ODOT UAS Program

Oregon Department of Transportation

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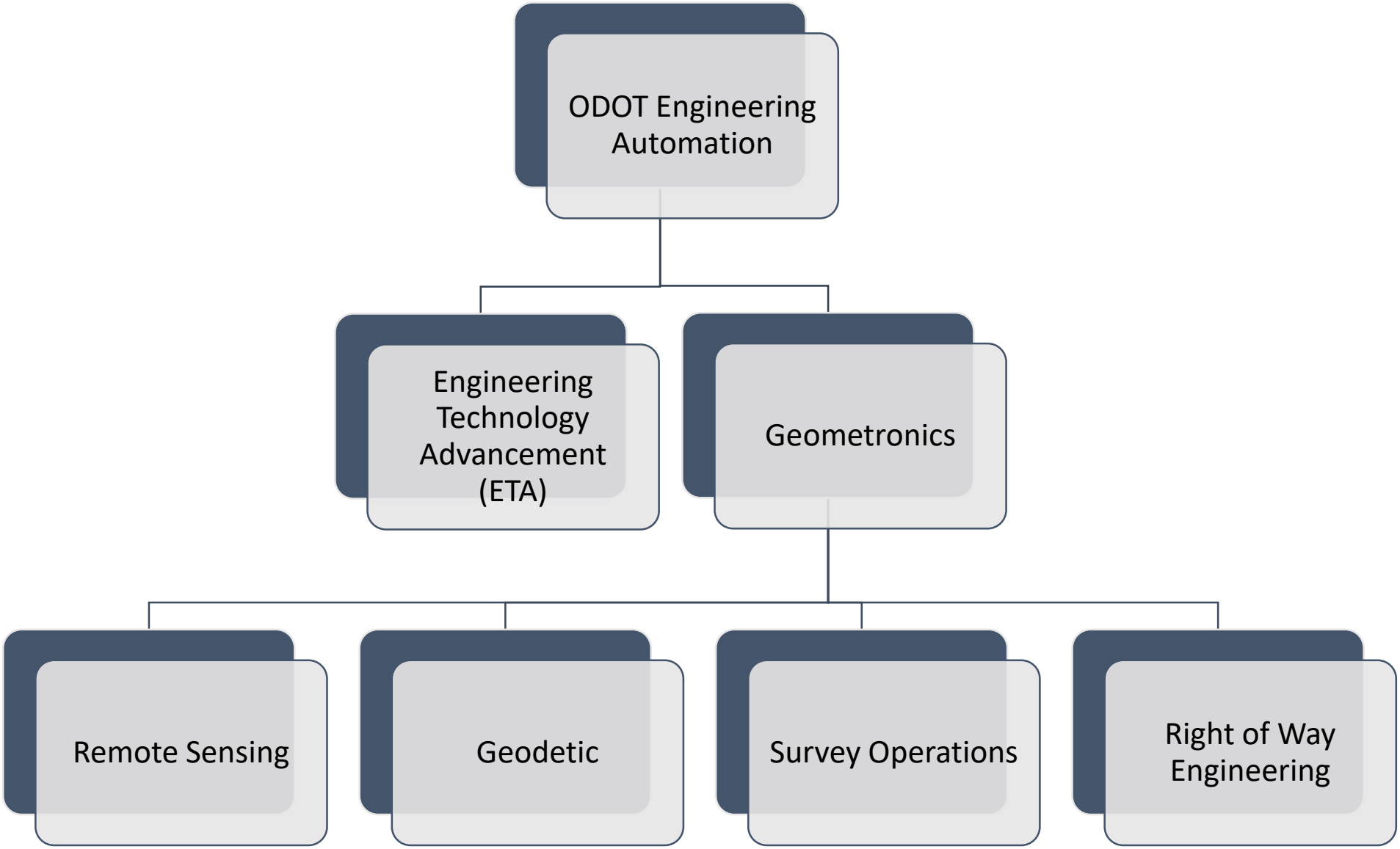
OSU UAS in Transportation

