Five Valuable Business Lessons Learned About Drones in Agriculture

More recent (and better) datapoints show what works and what doesn't for growers, agronomists, and precision agriculture service providers

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This is the second in a new series of Skylogic Research white papers intended to share lessons learned within specific industries. These reports will help you as a business owner in those industries maximize the value that drones can deliver. This year we are building on the analysis we did for the 2016 "Truth About" papers by incorporating real-world experience gained from businesses and drone pilots operating under the Federal Aviation Administration's Small Unmanned Aircraft (UAS) Regulations (aka FAA Part 107). As of March 21, 2017, FAA data indicates there are more than 37,000 drone operators certified under Part 107 and 44,000 commercial drones registered in the U.S.

Introduction

Media headlines tell us that agricultural drones are revolutionizing modern farming practices. This one, "DJI and Kansas State Partner to "Feed the World", is just one example of the barrage of announcements for a new agricultural drone solution, a new data service, or a new academic program that promises to revolutionize farming. When you look beyond the hype, you'll find that drones are, in fact, proving real value to farmers on a daily basis. They are providing crucial crop vigor data that was previously unattainable or had taken hours to collect by ground vehicles or by foot. And while that may not constitute a transformation of agricultural practices, it is a significant trend worth assessing. It's our view that with the total value-add of worldwide agriculture estimated at $3.2 trillion per year, even a modest improvement in yield would have a substantial aggregate economic impact.

Two and half years ago our research indicated that small drones might not be able to deliver more usable data to a farmer or provide a cost benefit over the existing image solutions available to them. But a lot has changed since then. Agriculture drones have matured, and so have the sensors and analytical solutions that support them. A rising number of software vendors are targeting the agriculture space with increasingly useful solutions. And a new generation of drones is delivering much needed functionality.

So what have agronomists and crop specialists learned about what works and what doesn't? What have growers learned about operating their drones? And where do we go or what can we expect from here?

LESSON 1

Drones provide more value than just NDVI imaging

Perhaps the most touted use for agriculture drones is capturing images for Normalized Difference Vegetation Index, or NDVI. NDVI attempts to simply and quickly identify vegetated areas and their conditions, and it remains the most well-known and used index to detect the health of live green plants today. NDVI allows agronomists and producers to identify problem areas and make timely decisions. Scouting maps can be requested at key dates as guidance for field visits. NDVI-based scout maps show variations in the field, so users know where to look in the field to determine where corrective or preventative measures are needed. Users can plan their field visit locations, upload scout maps to their GPS or print out a PDF report, and accurately evaluate the reasons for in-field variability.

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But growers and precision farming specialists are increasingly discovering that drones are a valuable tool for their many other remote sensing applications on the farm. The main goal of any remote sensing is to detect something in time to make a correction. Examples include:

- Soil composition
- Irrigation
- Disease
- Fertilizer
- Drainage
- Crop damage
- Yield estimation

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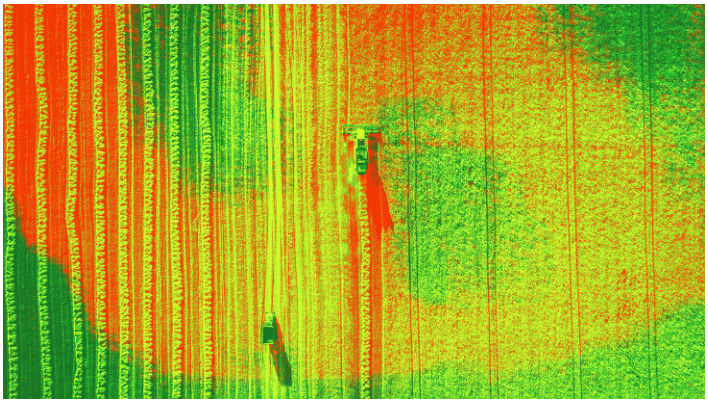
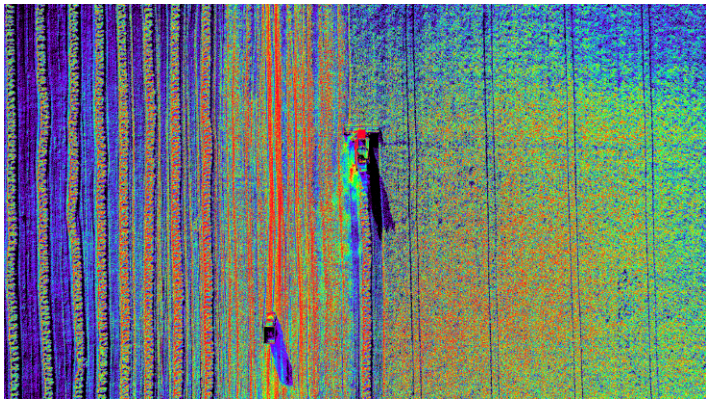
In Seven Ways to Use Drone Mapping on the Farm This Season, vendor DroneDeploy recounts how its users find applications for drones beyond just NDVI. Drone maps can be used to:

