Drones: Products, Regulations and Applications

City of Philadelphia Law Department: Continuing Legal Education

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Keystone Aerial Surveys, Inc.
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• Based in Philadelphia, PA with offices in Los Angeles, Tucson and Tyler, TX
• Founded in 1963 to provide remote sensing throughout the US
• 21 manned survey aircraft
• 22 mapping sensors including 8 UltraCam digital cameras and 2 Optech LiDAR systems (including new Galaxy delivered June 23rd!)
• Provide post production services from large format digital, LiDAR and UAS imagery
Keystone UAS

• UAS approved under 333:
  • As of June 1st – All UAS on FAA Approved Vehicle’s List
  • Altavian Nova F6500 (fixed wing)
  • DJI Inspire 1 Pro (Rotocraft)
  • SteadiDrone Mavrik X8 (Rotocraft)
• Keystone is approved for all types of mapping, remote sensing and imagery – except closed set television and film capture
My Bio

- Started with Keystone in 1995 as an aerial photographer
- Developed Information Technology and Digital Post Processing departments
- Lead imagery post processing team for nearly 10 years
- Application Development Certification, Certified Photogrammetrist and Geographic Information Systems Professional (GISP)
- Currently Executive Vice President and Director of UAS Division
  - Oversee all manned and unmanned flight operations, camera systems and post production
- Authored or Co-Authored 7 research papers
UAS Advantages over Manned Flight

1. Resolution: Most UAS data will be acquired at <2cm GSD
2. Frequency/timeliness – Able to fly a site repeatedly, on specific dates under most cloud conditions and under/beside for unique views
3. Costs are generally less, but for larger areas the prices are similar and for remote areas it can be much more
4. UAS can be ideal for small scale/high resolution 3D solutions
5. 3D’s – Dull, Dirty and Dangerous
Products Generated From UAS
Current Products
Ortho Photo (basemap) imagery
Current Products

3D point clouds:
From photo and LiDAR
Current Products

3D Meshes
- Draping\merging of point cloud and ortho photo to create a 3D scene
- Often referred to as 2.5D
Current Products

True 3D:
- Use of vertical and oblique imagery to create a true 3D environment
Current Applications

Package Delivery?

With the rise of drone technology do you think that we'll use drones to ship goods rather than FedEx or UPS trucks?

Probably.

But what about security? I'd be worried about people sitting on their porches with shotguns shooting down drones and stealing the shipment.

You could do that with a UPS truck.
Current Applications

Mapping:
• Currently limited by regulations and tools available
• For small applications, UAS data offers new levels of detail
Current Applications

- Land Survey Work – compliments or replaces ground work
Current Applications

Precision Agriculture: Used to determine crop health, pest infestation and water runoff/availability
  • Timeliness and repeatability are key selling points
Construction Job Sites: Planning, Monitoring, “As Built” Documentation of utilities and BIM
Current Applications

Stockpiles: Landfills, Mines, Quarries for Volumetric Calculations
• Safer than sending surveyors into dangerous location
• Cheaper than manned flights
• Repeatable under most weather conditions
• Accurate enough for inventories
Current Applications

- Inspection for Bridges, Piers, Towers, Windmills, etc.
  - Keystone has partnered with WSP\PB to provide this service to DRBA
  - Provides access to areas not previously accessible
  - Saves time and money when performing exterior/interior crack inspection
  - Lower cost may allow for more frequent inspections (but will not replace manual inspections completely)
  - Able to record what was seen for reference later (documentation/studies)
  - Reduces risk to inspection crews
  - Soon will be able to map the surface of the road and towers above traffic
Regulations
Current Regulations – 333 Key Rules

• UAV must be under 55 lbs. and speed not to exceed 100 mph
• UAV must be operated at 400 feet AGL or below
• UAV must be operated within visual line of sight of pilot and one observer (cannot daisy-chain observers/pilots)
• Pilot must hold a commercial, private, recreational or sport pilot certificate
• Operations cannot be at night
• Operations must be in VFR conditions (500 ft. below clouds)
• Must File a Notice to Airmen (NOTAM) – manual process with errors
Current Regulations – 333 Key Rules

- All operations must be 500 feet from buildings, vessels, persons and vehicles not participating in the operation
- Exemption holders receive a blanket COA with the restriction flights must be 5 nm from public airport with a tower, 3 nm from most other public airports and 2 nm from public heliport, gliderport or seaport
- Access to Civil COA process is granted to 333 holders
Current Regulations

Delaware Memorial Bridge:
- Worked closely with DRBA who manages both the Airport and Bridge between 4.7 and 4.9 Nautical Miles from New Castle Airport
- Keystone’s older 333 allowed for work within 5nm with written permission
- Remained under the bridge deck during flights
Keystone UAS

Timeline

- December of 2014: Began preparing 333 exemption
- January of 2015: Exemption submitted
- May 1st, 2015: Exemption granted Keystone is approved for all types of mapping, remote sensing and imagery using Altavian F6500
- July 2015: Keystone files for amendment for Quadcopter UAS exemption
- Oct. 2015: Amendment approved to fly Quadcopter
- Oct. 2015: Keystone submits a second amendment for more aircraft types
- Oct. 2015: Keystone submits two civil COAs
- April 2016: Keystone submits civil COA for bridge inspection
- June 2016: Keystone receives third amendment approval for all UAS types
- June 2016: COAs submitted in October approved
- June 2016: New Part 107 released with implementation in September
Risk Mitigation- 333 & Waivers?

• Keystone uses experienced pilots incurring costs of training flights and manufacturer training
  • Spent extensive time developing its Flight Operations Manual and Standard Operating Procedures for UAS operations
  • Checklists for deployment, pre-flight and post-flight are always used and updated
    • Weather, wind speeds, etc. are monitored and a UAS risk assessment worksheet is filled out prior to a mission
Risk Mitigation- 333 & Waivers?

- Keystone has developed a Data Privacy Policy governing collection, storage and security of any private information
  - Consent forms developed for Airport managers, Property owner/operator, nearby property owners and participants
  - Liability insurance in place with same firm as manned aircraft carrier

Will waivers and requests for airspace access be affected by an operator’s safety, insurance and risk mitigation efforts?
Thank You!

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