Drones in Agriculture
The Saskatchewan Experience

Greg Adelman PAg
Crop Command Agronomy
RoboFlight Canada
@AdelmanGreg
Topics

• Where did I Start?
• What did I learn?
• What works best?
• How can remotely sensed images help agriculture?
• What holds back the general use of remote sensing in Ag?
• What do we need to do?
• What works for growers?
Where did I Start?

- Started with two fixed wing drones to learn the industry
- Each survived one season
- Flew over 50 missions with 50 hours of airtime piloting the aircraft
- In 2015 we upgraded to the RF-70, a Phantom, and a Manned Cessna Aircraft
- In 2016 operations were moved nearly exclusively to Cessna aircraft
What did I learn?

- Information gathered is the key
- UAVs have limitations in Ag
- The data gathered can help in decision making
- Cessna aircraft are an inexpensive and efficient way to collect data
- You have to provide more than a picture or more than a geo-rectified image
How can Remote Sensing Help Ag?

- Find underperforming areas of fields and determine the cause
  - Nutrient deficiencies
  - Water stress (high or low)
- Help in pesticide drift assessment
  - Determine accurate areas effected
- Help in any crop related insurance claims
  - Unseeded acreage, Hail, drought, or flood
- Survey large farm operations for any deficiencies
- Use as a tool for yield determination of some crops
Nutrient Deficiency
Nutrient Deficiency
Drought Stress and Herbicide Drift
Color Infrared Mosaic
Images acquired using a KSU small Unmanned Aerial System

Soybean

Corn

Healthier Soybeans

Drought Stressed

Computer Enhanced Image

Healthier Soybeans

Herbicide Drift
Insurance Claim Assessment
Herbicide Drift on Peas
Unseeded Acreage Report
Hail damage event took place June 21, 2014 in a soybean field near Hillsboro, North Dakota. Field was flown on July 16, 2014.
Large farm Surveillance
Monitor Crops from Above
Nutrient issues, double planting, soil erosion, poor emergence
Willcox, SK Canola Seeding
Yield Determination
1. Keith silt loam, 3 to 6% slopes, eroded
2. Keith silt loam, 1 to 3% slopes
3. Sulco-Ulysses silt loams, 9 to 30 percent slopes, eroded
4. Keith silt loam, 1 to 3% slopes
5. Keith silt loam, 1 to 3% slopes, eroded
Nutrient management zones
For variable rate nitrogen applications
COMPARISON BETWEEN NDVI AND CROP YIELD MONITOR MAPS FOR CORN

NDVI Map
Flown August 1, 2014

Crop Yield Monitor Map
Harvested October 16, 2014

2.5 months difference

220 lbs/acre nitrogen

Lower Yields

Higher Yields

Bushels

Low NDVI

High NDVI

0 50 100 150 200 250
31-27-21 Ground Sampling

629 Avg. Kernels/ear
26,000 Plants/Acre
85,000 Kernels/Bushel
185.6 bu/acre

544 Avg. Kernels/ear
29,000 Plants/Acre
85,000 Kernels/Bushel
140.7 bu/acre

192.4 bu/acre
443 Avg. Kernels/ear
27,000 Plants/Acre
85,000 Kernels/Bushel
Estimated Yield = 183 bu/acre
31-27-21 Harvest Yield Map

Actual Yield = 186.11 bu/acre
Conclusions

• Yield map variation correlates strongly with late season NDVI imagery
• Yield was predicted from NDVI imagery within 1.7% error 41 days prior to harvest with the minimum 3 ground samples collected for each color zone
• More samples could potentially increase accuracy, but in this example, the difference was negligible
What works best?

- Drones work best for research purposes where extreme high resolution is needed (<1cm)
- Drones cannot efficiently cover large areas of farmland in Saskatchewan
  - Drones can cover a maximum 1000ac per day
  - A Cessna can cover 20,000 to 300,000 acres per day
- Agronomists don’t have time to fly the field and then look at the data
- Data needs to be in the agronomists hands before they reach the field
What holds back Drones in Ag?

- Over promising and under delivering by manufacturers
- Growers not educating themselves in precision agriculture
- Equipment dealers attitude towards precision ag
- A defined ROI on the usage of remote sensing
What do we need to do?

- Educate growers in an unbiased matter
  - Lose the hype
  - Provide precision education to growers
- Get buy in from Equipment dealers
- Utilize the information as a page to the whole story
  - Doesn’t replace other forms of information
- Realize that remote sensing will empower agronomists
What type of Drones work for Agricultural Growers?
Questions?

Greg Adelman PAg
306-718-7210
greg.adelman@cropcommandag.ca