1. Crop scout to detect parasites and fungi
2. Compile plant counts
3. Analyze stand establishment
4. Generate variable rate prescriptions for nitrogen and pesticides
5. Assess and clean-up damage after a storm
6. Negotiate fair crop loss percentages
7. Assess slope and drainage after the harvest

ACTION: We recommend you begin assessing drones by using them to produce NDVI maps, plant counts, or storm assessments, and build upon that foundation first. NDVI maps require less workflow and software integration, and are an effective way to make the value case for future investments or service offerings.





LESSON 2

Using drone data for variable rate prescriptions is not a slam dunk

Crop vigor assessments that form the basis of prescription maps for field application is far more complex than all the other use cases, but is often the most cited for drones. These assessments typically involve acquiring NDVI, thermal, or stereoscopic images from sensors mounted on a UAS and then processing and evaluating the data for potential use in variable rate technology (VRT).

To be clear, much of the workflow and data processing happens outside of the actual drone use and is much more complex than most drone solutions let on. SenseFly has produced a step-by-step guide that explains how drones fit within the precision crop scouting workflow. This workflow applies to the most common varieties of row crops (wheat, corn, soya bean, etc.). However, you'll notice there isn't much listed under the last step, which is "Execute" because that's where it gets tricky. Most agriculture drone data and solution providers have provisions for downloading a map. But it's up to you to figure out how to make that map usable and get it into your brand of field management or GPS based VRT; brands such as:

- Ag Leader
- Climate Fieldview
- Encirca
- Farm Works
- FARMsever
- John Deere
- R7 by Winfield
- SST Software

Not every software solution in the marketplace is compatible with each ag solution provider's map-based prescriptions. The adoption of variable rate applications and shapefile (.shp) prescriptions has continued in recent years, so providers have file conversion tools for shapefile prescription compatibility with their software and displays.

To be fair, some solution providers have gone the extra mile and have done some "pre-integration." For example, DroneDeploy offers a John Deere app that allows you to upload aerial drone maps of your fields to your My John Deere account and plan flights based on your existing fields.

We think it's best to understand that there are three parts to the equation: the drone, the sensor, and the data platform. All three need to be tightly coupled as an end-to-end solution.

ACTION: Take small steps when implementing a VRT project using drone data. Choose which steps are appropriate for your practice and tackle them one at a time. Do a test run on a pilot project. See how you do, and then use the pilot project test on one field to prepare for farm-wide implementation.

LESSON 3

It pays to do your homework on agriculture drone solutions

Not all agriculture drone solutions are created equal, so it pays to do a bit of research before committing. There are many factors to consider, from software compatibility to price to technical capabilities such as:

- Can you get all the components—drone, sensor, software, and analytics—from one company?
- Is an internet connection required in order to process data?
- Will it integrate well with your existing tools?

Be advised that many solutions are stuck in the "picture fascination" stage. They give you thousands of great looking images, but then it's up to you to invest time to figure out what's important and determine what it means to get results. And while it's great that drones can produce so many good images, there's just limited value in that. The greater value comes in identifying what's important (like weeds) and pushing out that information in a consumable way (like an application prescription).

We think it's best to understand that there are three parts to the equation: the drone, the sensor, and the data platform. All three need to be tightly coupled as an end-to-end solution. It's our view that very few agricultural UAV solutions actually do that, so it's wise to look at the details. If you have to piece any two parts together yourself, then you risk the full benefit.

