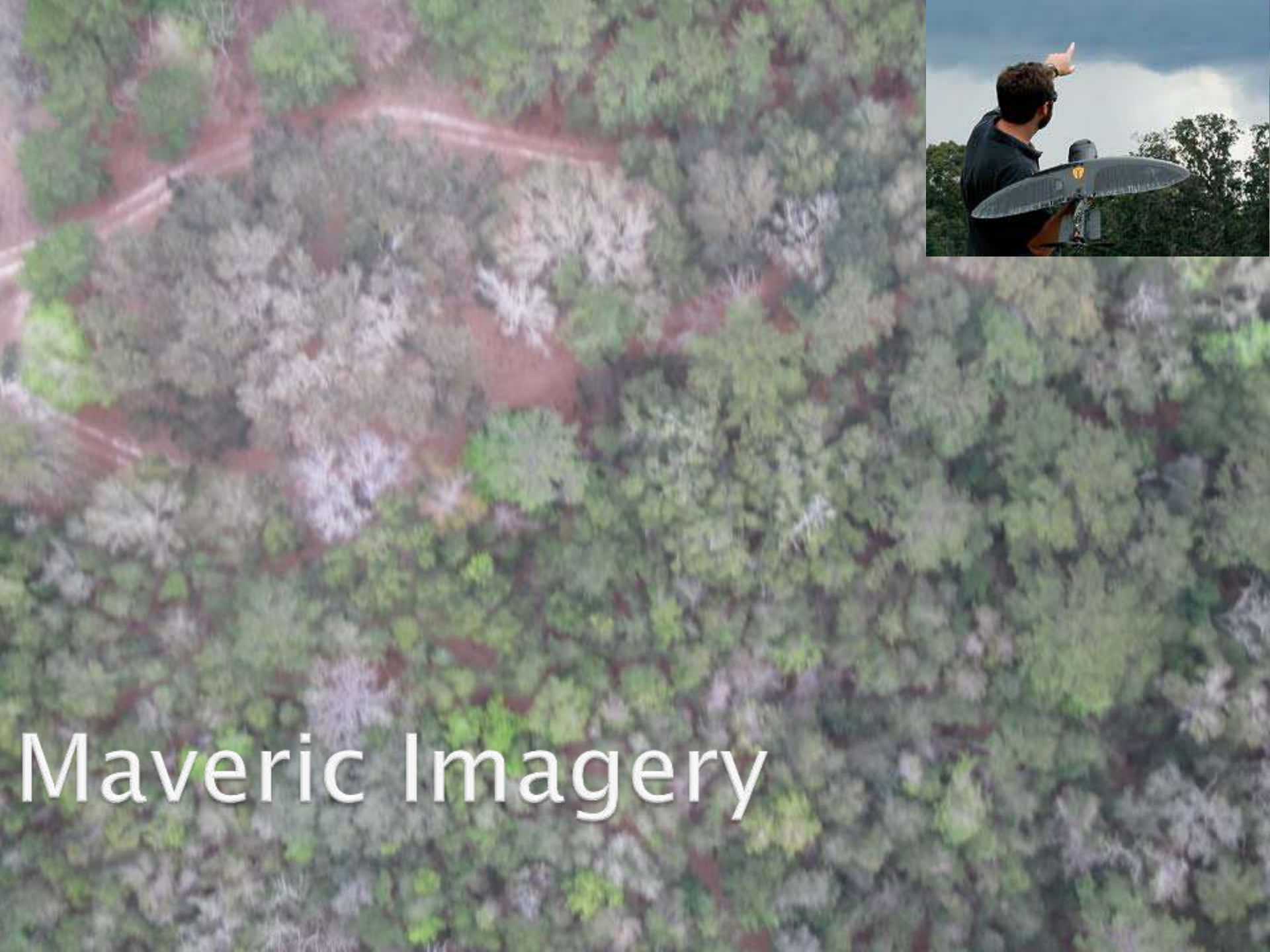


Phantom 2



Prioria Maveric- Getting Started

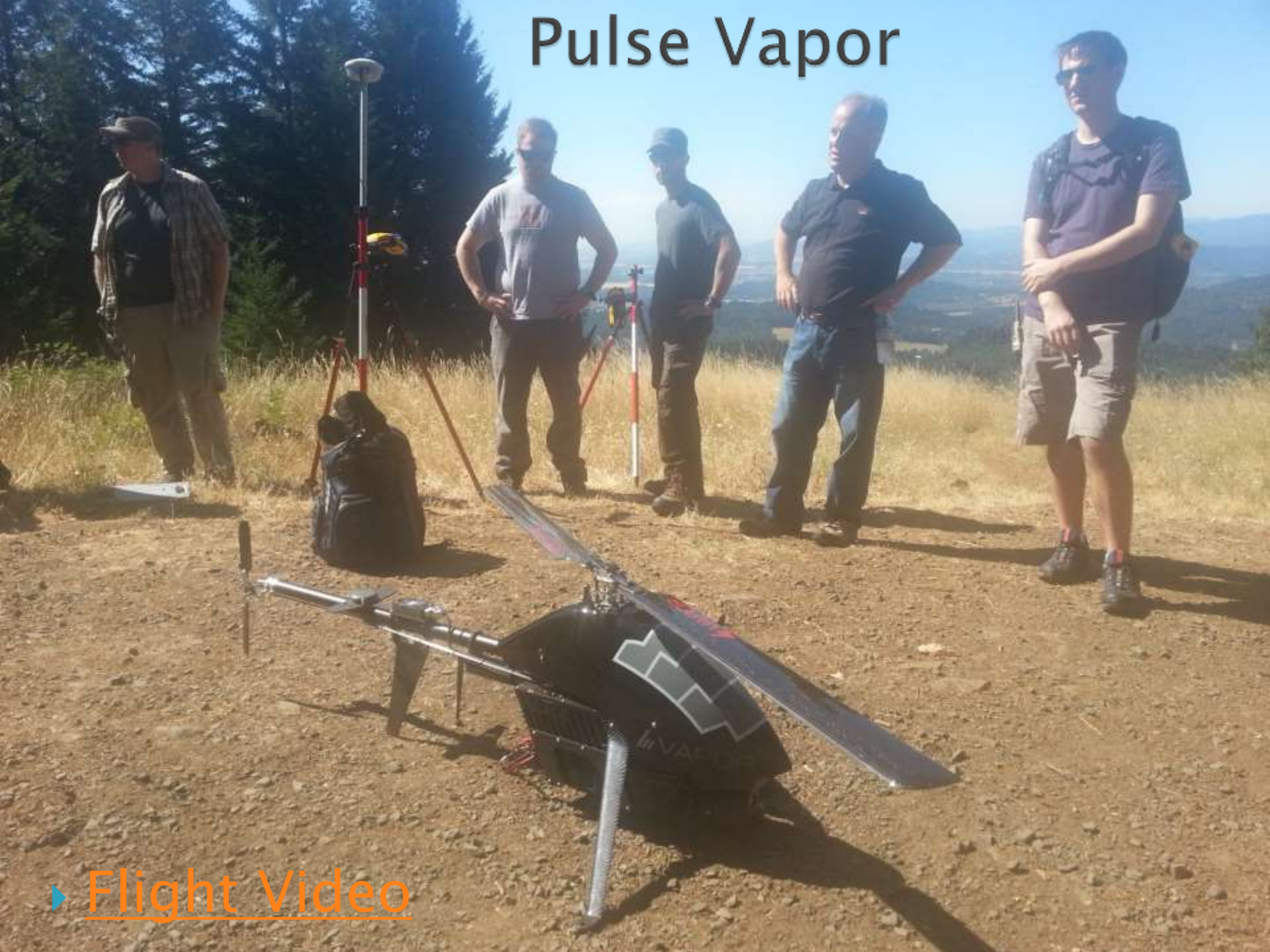
- McDonald Forest
  - October 2012 flight- First approved COA in Oregon
- Compact airplane with flexible wings
- Electrical power
- Get at look at the forest
- Journal article
  - Wing, M.G., J. Burnett, J. Sessions, J. Brungardt, V. Cordell, D. Dobler, and D. Wilson. 2013. Eyes in the sky: Remote sensing technology development using small unmanned aircraft systems. Journal of Forestry 111(5):341-347.


Maveric Imagery

Pulse Vapor

- Small frame helicopter
- Electrically powered
- EO and IR video
- Forest Search and Rescue Demo
  - July 24, 2013
  - McDonald Forest
  - About a dozen different objects
  - Three students!
  - Two forest sites
- Publication in review

Pulse Vapor



- Flight Video

Beaver Series: Ritewing Zephyr II

- In house product developed by AIS Lab
  - Generous help from Seth Johnson of VDOS
- Flown in Turkey in May 2013
  - Works flawlessly
- EO imagery with Canon S100
- Journal article:
  - Wing, M.G., J. Burnett, S. Johnson, A. Akay, and J. Sessions. In press. A low-cost unmanned aerial system for remote sensing of forested landscapes. International Journal of Remote Sensing.