07/31/2018

ODOT Engineering Automation

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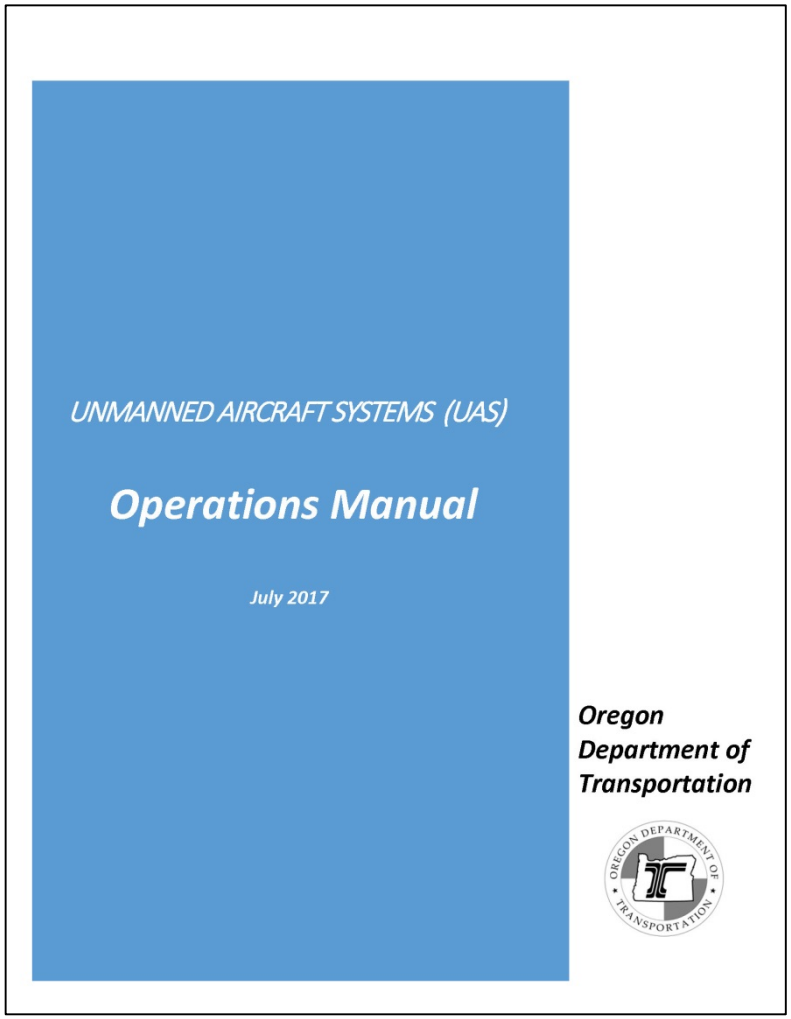
Program Milestones

- June 2015 – ODOT created UAS Operations Manager and purchased Aibotix Aibot X6V2
- April 2016 – Trained initial agency pilots
- May 2016 – ODOT received FAA Certificate of Authorization (COA)
- Dec 2016 – Draft version of UAS Operations Manual
- June 2017 – ODOT Communications purchased 10 GoPro Karmas
- July 2017 – Finalized UAS Operations Manual
- Feb 2018 – Began initiative to expand UAS at ODOT
- Apr/May 2018 – Purchased three DJI copters
- June 2018 – Started structure inspections with UAS
- Aug 2018 – Version 2: UAS Operations Manual

ODOT UAS Program



UNMANNED AIRCRAFT SYSTEMS (UAS)

Operations Manual

July 2017

Oregon Department of Transportation

Oregon Department of Transportation

POLICY

	NUMBER ADM 4-24	SUPERSEDES New Policy
	EFFECTIVE DATE 07/11/17	PAGE NUMBER 1 OF 3
	VALIDATION DATE	
	REFERENCE ORS 837.300 – ORS 837.390, ORS 166.017, ORS 192, OAR 731-001-0025	
SUBJECT **Unmanned Aircraft Systems (UAS)**	APPROVED SIGNATURE Signature on file with Business Services	

PURPOSE

The purpose of this policy is to establish policy standards regarding the use, storage, accessibility, sharing and retention of data acquired through the operation of Unmanned Aircraft Systems (UAS) and to adopt the ODOT UAS Operations Manual for all uses of unmanned aircraft systems by the Oregon Department of Transportation (Department), its contractors and consultants.

BACKGROUND

UAS are becoming an increasingly widespread and valuable tool both inside and outside of the Department. This makes it essential that the Department establish policy and operating procedures for the safe operation of the UAS and management of data collected by UAS.

POLICY

This Department policy establishes standards for the use, storage, accessibility, sharing and retention of data resulting from operation of Department-owned or contracted UAS in accordance with ORS 837.300 – 837.390.

It is also the policy of the Department that its employees, contractors and consultants will follow the ODOT Unmanned Aircraft System (UAS) Operations Manual.

Data Use

- Use the data collected by Department-owned or contracted UAS only for the operation and maintenance of its assets and advancement of Department goals and objectives.
- Obtain, process and make data available in a timeframe consistent with its intended use.

