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UAV Industry Insight: DroneMate's Predictions

Introduction

How is the drone industry going to pan out? Who'll be doing what in three years' time? The only thing you know about a forecast is that it will be wrong; the interesting question is *"how wrong?"*

This paper looks at the New Zealand drone industry from the perspective of a Part 102 operator closely involved with commercial surveying. DroneMate is an established aerial surveying company, drone services and training company and a reseller of Sentera plant health sensors.

The paper takes our experiences and condenses them into a short review of where the commercial market is now and where it might be in a few years time. While photography, video and other media work will carry on growing, we don't see that as the main part of the future drone industry and so don't dwell on it. The big future is data.

Of course, DroneMate's predictions will also be wrong but we hope not as wrong as others. *Here goes*.

Surveying

In the right hands, drones are brilliant at collecting aerial data, whether normal [RGB] photos, specific light wavelengths (such as plant health) or heat (thermal cameras). Current regulations, technology and common sense dictate that drones don't go beyond line of sight which means for most surveys, someone's going to have to travel to the survey site.

Let's say the drone operator travels 50kms to fly a survey. ***The typical costs for this might look like:***

	COST ITEM	SAMPLE SURVEY ASSUMPTIONS	COST
1	Travel	50 kms each way at $0.72/km	$72
2	Travel time (labour)	1.5hrs at $100/hr	$150
3	Survey cost (labour)	1hr on site, 50ha, 2GB of data	$100
4	Survey cost (equipment)	$3500 UAV, 3yrs life, 2hrs/wks, 48 wks/year	$12
5	Data sharing	Subscription to data sharing system, $500/year	$5
6	Data processing	Highly variable, starting from $0 (no processing)	$0+
	Total	***Excluding processing***	***$399+$6.7/ha+***

Ignoring processing (we'll get to that later), travel is 65% of the total survey and the largest cost component by far. This rings true for anyone who has asked us to travel a long distance to do a survey. "No problem, collecting the data will take a couple of hours and cost perhaps a few hundred dollars, but getting there and back is another $1000".

The next highest cost is survey labour (30%) and then comes the hardware costs and data costs, which are small (5%) and decreasing.

Every year the drones, sensors and software become cheaper, better and easier to use. The DJI Phantom 3 brought usable reliability when compared to the Phantom 2, and the Phantom 4 brought super-reliability and much easier use. This trend will probably continue with the next model: more functions, less money and less stress.

The same applies to software. A good autonomous flight planner will fly your drone autonomously over a site to collect data while also staying at exactly the same height above ground. Programme in the field, heights and a few extra things, press "go" and the drone does it and returns. The cost? $30 for a forever licence. Most flight planning aps are free.

And the internet keeps getting faster. Sending local data to anywhere on the planet is easy and getting easier every month.

Summarising the survey costs:

1. It's mostly travel;
2. The actual survey data can be done often really quickly;
3. Almost all surveys have the smart drone doing the flying; and
4. And the data gathered can be sent anywhere on the internet.

Survey Skills and Requirements

We talk to the people on site whenever we are flying a survey. 90% of the time they say "I reckon I could do that" and 90% of the time they are right. Pretty much anyone can, with some training. The interesting thing is they are on site anyway and, while watching the show, are not actually doing any work.

You don't need a PhD to work out how commercial drone usage will grow: it will be local people surveying sites near them or where they work.. This means lower labor costs.

All surveys are not the same, though. Some require more skills and better equipment and the market is just beginning to understand this. For example, surveying flat land for a plant health map is very different to mapping landslips over steep terrain. The complexities boil down to four main factors:

Survey Requirement	Skills/Equipment Required
High geospatial accuracy, i.e. the map's location and orientation on the globe	Use of ground control points, surveyors and/or specialist drone GPS equipment [RTK]
High resolution, i.e. for specific plant identification and complex terrain	Lower flights and/or better drone cameras/ sensors,and good flight planning software
Specialist light wavelengths, i.e. for plant variety and health	Specialist sensors on the drone, potentially a bigger drone and software to understand the sensor output
Complex airspace and regulations on site	Specialist drone operators allowed to operate in complex environments (Part 102 etc)

A surprisingly large number of surveys don't need the accuracy the clients think they need. For example: if surveying a pile of gravel to assess its volume, does the resulting map have to be orientated accurately to within 2cms in all dimensions on the globe? Most unlikely; clients usually want to know the dimensions of the pile to within a margin of error but couldn't care less whether its 150.25m or 150.75m above mean sea level.

