Drones for Surveying and other purposes

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Bio– Glenn Anderson

KYTC Traffic Operations, PE (Electrical)
Flying Radio Controlled airplanes for 39 years
Flying with video for 26 years (possibly first in KY in 1989)
Operated New Perspective Aerial Photography from 1994–2009
www.aerialrobotics.com
What is a drone?
Terminology

RPV – Remotely Piloted Vehicle (obsolete)
UAV – Unmanned Aerial Vehicle (almost obsolete)

FAA language:
UAS – Unmanned Aircraft Systems
sUAS – Small Unmanned Aircraft Systems

However, the term “Drone” is here to stay
Large UAS
Small UAS or sUAS

Fixed Wing:
Longer flight time
Requires an unobstructed area for launch and recovery

Multi Rotor:
Shorter flight time
Can fly almost anywhere
Seems like everyone has a drone
What caused this drone revolution?

- Acceleration/gyro sensors – car airbags
- Better batteries – cell phones
- Powerful microcomputers
- Improved GPS precision
- Software
  - Flight control software
  - Image processing software
- Chinese manufacturing
- Internet and Amazon etc.
- FAA – Lack of rules has created a “wild west” situation
Drones: making news daily
DJI – The drone any idiot can fly

FAA Approved commercial use by type
careless operators & misunderstood capabilities
Drones will be another tool in the KYTC surveying tool box

We currently have:

Robotic Total Stations

GPS RTK Base Station Setup
Survey Tools continued

KYCORS Network

Stationary Scanners

Aerial Photography, Mapping, LiDAR, and Mobile Mapping by our Consultants
Just in case of an EMP attack... We're back to the good old days.
Drones can be useful and they are changing the way people collect data.

Surveying

- Accident reconstruction
- Oblique photos have many uses

Bridge Inspection (from KTC quad)
Benefits

- **Efficient**
  - Survey 2 acres per minute with two people
    - Interim construction surveys
    - As-built surveys

- **Safe**
  - Styrofoam or frangible construction
  - Light weight, 4–8 lbs
  - Slow Flying, 0–50 mph
  - Flies below 200’
  - No people on board
  - Geofenced flight boundaries

- **Quick Response**
  - Accident reconstruction
  - Surveying
  - Bridge inspections
Benefits

- **Low Cost**
  - UAV ≈ $2,600
  - Manned aircraft and camera ≈ $2,000,000?

- **Better Images**
  - Flies close to the subject
  - Shoots through less atmospheric interference
Low altitude images
Just a few Deliverables from a Drone Mission

Orthomosaic

DEM

DSM

NIR
Digital Elevation Model

Digital Surface Model

DEM – digital elevation model is a 3-D representation of a terrain’s surface created from terrain elevation data.

DTM – digital terrain model represents the bare ground surface without any objects such as plants or buildings.

DSM – digital surface model represents the earth’s surface and all objects on it.

[Images of Digital Elevation Model, Digital Surface Model, and Digital Terrain Model]
With Airborne LiDAR, Yes. Because it delivers better elevation data in vegetated areas.

With Orthomosaics, No. Because the camera can't penetrate the vegetation. It records what it sees.

However, the DTM can be created by merging or fusing the data sets.
Drones with LiDAR?
Surveying with drones

- Identify the Mission location
- Plan Mission Boundary
- Identify and address any potential safety issues
- Notify property owners of the mission
- Layout Ground Control Points to give the project a Geospatial identity
- Fly the mission after complete systems check
- Check the data on site for any deficiencies. Refly if necessary.
- Do final processing in the office
- Deliver final product or products
Photogrammetry is the art and science of obtaining precise mathematical measurements and three-dimensional (3D) data from two or more photographs.

Photogrammetric techniques can be applied to virtually any source of imagery, whether it comes from 35-mm digital cameras or an earth-orbiting satellite. As long as the images are captured with stereoscopic overlap, one can derive accurate 3D data at a very wide range of scales.
Pix4D demo
How to legally fly

FAA Modernization and Reform act of 2012

Congressional mandate – Achieve safe integration of UAS into the national airspace (NAS) by September 30, 2015

This is probably not going to happen
For now – the section 333 exemption is a band-aid

http://www.jdsupra.com/legalnews/section-333-at-200-days-where-are-we-no-40060/
“Blanket COA” for 333 exemption holders
Below 200’ AGL
5 nm from towered airports
3 nm smaller airports
2 nm from heliports
Airspace terminology

Figure 8-3. Class G airspace extends from the surface to the base of controlled airspace (Class B, C, D, and E).
KYTC 333 exemption submittal approaching 3.5 months

Peter Sachs’s paper airplane took 3.5 months to approve so perhaps we are getting close
sUAS future? FAA NPRM Part 107

- Aircraft less than 55 lbs
- VLOS only
- Daytime only
- <100 mph <500’ agl
- UA Operator Certificate
- Aeronautical knowledge test
- Minimum 17 years old
- No airworthiness certificate
- Aircraft N# required

Comments closed 4/24/15
Likely 2017 before final rule
Questions

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