Data Storage

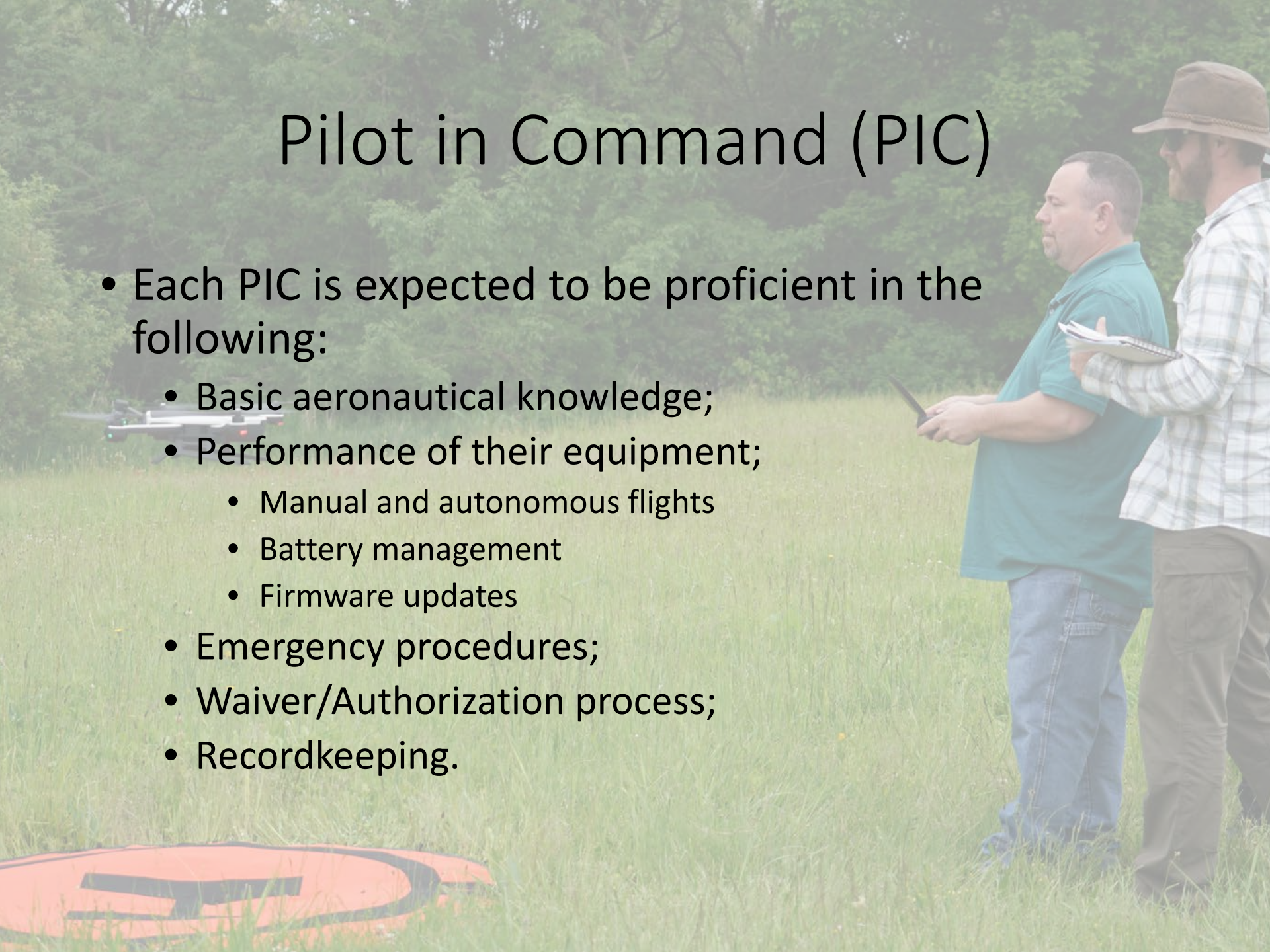
- Store data obtained by Department-owned or contracted UAS on electronic media in a location maintained and supported by the Department.
- Contract with external vendors for the storage of electronic records, including data obtained by UAS, where appropriate.

ODOT's Requirements

- All flights will have a Pilot-in-Command (PIC) and Visual Observer (VO)
- ODOT Pilots can only operate public aircraft
- A PIC must:
  - Pass FAA Part 107 aeronautical exam;
  - Attend agency approved training (on each airframe);
  - Log all flights and aircraft maintenance;
  - Maintain currency: 3 flights in 90 days;
  - Must notify landowners of operation;
  - Receive approval from UAS Program Manager.

Pilot in Command (PIC)

- Each PIC is expected to be proficient in the following:
  - Basic aeronautical knowledge;
  - Performance of their equipment;
    - Manual and autonomous flights
    - Battery management
    - Firmware updates
  - Emergency procedures;
  - Waiver/Authorization process;
  - Recordkeeping.

