


Aerial Information System (AIS) Lab and Unmanned Aircraft Systems (UAS)



Michael Wing
Associate Professor
Aerial Information System Laboratory Director
Oregon State University

Presentation Overview

- ▶ AIS unmanned aircraft system (UAS) lab
 - Current flight rules
- ▶ UAS platforms and sensors
- ▶ Recent forestry remote sensing projects

AIS Lab Flights 2015-20

- ▶ Erath Vineyards, Amity, OR
- ▶ Search and rescue, USCG
- ▶ Tree growth - Corvallis, OR
- ▶ Ship wreck - Dominican Republic
- ▶ Tree seedling productivity - Dorena, OR
- ▶ Rain forest canopy measurements - Brazil
- ▶ Sea turtle surveys - Maui, HI
- ▶ Vineyards - Shea Vineyards, Newberg, OR
- ▶ Tree seedlings - Northern AZ
- ▶ Riparian structure - Springfield, OR
- ▶ Geo-thermal topography - Brady Hot Springs, NV
- ▶ Elk population surveys - Various locations, OR
- ▶ Whale measurements - Newport, OR
- ▶ Bridge inspections - Independence, OR
- ▶ Vineyards - Mosel Valley, Germany
- ▶ Herbicide efficacy - Hyslop, OR
- ▶ Riparian Restoration - South McKenzie River, OR
- ▶ Madrone blight - King's Valley, OR

FAA Small UAS Rules (Part 107)

- ▶ Effective Aug. 29, 2016
- ▶ Platform must weigh less than 55 lbs
- ▶ Visual line of sight, daylight only
- ▶ Max altitude 400' AGL
- ▶ Not above other people
- ▶ No separate observer
- ▶ Operations in Class B, C, D, and E airspace are allowed with Air Traffic Control permission
- ▶ G airspace is open

FAA part 107 Pilot Requirement

- ▶ “Remote pilot in command” established
- ▶ Pilot must have a remote pilot airman certificate with a small UAS rating or be under the direct supervision of a person who does
- ▶ Remote pilot airman certificate
 - Pass an aeronautical knowledge test
 - Retest every 24 months
 - Be cleared by Transportation Security Administration
 - A regular pilot’s certificate also works

FAA part 107 Pilot Exam

- ▶ Remote Pilot Certificate
- ▶ 2.5 hours- 60+ questions
 - 70% + is a passing score
- ▶ https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/media/remote_pilot_study_guide.pdf
- ▶ 3DR exam prep site
 - <https://3dr.com/faa/study-guides/>
- ▶ METARs, Aeronautical Charts, Rules

Light lift: Phantom 4 and RedEdge



Medium lift: Matrice 200 and Altum



Heavy lift:
DJI s1000
and
Velodyne
32 LiDAR



South McKenzie restoration



Madrone disease and blight



SWWP seedlings & climate change



Flight and Processing Software

- ▶ Mapping
 - Google Earth Pro
- ▶ Mission planning and navigation
 - Universal Ground Control System (UGCS)
 - Mission Planner (Pixhawk)
 - DJI Ground Station (DJI)
- ▶ Processing and Structure from Motion (SFM)
 - Agisoft Photoscan, Pix4d
 - Point cloud processing
 - LidR, Fusion, CloudCompare
- ▶ Viewing, raster manipulation, and analysis
 - ArcGIS Pro (Raster Math)

Spatial Indices

- ▶ The combination of raster spectral bands
 - Color = red + green + blue
 - Many different indices are possible
- ▶ Normalized differential vegetation index
 - A measure of greenness
 - Uses near infrared (NIR) that is beyond human vision
 - $(NIR - Red) / (NIR + Red)$
- ▶ Color infrared
 - False color
 - Near infrared + Red + Green

Color

