Unmanned Aerial Systems: A Continued Look Into UAS at ODOT

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Update: A Year in Review

Office of CADD and Mapping Services:
- Acquisition of a SenseFly eBee RTK
- Completed Training

UAS Community:
- Closing of request for comments regarding the UAS Notice of Proposed Rulemaking (NPRM)
- Development of new hardware and software geared toward professionals instead of hobbyists
Hurdles with the Start of a UAS Program

- COAs and Regulations
- Rogue Operators
  - Over 390 UAS sightings reported by pilots in the last 3 months
  - 721 Events in 2015 so far!
  - Halted firefighting operations in California wildfires
- Preparing the Proper Workflow and Safety Plan
- Deciding and Evaluating a Platform
- Sensors and Airframe
Current Regulations

Regulations based on the operators COA and/or blanket COA received with a 333 exemption.
Small UAS NPRM
Operational Limitations

*Summary of Major Provisions Proposed Part 107*

- Unmanned aircraft must weigh less than 55 lbs.
- Visual line-of-sight (VLOS)
- Small unmanned aircraft may not operate over any persons not directly involved in the operation****
- Daylight-only operations
- Must yield right-of-way to other aircraft
- May use visual observer (VO) but not required
- Maximum airspeed of 100 mph (87 knots)
- Maximum altitude of 500 feet above ground level

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Small UAS NPRM Operational Limitations (Continued)

Summary of Major Provisions Proposed Part 107

- Minimum weather visibility of 3 miles from control station
- No operations are allowed in Class A (18,000+ ft.) airspace
  - Class B, C, D and E require ATC permission (Not G)
  - Requires preflight inspection
- Proposes a micro UAS option that would allow operations in Class G airspace, over people not involved in the operation, provided the operator certifies he or she has the requisite aeronautical knowledge to perform the operation****
Small UAS NPRM Operator Certification and Responsibilities

*Summary of Major Provisions Proposed Part 107*

- Pilots of a small UAS would be considered “operators”
- Operators would be required to:
  - Pass an initial aeronautical knowledge test at an FAA-approved knowledge testing center
  - Be vetted by the Transportation Security Administration
  - Obtain an unmanned aircraft operator certificate with a small UAS rating
  - Pass a recurrent aeronautical knowledge test every 24 months
Operators would be required to (continued):

- Be at least 17 years old
- Make available to the FAA, upon request, the small UAS for inspection or testing, and any associated documents/records required to be kept under the proposed rule
- Report an accident to the FAA within 10 days of any operation that results in injury or property damage
- Conduct a preflight inspection, to include specific aircraft and control station systems checks, to ensure the small UAS is safe for operation.
Small UAS NPRM Aircraft Requirements

*Summary of Major Provisions Proposed Part 107*

- FAA airworthiness certification not required. However, operator must maintain a small UAS in condition for safe operation and prior to flight must inspect the UAS to ensure that it is in a condition for safe operation.

- Aircraft Registration required and marked with appropriate numbering.
CADD and Mapping Services Current Position

- SenseFly eBee RTK
- Accuracy Assessment
- ODOT Business Policy
- Processing Workflow
- Deliverables

- Two active COA applications
  - LAW-52 and Deer Creek State Park
SenseFly eBee RTK

- Weight = 1.61 lb including camera
- Wingspan = 38 in.
- Material = EPP foam, carbon structure & composite parts
- Propulsion = Electric pusher propeller, 160 W brushless DC motor
- Battery = 11.1 V, 2150 mAh
SenseFly eBee RTK

**Hardware**

- Connects directly into the CORS RTK network for survey grade accuracy and real time corrections. (L1/L2, GPS and GLONASS)
- 3 cm horizontal and 5 cm vertical accuracy without ground control pts.*
- Canon WX (18.2 MP) auto-triggering camera
- 40 min. Flight time
  - During the duration of this presentation the eBee RTK can map a 3.0 square mile area (lowest resolution at the highest altitude)
  - More typical flight 50 acres (2.5 cm per pixel) in less than 10 minutes
SenseFly eBee RTK

Software

- eMotion
  - Flight Planning and Control Software
- Postflight Terra 3D
  - Professional Photogrammetry Software
eMotion

*Flight Planning and Control Software*

- **Planning**
  - Allows user to use 3D mission planning to plan the perfect flight.