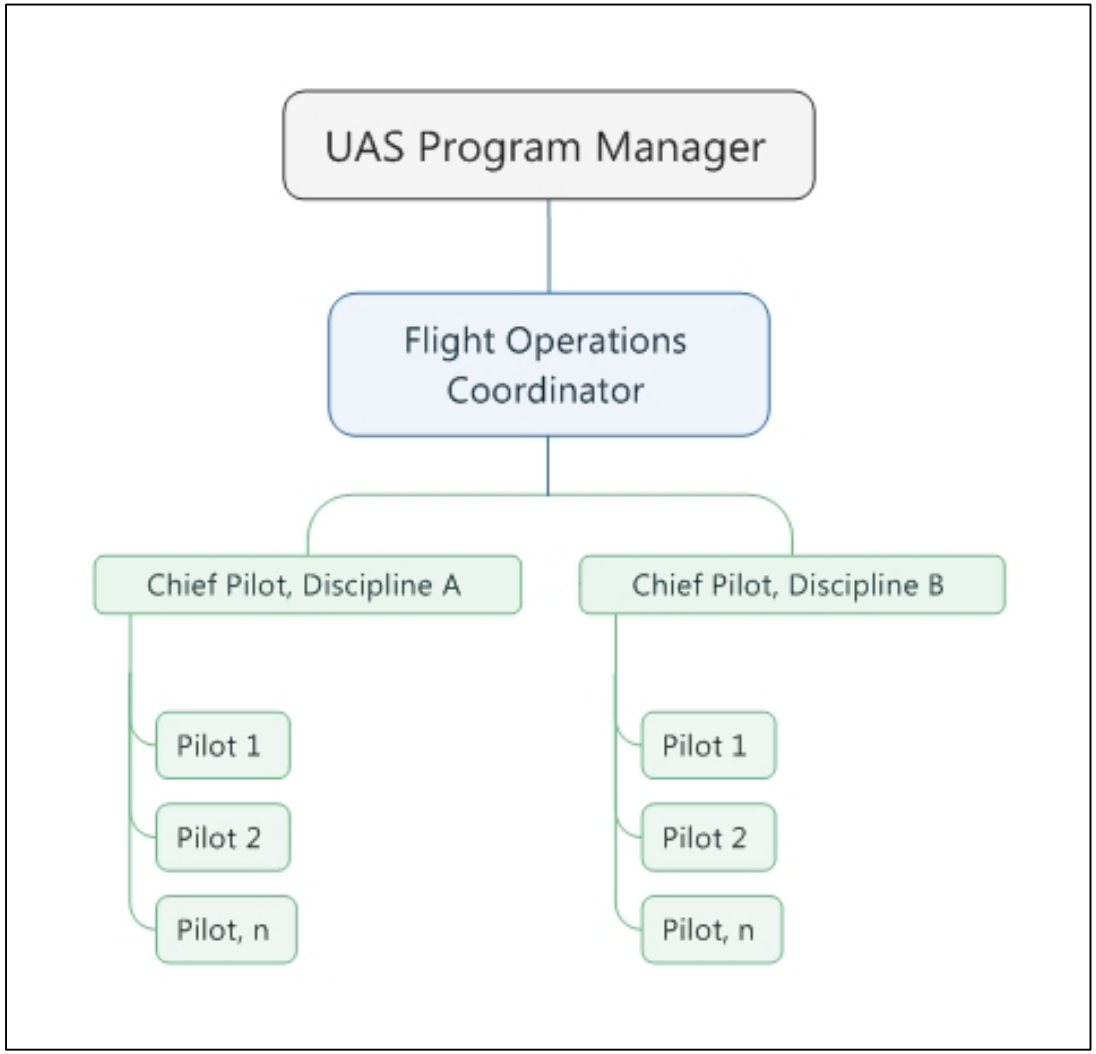


Visual Observer (VO)

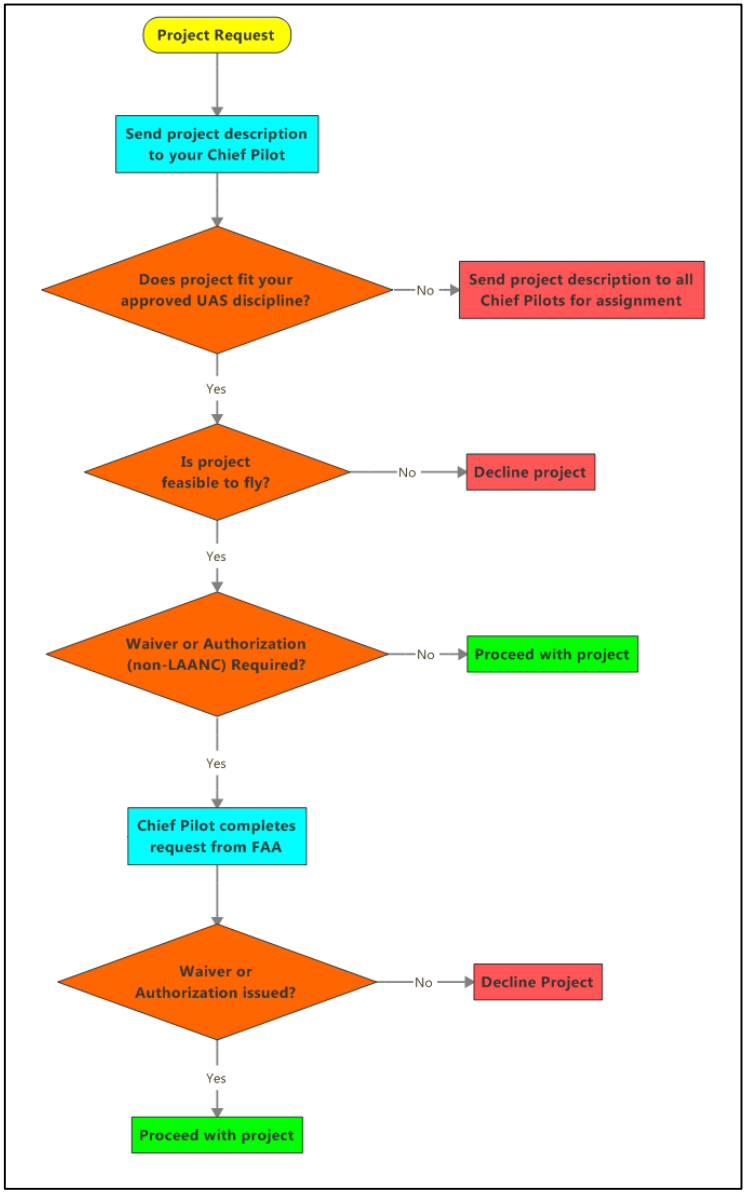
- An ODOT VO must:
  - Maintain communication with PIC at all times;
  - Aid in “Sterile Cockpit” environment;
  - Provide PIC with location of aircraft as it relates to all hazards to allow PIC to exercise effective control.

