Unmanned Aerial Vehicles (UAVs)

A Blessing or a Curse

Next High-Tech Tool for Agriculture and Beyond

Photo Credits

http://modernfarmer.com/2014/01/precision-hawk/
http://nimbus.unl.edu/projects/crop-surveying-using-aerial-robots/
http://hoosieragribusiness.wordpress.com/2014/09/22/are-drones-the-next-big-thing-in-ag/
Class G (uncontrolled) airspace is mostly used for a small layer of airspace near the ground, but there are larger areas of Class G airspace in remote regions.
Can I Fly an UAV? – Yes, No, Maybe

<500 Feet = Non Navigable Airspace

>500 Feet = Navigable Airspace

Property Rights?

<500 Feet = Non Navigable Airspace
Can I Fly an UAV? – Yes, No, Maybe

- Personal Use (Hobbyist or Recreational Use)
- Do not fly model aircraft higher than 400 feet above the surface.
- When flying aircraft within 3 miles of an airport, notify the airport operator, or when an air traffic facility is located at the airport, notify the control tower, or flight service station.
- Maintain visual contact with UAV at all times. (specifically not in AC 91-57)
Can I Fly an UAV? – Yes, No, Maybe

- the aircraft is flown strictly for hobby or recreational use;
- the aircraft is operated in accordance with a community-based set of safety guidelines and within the programming of a nationwide community-based organization;
- the aircraft is limited to not more than 55 pounds unless otherwise certified through a design, construction, inspection, flight test, and operational safety program administered by a community-based organization;

SEC. 336. SPECIAL RULE FOR MODEL AIRCRAFT – FAA Modernization and Reform Act of 2012
Can I Fly an UAV? – Yes, No, Maybe

• the aircraft is operated in a manner that does not interfere with and gives way to any manned aircraft; and

• when flown within 5 miles of an airport, the operator of the aircraft provides the airport operator and the airport air traffic control tower (when an air traffic facility is located at the airport) with prior notice of the operation (model aircraft operators flying from a permanent location within 5 miles of an airport should establish a mutually-agreed upon operating procedure with the airport operator and the airport air traffic control tower (when an air traffic facility is located at the airport)).

SEC. 336. SPECIAL RULE FOR MODEL AIRCRAFT – FAA Modernization and Reform Act of 2012
<table>
<thead>
<tr>
<th>Hobby or Recreation</th>
<th>Not Hobby or Recreation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flying a model aircraft at the local model aircraft club.</td>
<td>Receiving money for demonstrating aerobatics with a model aircraft.</td>
</tr>
<tr>
<td>Taking photographs with a model aircraft for personal use.</td>
<td>A realtor using a model aircraft to photograph a property that he is trying to sell and using the photos in the property’s real estate listing.</td>
</tr>
<tr>
<td><strong>DEPARTMENT OF TRANSPORTATION</strong></td>
<td></td>
</tr>
<tr>
<td>Federal Aviation Administration</td>
<td></td>
</tr>
<tr>
<td>14 CFR Part 91</td>
<td></td>
</tr>
<tr>
<td>[Docket No. FAA-2014-0396]</td>
<td></td>
</tr>
<tr>
<td><strong>Interpretation of the Special Rule for Model Aircraft</strong></td>
<td></td>
</tr>
<tr>
<td>Using a model aircraft to move a box from point to point without any kind of compensation.</td>
<td>Delivering packages to people for a fee.</td>
</tr>
<tr>
<td>Viewing a field to determine whether crops need water when they are grown for personal enjoyment.</td>
<td>Determining whether crops need to be watered that are grown as part of commercial farming operation.</td>
</tr>
</tbody>
</table>
Can I Fly an UAV? – Yes, No, Maybe

• Nationwide Community-Based Organization

Academy of Model Aeronautics National Model Aircraft Safety Code
Crop Scouting

SPARC Plots at South Farm on August 2, 2013
Crop Scouting

SPARC Plots at South Farm on August 28, 2014
Crop Scouting – Autonomous Flight
Aeriality
Simple Tools for Aerial Imagery

Aeriality Video Pushbroom

http://www.aeriality.io/
Crop Scouting – Nitrogen Stress

Nitrogen Plots at FSRC on October 11, 2013
Crop Scouting – Nitrogen Stress

Nitrogen Rate Study at Graves-Chapple Farm on August 27, 2013
North Plots

Corn - Cover Crop Plots - Image Captured on June 23, 2014
Moving Ground-Based Sensor to UAVs
Crop Scouting – Corn Hybrid Differences

at Hundley-Whaley Farm on August 28, 2013
170 acres. 15cm ground resolution. About 20 minutes flying – Fixed Wing

https://www.facebook.com/VoltAerialRobotics
Here's a photo from a DJI Phantom 1 with Go Pro 3 camera. Corn field on July 15, 2014 in Cooper County.
Use of Multispectral Cameras

Spray-Swath Overlaps?