Agriculture is another good example: a run off map showing where the water flows and pools needs to be accurate with regard to elevations. Very often maps are accurate from edge to edge but the whole map may be slightly 'tilted' due to Z axis [height] error. For drainage, an erroneous tilt of 1m across a 200ha farm could mean a different flow regime and may require tight surveying standards. Conversely, a survey looking at plant health across the fields is unlikely to care whether the map has a small tilt.

As the industry learns that not all surveys are equal and that some are easier than others, DroneMate see the survey market diverging into three segments:

1. Simple, repeatable surveys, e.g. surveying an aggregate stockpile. The area to be flown stays the same and the flight mission can be pre-programmed. At the end of the month, say, and if weather conditions permit (checklist), the site manager sends up the standard issue drone to fly the survey.

2. Repeatable but more complex, e.g. surveying a farm with specialist sensors (NDVI etc). The areas are known well and there are two or more types of flight missions, i.e. perhaps an RGB survey and a plant health survey. When asked by the farmer, the local drone company drives a few kms and uses a more or less standard drone with specialist sensors on board.

3. Complex: each job requires planning, integration with other functions (surveyors) and perhaps specialist equipment. These jobs, such as water run off analysis for council consenting, can require a super-accurate map and will require higher skills and equipment to get the accuracy.

The three segments lead towards three types of drone operators:

1. In-house, i.e. employees on or near site trained on specific missions.
2. Local operator, i.e. the nearest town has a multi-skilled operator who can do a variety of standard and non-standard surveys at short notice.
3. National operator, i.e. the highly specialised drone services company doing one-off projects, each of high value.

The skill level, equipment and commitment level are very different for these three segments:

Market Segment	Skill level	Typical Equipment	Commitment
In-house	2 or 3 days generic drone training, survey training & flight planning	Standard drone, replaced every 3 or 4 years	Limited
Local Operator	Beyond drone training, several courses on surveying, data analysis & complex terrain surveying experience	Standard mid-range drone (plus spare drone) with battery banks, special sensor & data management software	Moderate
National Operator	Highly trained & experienced	Suite of drones and sensors, dedicated data management & analysis software	Significant including Part 102 certification

Each of these segments has a different cost structure and resulting survey cost.

DroneMate has found that after talking to the client about what they want to do with the survey, we can often adjust the quality of the survey to deliver a product the client wants at a price they are prepared to pay. Clients don't yet understand the trade offs in this process but when they do, the opportunities for drone operators will be enormous.

Processing and Analysis

Collecting the data is only one part of the supply chain. The whole surveying "value chain" or "supply chain" actually has four essential components:

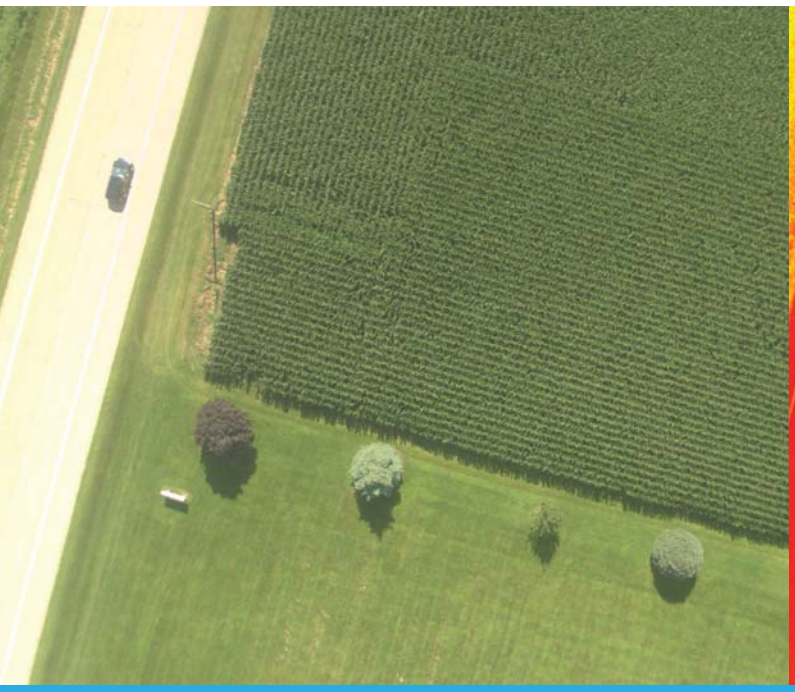
1. Data acquisition, i.e. flying the survey and getting the data;
2. Processing the data into a coherent map or survey file structure;
3. Analysis, i.e. turning data into information, and
4. Sharing and taking actions on the information.