Zephyr II Components

Component	Cost
2.4 GHz Tx/Rx	$360
4500 mAh 11.1 V LiPo	$30
Airspeed Sensor	$25
ArduPilot APM 2.5	$160
Canon S100	$300
RiteWing Zephyr II	$325
TTC Radio	$86
uBlox GPS Module	$76
Voltage Regulator	$15
Total	$1,377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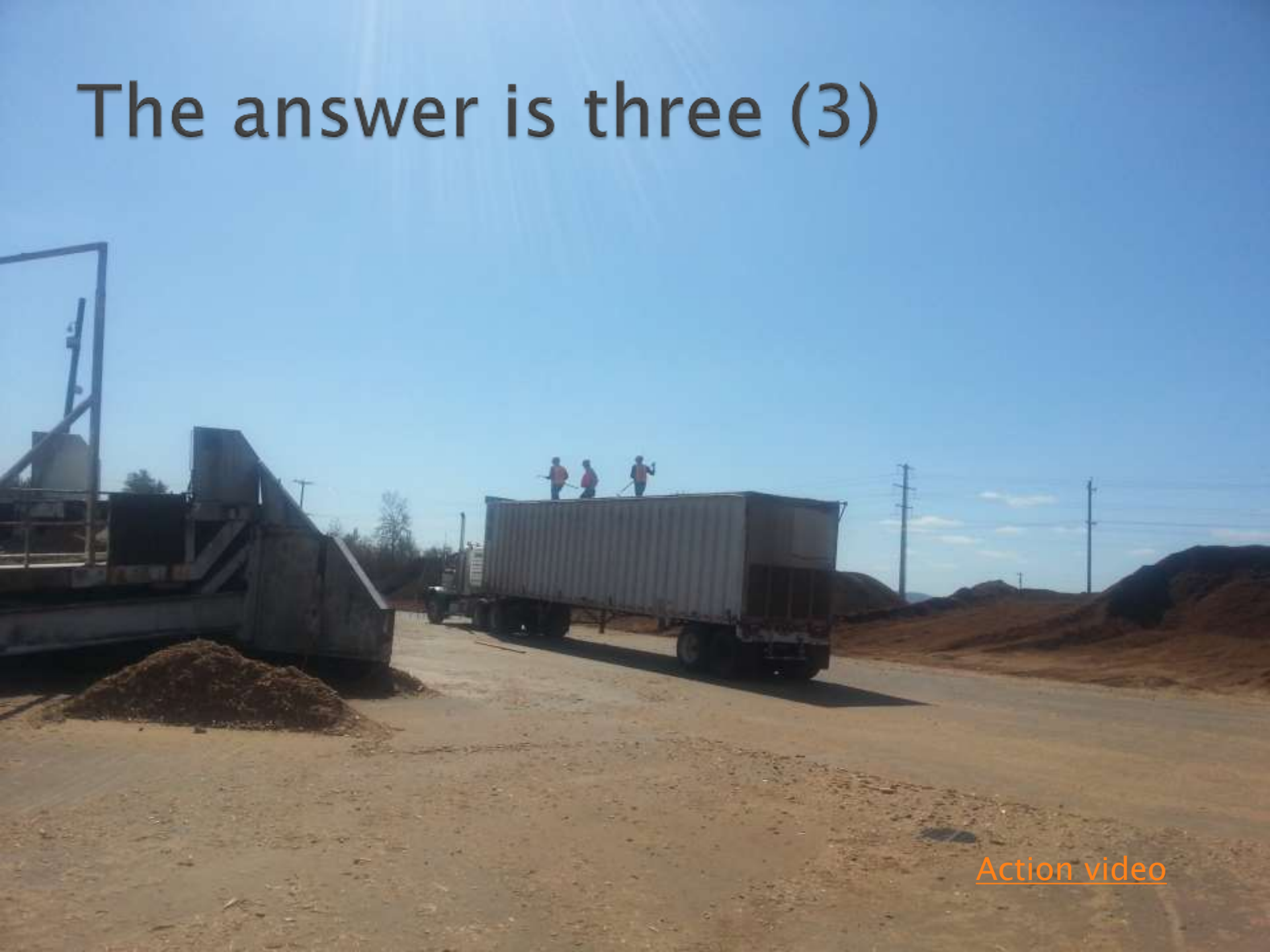
Biomass measurements

- Biomass products are ground up
- Loaded into trucks for incineration
- Dry chips often result in a truck not being able to reach desirable capacities
- Solution: build a “hurler” that can propel biomass grindings into a truck at speeds up to 90 mph

The answer is three (3)



Action video

Mangrove Damage- Mexico

- Hurricane Wilma 2005
- Significant resource damage

- Flight

Thank you for your attention