An Industry Perspective
UAV’s in Agriculture

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UAS in Ag Today

- Remote sensing is not a new science
- Lots of energy around UAS and their potential applications
- Complex systems – complete automation, multi-drone
- Data science / Decision Support Systems (DSS) are lagging
## Example of UAS Evolution

<table>
<thead>
<tr>
<th>Feature</th>
<th>swingletCAM</th>
<th>eBee Ag</th>
<th>eBee SQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wingspan (cm)</td>
<td>80 (31.5 in)</td>
<td>96 (38 in)</td>
<td>110 (43.3 in)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>0.5 (1.1 lb)</td>
<td>0.71 (1.56 lb)</td>
<td>1.1 (2.42 lb)</td>
</tr>
<tr>
<td>Radio link range</td>
<td>Up to 1 km (0.62 mi)</td>
<td>Up to 3 km (1.86 mi), up to 8 km (4.97 mi)*</td>
<td>Up to 3 km (1.86 mi), up to 8 km (4.97 mi)*</td>
</tr>
<tr>
<td>Detachable wings</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cruise speed (km/h)</td>
<td>36 (22 mph)</td>
<td>40-90 km/h (25-56 mph)</td>
<td>40-110 km/h (25-68 mph)</td>
</tr>
<tr>
<td>Wind resistance</td>
<td>Up to 25km/h (15 mph)</td>
<td>Up to 45 km/h (28 mph)</td>
<td>Up to 45 km/h (28 mph)</td>
</tr>
<tr>
<td>Max flight time</td>
<td>30 min (w/ IXUS)</td>
<td>40 min w/S110, 30 min w/SQ</td>
<td>55 min</td>
</tr>
<tr>
<td>Coverage @ 122m</td>
<td>40 ha (100 ac) w/ IXUS</td>
<td>60 ha (150 ac) w/ SQ</td>
<td>200 ha (500 ac)</td>
</tr>
<tr>
<td>Control station</td>
<td>eMotion 1 &amp; 2</td>
<td>eMotion 2 &amp; Ag (in validation)</td>
<td>eMotion Ag</td>
</tr>
<tr>
<td>Release Date</td>
<td>2009</td>
<td>2014</td>
<td>2016</td>
</tr>
</tbody>
</table>

*in ideal conditions
Fruits of a thriving industry:
- Rapid development
- Several platforms
- Numerous sensors
- Lower price point, high volume
- Piles of data
- Few standards
Optical Payloads

- Modified vs filtered lens
- Single vs multiple lens’s
- Non-calibrated vs calibrated – panel?
- Uses irradiance vs no irradiance
Data Structure

Considerations:
- Formats
- Compression
- Layering
- Correction Parameters
  - Vignetting
  - Lens distortion
  - Dark current
  - Radiometric Cal.

Data Structure:
- Red
- Green
- Near-Infrared (NIR)
- Red-Edge (RE)
- RGB
Other Sensors

Flexible & Diverse Options:
• Not all systems have one type of sensor
• Ability to plug & play provides flexible data
• Each sensor generates different types of information
• Requires several different file formats
Processing & Data Overload

Merging Thousands of data points creates:

- Digital Surface or Terrain Models
- Reflectance Maps
- Index Maps
- Point Clouds
Drone Data Consumers

- Goal is to consume imagery for derivative products
- No simple implementation with so many aircraft, cameras and sensors
- Without simple ability to ingest an entire industry is at risk
Experience and Solutions Needed!

- **Standards**
  - Multi-band, filtered imagery
  - Data processing quality
  - Sensor calibration and certification

- **Data formats & compression**
  - Efficient and high-quality data transmission

- **Analysis**
  - More science and automation needed!

- **AgGateway Organization**
  - Promotes Ag industry eConnectivity
  - Remote Sensing Working Group
    - Use and promote existing standards
    - Publish for ag industry
Thank you!

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