



Drone-based Aerial Intelligence in Precision Agriculture

PrecisionHawk's drone-based aerial intelligence platform gives agriculture professionals greater access to data about their farming assets and day-to-day operations.



KEY TAKEAWAYS:

- Founded in 2010 to serve vintners, PrecisionHawk's aerial intelligence technology is built on nearly a decade of work with leading global agricultural research firms and independent farmers.
- From scouting crops to generating prescription maps, PrecisionHawk's drone-based solution supports a wide range of farming applications.

TABLE OF CONTENTS

01...Executive Summary

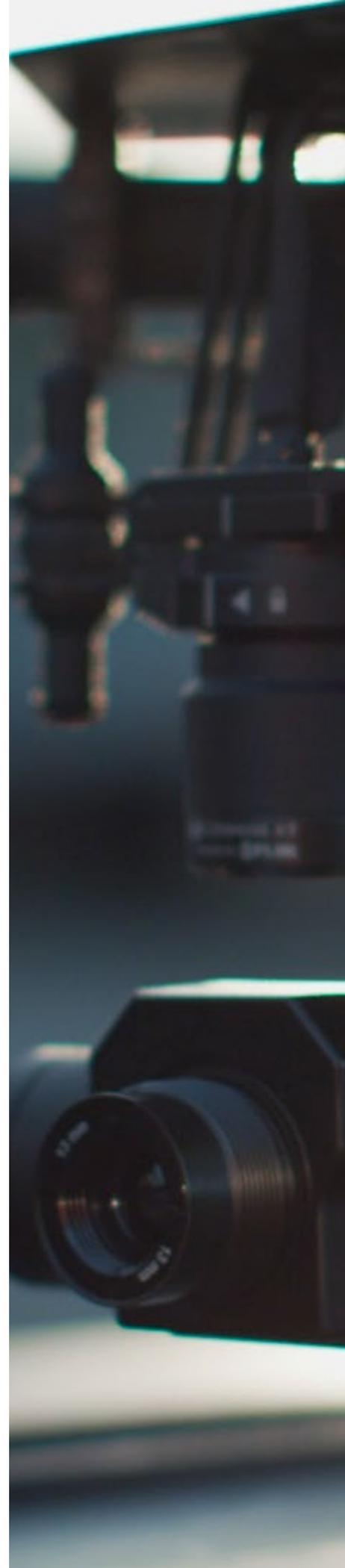
- 03...About PrecisionHawk
- 04...The Growth of Precision Agriculture
- 05...A Simple Solution
- 07...PrecisionHawk's Agriculture Solution

08...Our Drone-Based Ag Solution

- 11...Discover**
- 11...Collect**
 - 12...A typical mission
 - 13...Flight Operations and Training
- 14...Process & Analyze**
- 16...Report, Integrate, and Action**
 - 16...Export What you Need
 - 16...Integrate with Your Data Management System

17...Put Drone-based Aerial Intelligence to Work

- 19...Why Choose PrecisionHawk?



Executive Summary

03...About PrecisionHawk

04...The Growth of Precision Agriculture

05...A Simple Solution

07...PrecisionHawk's Agriculture Solution



Smart farming is a fast-growing global market that is expected to reach at least \$13.5 billion by 2023.¹

Also called “smart agriculture” or “precision agriculture”, the introduction of drones, computer vision, autonomous machinery, and big data analytics into traditional farming methodologies is a watershed moment for the agriculture industry.²

At the center of this growing modernization movement are farmers with decades of farming knowledge. They find themselves at the crossroads of relying on practices that, though proven, leave potential profits in the field and embracing new technology that promises greater yields and efficiencies, but might seem unnecessary, time-consuming to learn, and daunting to adopt.

What’s needed is a simple solution for collecting and analyzing data. Agriculture technology (“Ag-tech”) is rapidly changing to meet this need—universities and technology-minded companies are now leading research on drone applications in agricultural settings.^{3,4}

¹ <https://www.businesswire.com/news/home/20180813005432/en/Global-Smart-Agriculture-Market-2018-2023---Analysis>

² <https://www.forbes.com/sites/lorinfries/2019/01/23/smart-farming-through-the-internet-of-things/#7d426d2be893>

³ <https://www.uta.edu/news/releases/2019/02/USDA-Su-agriculture-data.php>

⁴ <https://www.precisionag.com/service-providers/business-management/progress-and-trends-shaping-higher-education-in-precision-agriculture/>





PrecisionHawk's drone-based aerial intelligence platform gives agriculture professionals greater access to data about their farming assets and day-to-day operations.

About PrecisionHawk

PrecisionHawk strengthens business intelligence with drone-based remote sensing and analytics. We make enterprise operations safer, more efficient, and more effective.