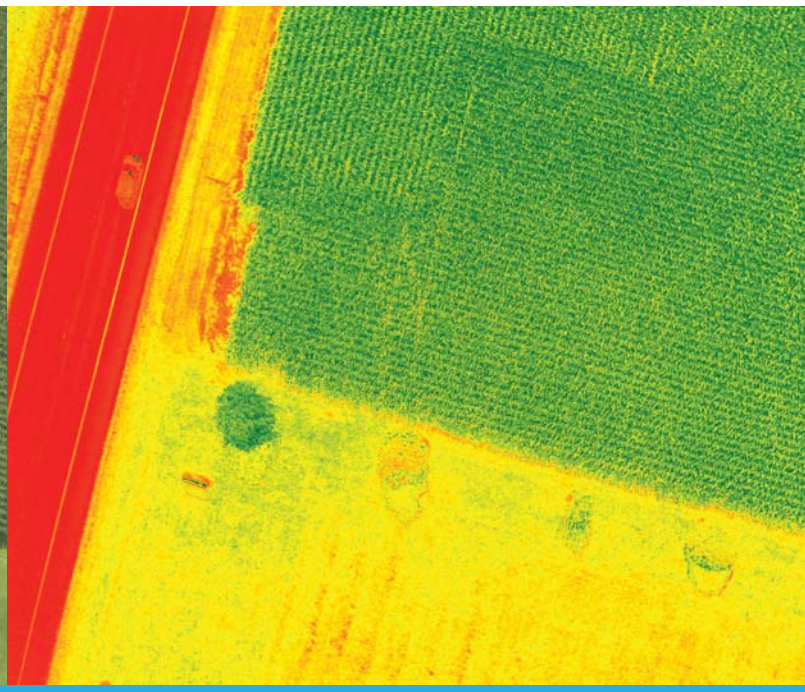
After collecting the data, the next step is how to analyse the data and then make decisions. Once the survey has been flown, thanks to fast internet the data can be moved effortlessly from the survey site to anywhere in the world. This is a huge opportunity for the drone industry:

1. The drone surveyor only needs to know how to collect a good survey;
2. Data processing and analysis can happen anywhere in the world, such as in cloud processing centres and where the analytical expertise lives;
3. Data can be agglomerated to provide extensive data on which to do analysis and build machine learning; and
4. The information from the analysis can also be shared with anyone, anywhere.

On top of this, processing data into a coherent map or a "valuable format" is getting dramatically easier and cheaper. For example, both DroneDeploy and FieldAgent process either free or low cost orthomosaic maps on demand and can develop analysis zones within a survey field nearly instantly.

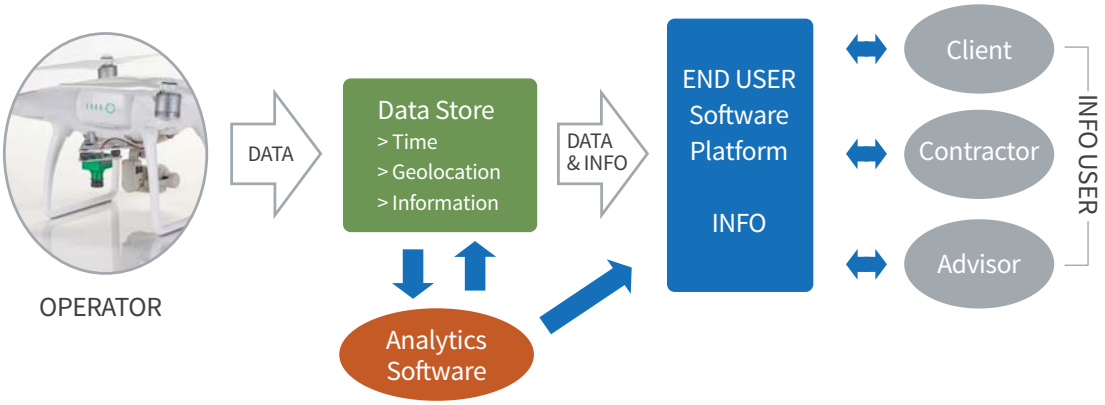
Software and sensor technology are moving so fast that the dream of "the drone lands and within minutes there's an accurate map available" is soon to be reality. The key is to make sure the drone operator is sufficiently skilled to collect good quality data that will then lead to a good quality map.