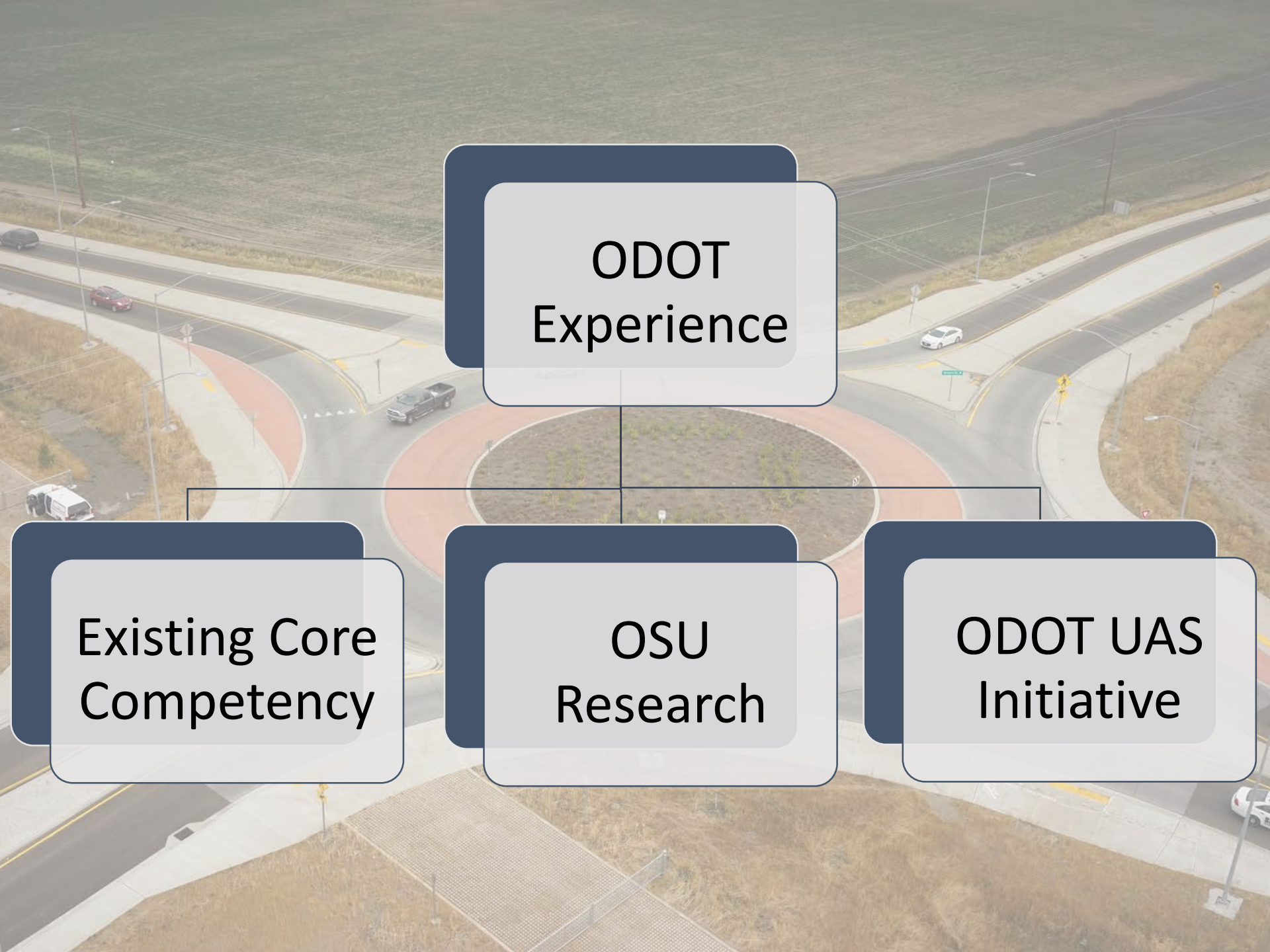
ODOT’s UAS Fleet

ODOT UAS Program Structure



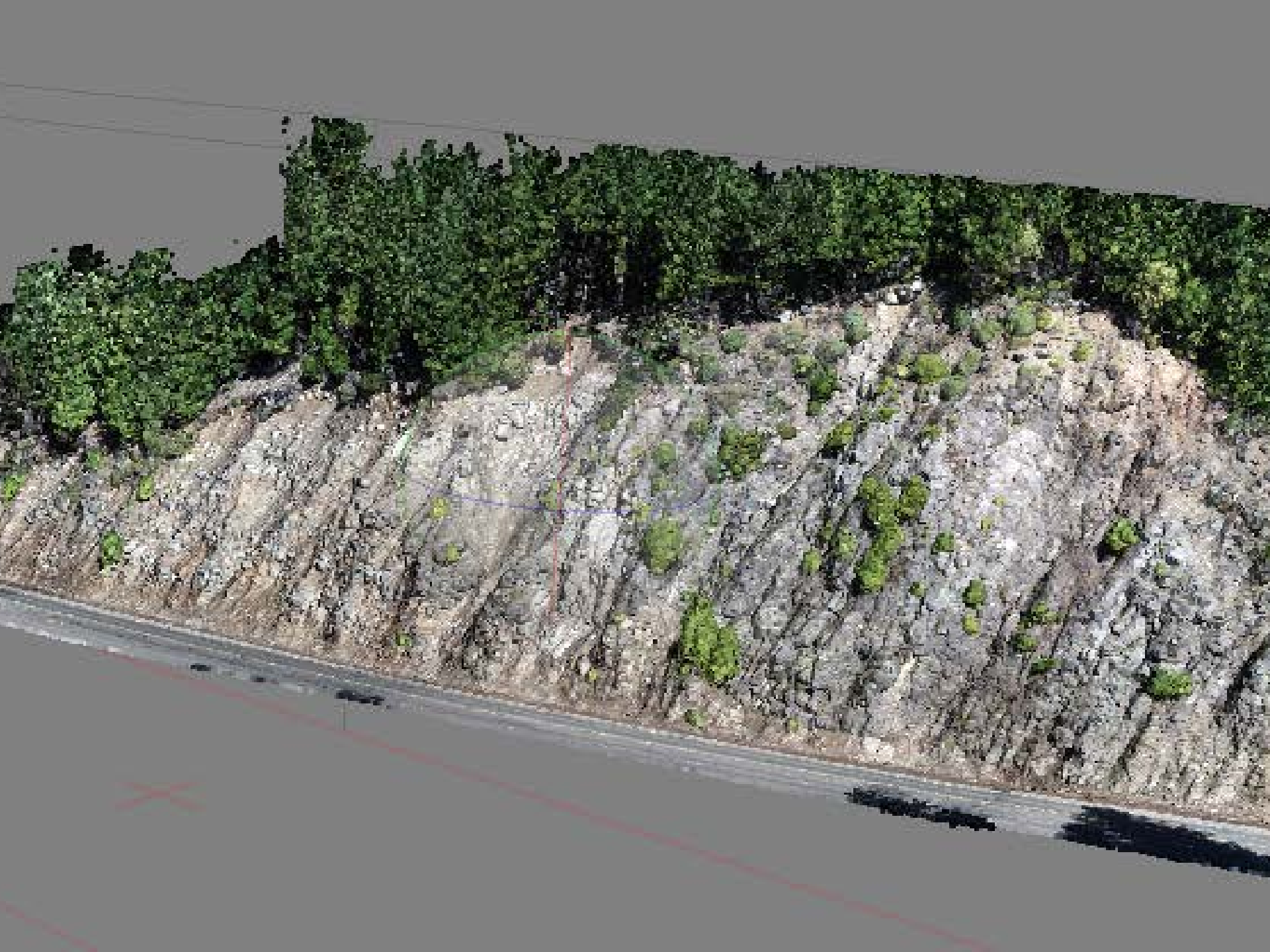
Flight Authorization Structure

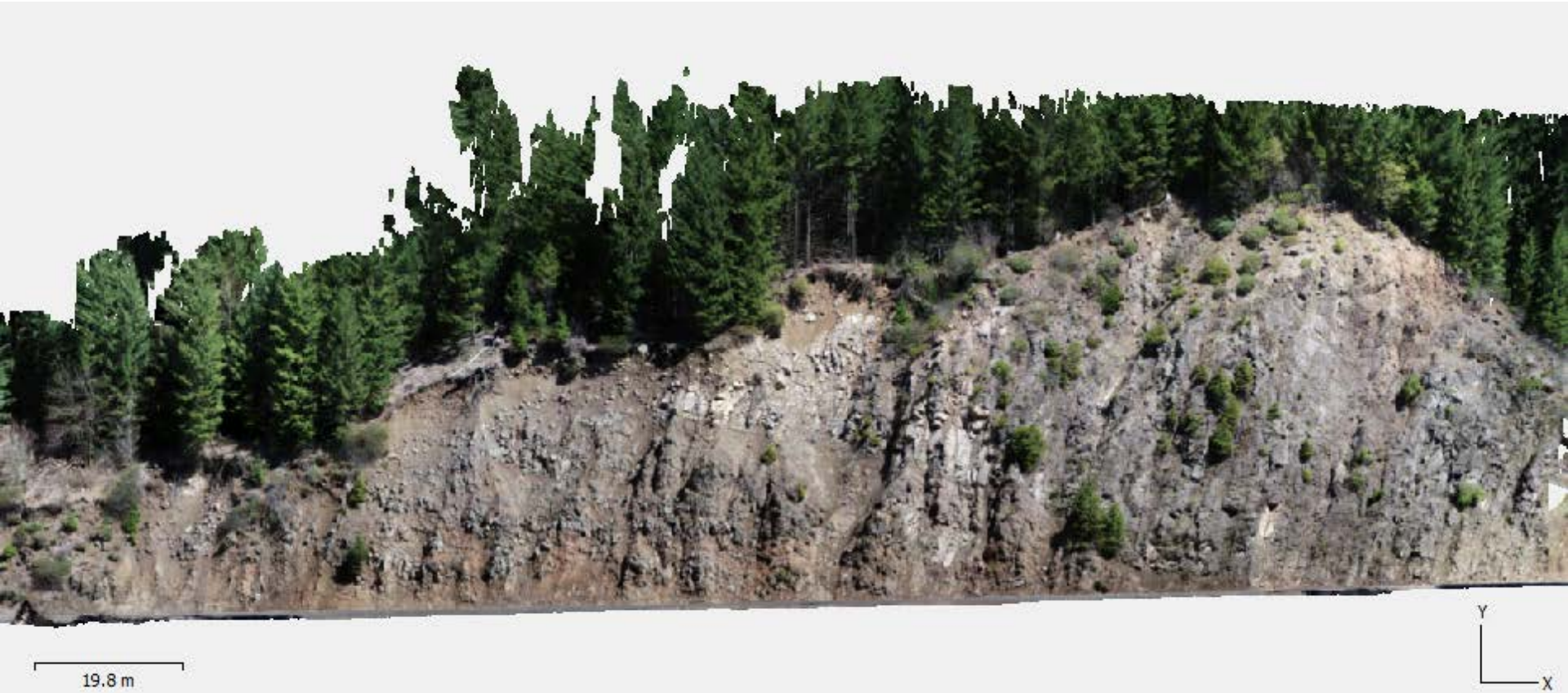