Old N&S Dead-Furrows
Color infrared photos can help ranchers manage invasive species. This picture of an Old World bluestem pasture was taken in the fall, after the grass browned down, but the image still showed the bluestem (light pink), annual broomweed (yellow) and invasive sericea (reddish areas). Photo courtesy of Kevin Price
The Yamaha RMAX crop sprayer (246cc gasoline twin) with an AUW of 207 lb. has an endurance of 60-90 minutes with a payload capacity of 66 lb (equivalent to about 10 gallons of gasoline, which could be used for extending endurance).
23 cc two-cycle engine from a Yamaha weed whacker. A tank of mixed gas keeps the chopper flying for an hour.

The G15 weighs 15 pounds and is capable of carrying 15 lb. The carbon fiber rotors have a 71 inch span.

G15 AutoCopter - $50,000 to $75,000
The eBee has a flight time of up to 45 minutes allowing to cover areas of up to 2400 acres in a single flight. With its 16MP camera it can shoot aerial imagery at down to 3cm/pixel resolution.
Trimble® UX5 Aerial Imaging Solution
LA100 - Lehmann Aviation - $990

http://www.lehmannaviation.com/

3 feet - wingspan
1.9 pounds - weight

Flight time only 5 minutes
Cost: $50,000

6.6 feet - wingspan
14 pounds – weight
payload of 4.4 lbs – 30 min of flight time
payload of 0.9 lbs – 120 min of flight time

**Volt Aerial Robotics**

http://www.voltaerialrobotics.com/
Chesterfield, MO
Volt Aerial Robotics

6.6 feet - footprint
4.4 pounds – max takeoff weight
payload of 1.1 lbs – 18 min of flight time
payload of 0.22 lbs – 25 min of flight time

Cost: $10,770

http://www.voltaerialrobotics.com/
Chesterfield, MO
Cost for Kit: $7500

http://www.precisiondrone.com/

Noblesville, Indiana
Cost for Kit: $17500

Pacesetter

http://www.precisiondrone.com/

Noblesville, Indiana
UAV 350 QX AP BLH7900

Cost for Kit: $900

http://www.bladehelis.com/350QX2AP/
Cost: $3698 without camera

AG Pro Scout Kit
by
Aerial Media Pros

http://aerialmediapros.com/

Costa Mesa, CA
14 inch - footprint
2.2 pounds - max takeoff weight
10 min of flight time with just a GoPro Hero 3 camera

Dji Phantom
Cost (Begin at): $479
Total Kit (Begin at): $1200

http://www.dji.com/product/phantom/
Dji Phantom 2

Cost (Begin at): $679
With Zenmuse H3-3D gimbal: $959

Dji Phantom 2

Cost (Begin at): $679

Total Kit (Begin at): $2100 + camera

Modified Go-Pro Camera with

Kit with 3 lenses - $889.00
Update on FAA and UAVs

- FAA Announces UAS Six Test Site Operators – December 30, 2013
- FAA Approves First Commercial UAS Flights over Land - Surveys Will Check Pipelines, Infrastructure on Alaska North Slope – June 10, 2014
Texas A&M and UAVs

• Fully Operational Lone Star UAS Center Conducts Drone Test Flights over South Texas Ranchland
  – The missions will address several of the FAA research goals designed to safely integrate unpiloted aircraft into the national airspace by 2015, including:
    • system safety and data gathering as it relates to marine environments;
    • best practices for use of a chase plane that can more efficiently match speed and follow the UAV; and
    • continue refining process of ensuring air traffic control communications between UAV, ground control station and Mission Control Center in Corpus Christi.
Texas A&M and UAVs

- Fully Operational Lone Star UAS Center Conducts Drone Test Flights over South Texas Ranchland

The RS-16 is the University’s largest UAV, with a wingspan of nearly 13 feet and a maximum weight of 85 pounds. It launches with a pneumatic catapult and lands on its belly in the soft mudflats common in this coastal Texas region.
Texas A&M and UAVs

• Bird’s-eye view: AgriLife Research helps bring aeronautics to agriculture

An unmanned aircraft in flight at the Texas A&M University Riverside Campus range.

Preliminary UAS data showing three vegetation types plus non-vegetation. Photo and Image courtesy of Dr. John Valasek, Professor Aerospace Engineering
Update on FAA and UAVs

• Section 336 of the 2012 FAA Modernization and Reform Act– Public Comment ended September 23, 2014

• FAA Grants Exemptions for Commercial UAS Movie and TV Production – September 25, 2014
  – Six companies can now fly small UAS following FAA-approved safety procedures.
  – Section 333 – "Special Rules for Certain Unmanned Aircraft Systems"
FAA-approved safety procedures required by those approved for movie production

- the companies can use camera-equipped UAVs on outdoor movie and television sets that are closed to the public.
- the UAV must weight 55 pounds or less.
- the equipment must be inspected before each flight, fly no higher than 400 feet.
- be operated by a technician with a pilot’s license.
- the FAA must be notified of filming.
- night use is prohibited, at least for now.
Aerial Precision Ag, also known as APA, is a division of Cirrus Rotors - http://aparotors.com/about-us/