ACTION: The research process to find the best solution can be overwhelming and time consuming, but there is some good news. We've done a fair amount of this work already which you can access in our latest report Using Drones to Ensure ROI in Precision Agriculture. You'll also find a checklist there to help you determine which solution is the best fit for you.

LESSON 4

Calculating ROI is harder than you think, but worth the effort

There is no one-size-fits-all equation for determining the return on investment (ROI) of an agricultural drone solution. We believe it is a subjective exercise that's dependent on your needs and the particular problem you are trying to solve. After all, "ROI" is subject to the way you consume the vendor's service. Some vendors offer "freemium" pricing strategies in which they provide basic data services free but charge a premium for more advanced features and functionality.

One could argue that, to understand the value of any precision agriculture technology, you should calculate the "achieved cost savings" or "added yield." But in most cases, a precision agriculture technology is an integrated part of a larger system (for example, the software that controls the auto-steer on a tractor), so it's more difficult to show cause and effect. There are so many factors that affect cost savings or yield that trying to calculate it that way would understate the true impact of any one piece of technology. Drone-based data can impact outcomes in many ways such as:

- Reduced chemical use due to optimum distribution of agrochemicals
- Decreased weed and disease-related losses due to early detection and timely treatment
- Reduced environmental impact due to selective application
- Higher quality and healthier produce
- Better prediction and management of risks

ACTION: We advise agricultural drone solution shoppers to look at the range of features and pricing plans in a vendor's offering. ROI for you will be different from another based on how much of the service you want to consume. Once you've determined the features and pricing plans, sketch out a long-term ROI impact study that assesses these four areas:

1. **Financial –** you can collect data faster and take more acres under management more effectively
2. **Environmental –** fewer inputs, less fertilizer
3. **Efficiency –** saved time, only the right inputs
4. **Yield –** it's a clear implication but you would need to measure that over many seasons

LESSON 5

You need a license to fly a drone for commercial purposes, but it's not complex

In the U.S. there are now laws in place that require you to have a license if you are going to fly a drone for commercial use and that includes assessing fields, crops, or livestock that are part of a commercial farming operation. Beginning August 29, 2016, the small UAS Rule took effect. The rule says operators have to obtain a remote pilot certificate with a small UAS rating. Under this rule—also known as Part 107—the person actually flying the drone must have this certificate, or be directly supervised by someone who has one. The FAA has published a variety of documents to assist businesses seeking to be compliant with the new regulation. You can find an article with references to those documents here.

Licensing educates drone operators on important issues such as airspace, flying within line of sight, and other topics that promote safe flying habits. The good news is that it's not difficult to obtain that license. The process is outlined by aviation attorney and commercial pilot instructor Jonathan Rupprect here. Additionally, the FAA has published the Remote Pilot – Small Unmanned Aircraft Systems (sUAS) Study Guide to communicate the knowledge areas you need to study to prepare to take the Remote Pilot Certificate with an sUAS-rated rating airman knowledge test.

ACTION: Start studying. Resources abound like this Part 107 test study guide. This particular guide has the material the FAA suggests you study and also includes essential material they left out. Once you understand what the rules are, make a business plan for operations under Part 107. Go back and skim over the Part 107 Summary and read about Part 107 waivers (COAs) and determine if you need to perform non-107 types of operations such as flying at night or beyond visual line of sight.

What's next?

Drone manufacturers and Moore's Law are both hard at work—making things faster, lighter, and cheaper. At Skylogic Research, we are tracking the development of new sensor technology. That technology is progressing rapidly in agriculture drones and aerial imaging processing—more rapidly and at lower costs than satellite or manned aircraft. For example, the five major providers of drone image sensors today, MicaSense, Parrot, Sentera, Slantrange, and Tetracam, are working to tackle concerns over the lack of calibrated imagery from drones. Calibrated imagery provides the added value of monitoring crop changes over time. They are also working to solve the issue of images taken with cloud cover and differing sun positions. In a perfect world, data would come from a sensor with RBG, various light bands, and an ambient light sensor. Keep your eye on this space for more innovations.

That's our look at the valuable business lessons learned since Part 107 went into effect. There are plenty of opportunities, plenty of competition, and plenty of reasons for farmers and agriculture specialists to use drones in every phase of the growing process. Those that do will save time, make more money, and increase customer satisfaction. More important, they will not get left behind as the agriculture industry continues to digitize.