ODOT Experience
Existing Core Competency
OSU Research
ODOT UAS Initiative

Existing Core Competencies

- Remote Sensing
  - Orthoimagery
  - Orthomosaic
  - Point cloud
- Surveying and Mapping
  - Data extraction for design
  - Point cloud (lidar and imagery) manipulation and analysis

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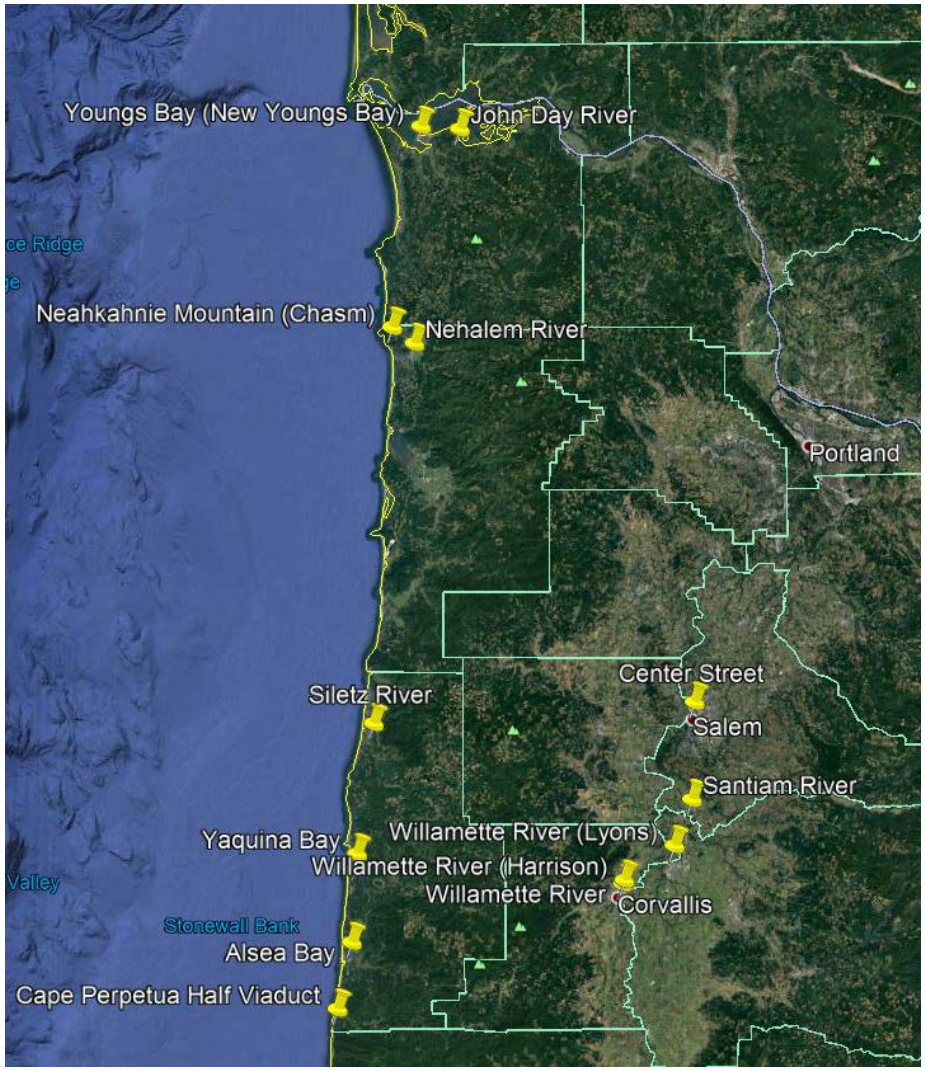
Bridge Inspections