- **Simulation**
  - Puts the perfect flight plan to the test in 3D with the UAS safely on the ground.

- **Monitoring and Control**
  - Using the same interface the operator can control and monitor the UAS in flight

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Postflight Terra 3D

- **Check in the Field**
  - Provides a quick quality report in the field to insure proper coverage and accuracy

- **Generate Orthos, 3D models & Point Clouds**
  - Creates deliverables directly into the remote sensing workflow (.las and georeferenced tiff images)
Remote Sensing Deliverables

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**Orthomosaic Raster**
- Format(s): geoTiff (MTL, KMZ, png, xml)
- Compatible with:
  - ArcGIS
  - Google Earth
  - Terrain Models
  - All leading brands of GIS software

**3D Point Cloud in .las format**
- Format(s): las, txt, tif, pcp, ascii
- Compatible with:
  - ArcScene
  - ArcGIS
  - Google Earth
  - Terrain Models
  - All leading brands of GIS software

**DSM in a geoTIFF**
- Format(s): geoTiff (MTL, KMZ, png, xml)
- Compatible with:
  - ArcGIS
  - Google Earth
  - Terrain Models
  - All leading brands of GIS software

**3D Textured Mesh**
- Format(s): Wavefront (.obj)
- Compatible with:
  - Autodesk
  - Bentley MicroStation
  - 3DS Max
  - 3DS MAX

**Contours**
- Format(s): dat, shp
- Compatible with:
  - Vector
  - AutoCAD
  - ArcGIS
  - AutoDesk
  - Quick Terrain
  - TerraScan
  - Bentley MicroStation
  - All leading brands of GIS software

**Imagery in .tif format**
- Format(s): Mr. Gift (.jpg, .png)
- Compatible with:
  - Google Maps
  - Maps
  - Other map servers

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Ohio UAS Test Center

The OH/IN UAS Center is a joint venture between the states of Ohio and Indiana established in 2013 by Governors John Kasich and Mike Pence

Overall mission of the UAS Center is to provide:
- Catalyst for UAS Commercialization
- Direct support to State & Federal Partners for UAS Research, Development, Test & Evaluation (RDT&E) and Operations
- Direct support to Universities and Colleges for UAS Research and Development (R&D)

Developing capabilities to support UAS RDT&E at a variety of test ranges

These activities will enhance economic development and place Ohio in a leadership role as FAA prepares to integrate UAS into the National Airspace System
Ohio UAS Test Center

- 13 Active COAs
- 30 COAs in work at FAA
- Section 333 Exemption submitted to FAA – 7 platforms
- 30 COAs in work supporting State of Ohio Agencies, Universities, Municipalities and businesses
Moving Into the Future

**Rotor UAS**
- Bridge Inspection
- Sign Inspection
- Asset Inventory
- Geotech
- Crash Investigation & Forensic Mapping
- Construction Inspection
- Infrastructure Monitoring
- Dam Inspection
The Future of UAS in Ohio

As the saying goes...

“The future looks bright”

This year we will start off small, but with the intent to grow the program across the state over the years.
The Future of UAS in Ohio

- Identify Deployment Opportunities to Other State Agencies
  - Develop standards of practice for each equipment type
  - Develop deployment strategies
- Investigate how we combine data sets & leverage all data to move us to 3D Design and Modeling
- Evaluate how to efficiently and effectively data share with other offices and agencies.
The Future of UAS in Ohio

University Research, Key Areas of Research
- Modeling and Simulation
- Human/Machine Interface
- Sensors
- Data Management & Processing
- Dynamic Modeling
- Detect and Avoid
- Cooperative Control
- Position, Navigation, and Timing
- Spectrum Management, Antenna Design
- GPS Robustness
- Data Link security
The Future of UAS in Ohio

- Sinclair Community College
  - Ribbon cutting for the National UAS Training and Certification Center this past August
- Clark State
- Ohio University
- The Ohio State University
- Air Force Institute of Technology
- Bowling Green State
- Case Western Reserve University
- Clark State Community College
- Kent State Community College
- Lorain Community College
- University of Cincinnati
- University of Dayton
- University of Toledo
- Wright State University

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Ohio Contacts/ Information for UAS

Indiana/Ohio UAS Center and Test Complex:

http://www.dot.state.oh.us/Divisions/uas/Pages/default.aspx

Ohio Department of Transportation: