Drones and Their Role in Agriculture

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UT Extension
Current FAA Regulatory Environment

- Public UASs can fly under a Certificate of Authorization (COA).
  - Government entities at the Federal & State levels
    - Universities
    - Law Enforcement
    - Fish and Wildlife
    - NRCS
    - USGS
  - UAS that meets the qualifications and conditions required for operation of a public aircraft.
  - Private companies can partner with Government entities to fly under the entity’s COA
**Current FAA Regulatory Environment**

- Commercial UASs must have a FAA 333 Exemption

<table>
<thead>
<tr>
<th>Hobby or Recreation</th>
<th>Not Hobby or Recreation</th>
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<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>
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<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/she is trying to sell and publishing the photos in a real estate listing</td>
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<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>
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<tr>
<td>Viewing a field to determine whether crops need water when they are grown for enjoyment</td>
<td>Determining whether crops need to be watered that are grown as part of a commercial farming operation</td>
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Unmanned Aerial Systems (UASs)

- Communications
- GPS
- Auto-Pilot
- Cameras
Unmanned Aerial Vehicles (UAVs)

**Multirotor UASs**
- Vertical takeoff and landings
- Ability to hover
- Limited flight time
- Difficult to fly if not fully automated
- Requires fully automated flight features for full usability
- Requires more maintenance
- Relatively inexpensive

**Fixed-Wing UASs**
- Hand/catapult launched
- Longer flight time, can cover a lot of area
- Difficult to fly if not fully automated
- Requires fully automated flight features for full usability
- Minimal maintenance
- More expensive
Flight Coverage

Field Size: ≈ 40 acres
Flight Speed: ≈ 16 ft/sec
Flight Time: 18 minutes

Field Size: ≈ 92 acres
Flight Speed: ≈ 16 ft/sec
Flight Time: ≈ 42 minutes

Battery Technology is Evolving
Communications
GPS/Autopilot
Cameras

UASs are a Platform to Collect Precision Ag Data

- Video - Get live video feed on monitor, laptop or tablet
- R, G, B Cameras (Red, Green and Blue)
- Multispectral Cameras (R, G, B, NIR)
- Hyperspectral Imaging Cameras
- Thermal Imaging Cameras
- Lidar (Elevation)

Camera Technology is Rapidly Evolving!
Directed Scouting

Gives you a bird’s eye view

- Equipment
  - UASs – Rotary-Wing
  - GPS/Autopilot
  - GoPro video camera
  - Gimbal camera mount
  - Ability to live stream video to the ground
  - Monitor, laptop, tablet or smart phone
Directed Scouting

- Diseases
- Insects
- Weeds
- Crop Progress
- Crop Stress
Mapping

- **Equipment**
  - UAS – Fixed-Wing or Multicopter
  - GPS/Autopilot
  - Camera
  - Laptop, tablet
  - Internet access

- AgriEye
- Precision Drone
  - Precision Scout
- Altavian
  - NOVA F6500
- Trimble
  - UX5
Integrating UASs in Your Farming Operation

- **Mapping**
  - Replanting Decisions
  - Drainage Issues
  - Crop Insurance Claims
  - VRA Crop Inputs
  - Yield Estimation
  - Soil/Vegetation Moisture Monitoring
Mapping
Variable Rate Application of Crop Inputs

Vegetative Indices

Fertilizer, Varieties, Seeding Rate

Factors Influencing the Data
• Sunlight Intensity
• Sun Angle
• Time of Day

The Technology is Evolving!

PGRs and Defoliants

Zone Management

The Technology is Evolving!
Stressed Plants Have Higher Leaf Temperatures

Factors Influencing the Data
- Cloud cover
- Wind

Mapping
Plant Health Monitoring

The Technology is Evolving!

Cornerstone Mapping
Mapping Requires

- Stitching pictures together
- Orthorectifying the image
- Georeferencing the image
- Process the data
- Generate a useable map
Flight Coverage

Field Size: ≈ 40 acres
Flight Speed: ≈ 16 ft/sec
Flight Time: 18 minutes
Number of Pictures: 37
File Size: ≈ 111 MB

Field Size: ≈ 92 acres
Flight Speed: ≈ 16 ft/sec
Flight Time: ≈ 42 minutes
Number of Pictures: 152
File Size: ≈ 450 MB
Processing the Data

Questions to Think About

- Moving data around
  - What kind of internet speed do you have
  - Consumer grade internets are built for download not upload
  - Companies may throttle your internet with too much use

The Industry is Evolving!
Integrating UASs in Your Farming Operation

What are you hoping to do with the data?

- Flying
- The type of UAS you need
- The type of camera you need
- Agronomic Decisions
- Do you process the data yourself
- Data Processing
- Computing power requirements
- How do you move and store data

Are you set-up to use the data?
So What Are Your Options?

- You buy it
- You fly it
- You crash it
- You process the data
- You make the management decisions
So What Are Your Options?

• You buy it
• You fly it
• You crash it
• Let a 3rd party vendor process the data
• You make the management decisions
So What Are Your Options?

- Let someone else buy it
- Let someone else fly it
- Let someone else crash it
- Let someone else process the data
- You make the management decisions
Take Home Message

• UASs have the potential to make your farming operation more sustainable
• Know what you want to do with a UAS before buying one
• Directed scouting is the easiest application
• Mapping brings about data processing challenges
• Potential for inaccurate data without proper data capture and processing
• While UASs maybe fun to fly, don’t consider them toys
Questions