Summer/Fall 2018

- 13 Bridges identified as test sites
- Focused in Region 2
- “Proving” OSU’s Research
- Members from Bridge and Engineering Automation Sections on research team



Next Steps

1. Can we fly the structure under rules defined in Part 107 and ODOT's UAS Operation Manual?
2. Review airspace for each structure and request FAA authorizations if necessary
   A. Three structures are in Class D airspace
      A. Salem – non-LAANC
      B. Newport – LAANC
      C. Astoria – non-LAANC
3. Identify equipment
   A. DJI Matrice 210 w/X4S and Z30
4. Practice, practice, practice
   A. How does the equipment handle under a structure?
5. What does success look like?
   A. Can we see things with UAS that were impossible or difficult to see before?

Inspection Operational Considerations

- Safety
- Mission Planning
  - Crew
    - Pilot
    - Visual Observer
    - Inspector (SME)
  - Equipment
    - DJI Matrice 210 w/ top gimbal mount
      - X4S
      - Z30 (30x zoom)
    - Sonetics closed loop intercom headsets

DJI Matrice 210

- Pros
  - Top mount gimbal
  - 30x Optical Zoom sensor
  - Dual controller
  - Stabile platform
  - Avoidance sensors

- Cons
  - Gimbal freedom
  - Fixed landing gear
  - Hard to see with dark background
  - DJI's "RTK"

Bridge Inspection Challenges

- Bad lighting
- Copter hard to see in dark backgrounds
- Pilot “comfort” when flying in stressful situations
- Off the shelf solution don’t fit 100%
- Data management:
  - How do we effectively deliver data?
  - What’s the best way to visualize a structure inspection with 100s or 1000s of images?

UAS and Distracted Driving

- Tested differing UAS attitudes (racing, mapping pattern, etc.) at varying distances (0ft, 25ft, 50ft) from roadway;
- Operators and UAS both caused distraction;
- The further away from traffic and the less erratic the flight pattern the lower number of distracted glances;
- Signs warning motorists of remote operations might help with distraction.

UAS in ODOT Initiative

- Goal is to expand use of UAS at ODOT
- Prior to initiative, ODOT was only using UAS for remote sensing and public outreach
- Initiative team visited every region to discuss uses
- Offered to provide UAS on a project for free
- We received a lot of good ideas:
  - Wildlife surveys
  - Aid in planning
  - Progress tracking
  - Public outreach
  - Slope monitoring
  - Traffic monitoring

Roundabout “Rodeo”

Direct Georeferencing AirGon (GeoCue) Loki

- The Loki System Controller (including the Septentrio AsteRx-m2 GNSS Engine)
- Maxtena (M1227HCT-A2-SMA) L1/L2 GPS/GLONASS active GNSS antenna
- A personality cable Controller to antenna cable
- Charging/Data cable
- Mounting kit for Phantom/Inspire
- ASPSuite, Advanced Edition

Lessons Learned

- You can grow too fast
- Expensive doesn't equal higher quality
- Check props before each flight!
- No replacement for a good pilot
- Technology is moving rapidly
- No replacement for good planning
- DJI always updates firmware at the wrong time

ODOT's Next Steps

- Educate ODOT on UAS use
- Updating Operations Manual
- Bridge inspection implementation
- Contracting specifications
- Further equipment testing
- Advanced pilot training
- Automated electronic UAS Program tracking system

Questions?

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