Three Data/Information Entities and Their Owners

The “processing, analysing and sharing” steps actually require three distinct “systems”, as shown in the diagram below:



A definition of the three systems is:

Data store: a [probably cloud-based] hub for raw survey data that stores and facilitates the use and sharing of data.

Analytics: a platform where large amounts of data can be accessed and algorithms run over it.

End user platform: where the ultimate client can review the survey information, share it with others such as their advisers, relate it to other inputs and make decisions.

The USA is showing that these three systems are usually separate , they are unlikely to be combined into one platform in the near future for three reasons.

Firstly, the end user (farmer, contractor, quarry owner etc) wants a minimal number of information platforms for their business. For example, a plant health map needs to be associated with moisture readings, application history (fertiliser placement, pesticide etc), planting and historical yield data to see the complete field picture.

Most end user platform providers are and will stay as, regional/national companies. They need to know their customers and the local farming environment intimately because they rely on their subscriptions. There are currently many end user platforms; the near future may see fewer, perhaps grouped around fertiliser providers, equipment providers or farm service providers who have the capital and client base.

Secondly, analysis is getting more and more niche. Analysts create value based on huge amounts of data and a depth of understanding of a narrow field. For example, sweetcorn nitrogen stress algorithms are being developed by the University of Minnesota, helped by the fact they are surrounded by sweetcorn fields and have access to sweetcorn data. They would have limited skills, aptitude and desire to analyse grass dry matter in New Zealand, especially if they don’t have any data.

Analyst/developers create value for themselves by selling the analytical tool, making it available to as many as possible for a fee ($/acre, $/mth etc). It makes no sense for them to be exclusive to one data store or regional/national end user platform as the reach will be too narrow.

Thirdly, drone data storage and sharing is not noticed by the ag industry as the issues are drone, not farm, related. But without a cloud-based system that organises, verifies and geolocates images, and enables sharing to customers and stakeholders, most drone operations struggle to keep track of their own data.

The volume of data a drone collects very quickly becomes unmanageable. This makes 'raw data storage' unappealing to end user platforms as it would clog them up. They want information, not data.

Drone surveying in New Zealand has been hampered by a lack of understanding of these three systems:

- Clients want information rather than a USB stick with a thousand images on it.
- Drone operators don't have the skills or resources to get valuable and timely insights to their clients. They fly drones and are not analysts.
- End user system providers can't get the data their clients want because there aren't smart drone operators nearby who can send them the data or information they can input.

Over the next few years the linkages and relationships between data store, analytics and end user platforms will develop to present a cohesive solution to end users. This is happening at top speed in the US.

Conclusion

Drones are a transformational technology that will dramatically reduce the cost of data collection. At the same time, the value of the data will be massively increased by smart analysis and learning systems, all facilitated by seamless data movement around the globe.

The scenario set out above is DroneMate's view, developed over several years flying drones, doing surveys, using sensors, marketing sensors and delivering information to clients. What comes next is going to be interesting. We see four big NZ trends starting:

1. Understanding that owning a drone does not make you a commercial operator. Drone operators need to provide solutions to customers, not USB sticks. For everything but real estate and video work, future drone operators will need data store and access to analytical tools, both with easy interfacing to other systems, to manage the data and actually help customers.

2. Customers wanting surveys will learn (1) how easy a drone is to use and (2) that they can do simple surveying themselves, with some training. This will see a huge growth in companies buying drones and using them on site, and the associated training to make their people skilled enough for the survey tasks they need to do.

3. End user software platforms will realise drones can add value to farms cost-effectively. Large scale imaging, especially from satellites, may cover huge swathes but it is often expensive, low resolution and hampered by NZ weather. The arms race to capture the end user and their information will lead to relationships between drone companies and platforms, and the rise of the committed local drone operator model described earlier.

4. In line with the above, the ag and drone industries will develop standard protocols for transferring maps and data. The current cries of "success!" when a map from one system is moved to another and then actually works will become a thing of the past.

We hope you have enjoyed this exploration of drone industry strategy. We welcome all comments and love being shown to be wrong. That's how we learn.

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