The Benefits of Drone Use in Evaluating the Building Enclosure

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History

- One of the first recorded uses was by Austrians in July 1849

- 1898 Spanish – American War when the U.S. military fitted a camera to a kite, producing one of the first aerial reconnaissance photographs
History

- The term “drone” originated from the British produced unmanned radio controlled aircraft in 1935 that were used as anti-aircraft practice targets.

- A Lightning Bug Drone was used during the Vietnam war, it was one of the first drones used for surveillance by the USAF.
History

- Whatever the size of the drone, they all perform the same functions:
  - Providing intelligence, surveillance, reconnaissance (ISR) via photographs and/or videos
How Does a (sUAS) Drone Work?

An unmanned aerial vehicle system has two main parts: drone itself and control system.

Majority of (sUAS) used by hobbyists or for commercial use have multi-rotors.

Multi-rotor drones are inherently unstable and require an on-board computer to stabilize flight.
How Does a (sUAS) Drone Work?

- Roll, pitch, yaw, and thrust can be changed by speeding up or slowing down
  - Roll – moves the UAS side to side
  - Pitch – moves the UAS forward or backwards
  - Yaw – changes the direction the UAS faces
FAA Regulations

- 2015 – FAA created regulations and rules for drone use due to safety concerns
- Ch 14 CFR – Part 107
- Certification was originally required for hobbyist and for commercial pilots (Pilot Certificate)
- As of 2017 certification is only required for commercial pilots
## The rules for operating an unmanned aircraft.

<table>
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<tr>
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<th><strong>Fly for Fun</strong></th>
<th><strong>Fly for Commercial Use</strong></th>
</tr>
</thead>
</table>
| **Pilot Requirements**  | No pilot requirements                                                            | Must have Remote Pilot Airman Certificate  
Must be at least 16 years old  
Must pass TSA vetting                                                   |
| **Aircraft Requirements** | Must be less than 55 lbs.                                                        | Must be less than 55 lbs.  
Must be registered if over 0.55 lbs. (online)  
Must undergo pre-flight check to ensure UAS is in condition for safe operation |
| **Location Requirements** | 5 miles from airports without prior notification to airport and air traffic control | Class G airspace*                                                                           |
| **Operating Rules**     | Must ALWAYS yield right of way to manned aircraft  
Must keep the aircraft in sight (visual line-of-sight)  
Must follow community-based safety guidelines  
Must notify airport and air traffic control tower before flying within 5 miles of an airport  
Must NOT be physiologically impaired | Must keep the aircraft in sight (visual line-of-sight)*  
Must fly under 400 feet (elevation)*  
Must fly during the day*  
Must fly at or below 100 mph*  
Must yield right of way to manned aircraft*  
Must NOT fly over people*  
Must NOT fly from a moving vehicle*  
Must NOT be physiologically impaired |
| **Example Applications** | Educational or recreational flying only                                           | Flying for commercial use (e.g. providing aerial surveying or photography services)  
Flying incidental to a business (e.g. doing roof inspections or real estate photography) |
| **Legal or Regulatory Basis** | Public Law 112-95, Section 336 – Special Rule for Model Aircraft  
Commercial sUAS pilots typically operate in Class G Airspace

Class G airspace extends from the surface to the base of the overlying Class E airspace

A remote pilot will not need ATC authorization to operate in Class G airspace
Drone Capabilities

- Aerial photography
- Aerial Thermography
- Laser Scanning for As-Builts
- 3D Mapping
- Facade Condition Studies
- Allows Focus on Actual Issues
- Storm Damage Assessments
- Structure Inspections
Facade Inspection Methods

- Typically use ladders, lifts, hoists, rope access or swing staging
- These methods are time consuming and expensive
- The more complex the configuration, the more expensive
Binocular Inspection
Man Lift
Swing Staging
Rope Access Methods
Small Unmanned Aircraft Systems (sUAS) - Drones
Avoids Expensive Access Methods

- Allows access to hard to reach locations
- Up to 400 feet above the structure*
<table>
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<tr>
<th>Method</th>
<th>Average Costs for Evaluation Use</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binoculars</td>
<td>$135/hour</td>
<td>No ability to capture images observed for later use.</td>
</tr>
<tr>
<td>High Reach Equipment</td>
<td>$2,500/120’ lift per week (not including operator or engineer)</td>
<td>Costly, coordination with facility operations critical, potential for mechanical failure. Tremendous attention to safety.</td>
</tr>
<tr>
<td>Swing Stage</td>
<td>Initial installation $2,000 Relocate for each drop $1,200 (if on same building level) $1,000 per drop for operator and engineer</td>
<td>Costly, coordination with facility operations critical, Delay in observation due to mobilization and relocation of staging for each drop.</td>
</tr>
<tr>
<td>Helicopter</td>
<td>$1500 to $2000 per hour.</td>
<td>Weather and FAA Clearance</td>
</tr>
<tr>
<td>Drone</td>
<td>The average cost for drone survey is approximately $3,000-$4000 total (this includes pilot, engineer and report). Exact price may vary depending on your area and project details.</td>
<td>FAA Regulations, Battery Life, Weather (wind, rain, etc.)</td>
</tr>
</tbody>
</table>
Overall View of an Entire Site
Photos for Design and Renderings
Infrared Thermography for Moisture or Air Leakage
3D Modeling
Orthomosaic
Building Enclosure Evaluations
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Aerial Views for Measure Ups
Evaluation after a Major Weather Event

- FAA issued 137 authorizations to local, state and federal agencies for support to Hurricane Harvey Recovery
- Insurance, utility, and AE firms used drones to assess damage
Storm Damage Assessment

- Quickly assess damage to facilities
- Easy access
- Minimal safety issues
Additional Uses

- Amazon announced it was exploring using drones to deliver packages in 2014
- Exploration of delivering medicine
- Law Enforcement & Emergency Rescue
  - Used to deliver life jackets to flood victims
  - Use IR on Drones for Search & Rescue
  - Disaster Relief
- Real Estate Surveys
- Mining and Transportation – Site Assessments and Geological Mapping
- Used in Africa for Anti-Poaching Missions
- Agriculture – Crop Monitoring
Limitations

- sUAS should be considered a tool and not a solution to a problem
- Professionals are needed to analysis and interpret the data
- Visibility: drone must be in line of sight of the pilot
- Weather: cannot be flown in 20+ mph
Conclusion

“The Drone Age” is here to stay

- They inspect hard to reach places
- They can be deployed quickly
- They are popular – multiple uses
- Evaluating building enclosures can be performed annually at lower costs