Founded in 2010

\$107M raised

200+ employees

15,000+ drone pilots
in-network

Rated "A" by ISNet



Granted the **first**
BVLOS waiver
by the FAA

Learn more about us at PrecisionHawk.com/agriculture

THE GROWTH OF PRECISION AGRICULTURE

New technology does not automatically garner improvements. There is a line between what is practical to adopt and what is just a different way of doing business. What matters in agriculture is that farmers are able to use the best tools available to ensure optimal crop or livestock performance.

PrecisionHawk understands this objective and believes that adopting a new framework for agricultural best practices should be seamless and straightforward, not costly and time-consuming. And new software must fit into existing farming infrastructure.



Even today, there is a lack of precise, historical data that a farming operation can use to make prescriptive changes to a field. Sure, farmers may have access to dated soil-maps or previous season yield data or even point-collected soil samples, but many struggle to convert such information into directed action. Furthermore, the data products might lack the granularity necessary to make to account for the level of variation that might exist in a field.

Manual surveying of only small sections of fields or herds is time-consuming and error-prone. This leads to data inconsistencies and inaccurate prescriptive actions. **With a bird's eye view, drone operators can gather precise data** on hundreds if not thousands of acres in a day.

A SIMPLE SOLUTION

With drone-based aerial intelligence, farmers can collect and analyze data from their crops that, until now, have been inaccurate and incomplete. **On the PrecisionAnalytics platform, a farmer can monitor crop health and yields, verify stand establishment, and run a myriad of other analytic reports, all at the click of a button.**



With PrecisionHawk's PrecisionAnalytics software, these data projects are streamlined, with answers returned in minutes instead of days or weeks. PrecisionAnalytics allows a farming company to:

Map farms with visual, multispectral, and thermal sensors

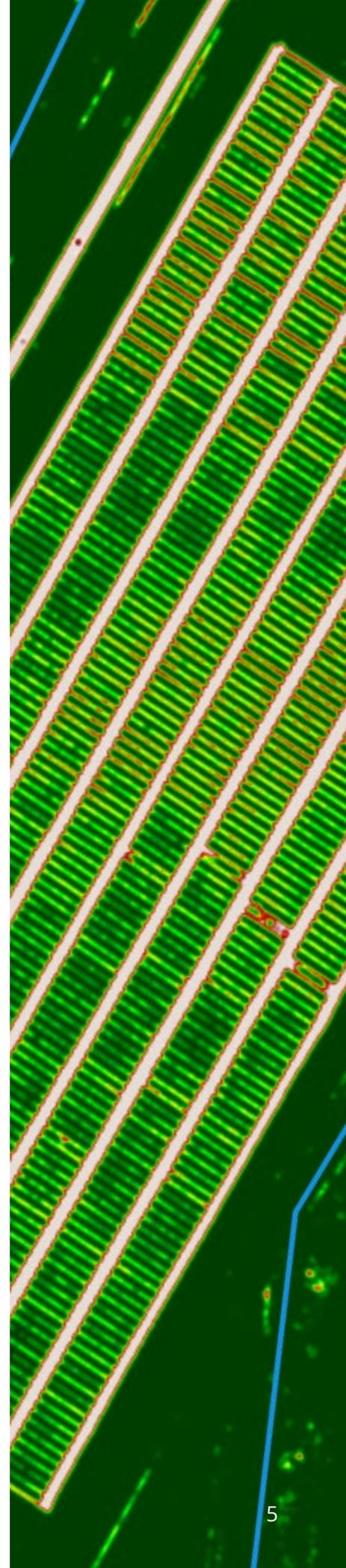
Monitor plant health with an array of vegetative analytics

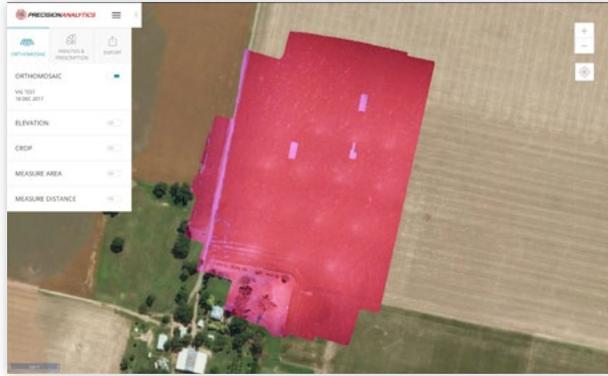
Generate plant counts and forecast yield

Define custom zones for summaries of analysis

Conduct time series analysis of field/crop performance

Produce dynamic reports that show user define areas of interest





PrecisionAnalytics also allows:

- Optimize input timing
- Create prescription application maps directly in the interface
- Assess and measure the extent storm damage
- Inventory tree crops and assess individual tree health
- Detect trial plot boundaries for precise aggregation of research data
- Determine optimal foraging areas
- Easily share data without the requirement of a PrecisionAnalytics account

We've built our service on years of agricultural operations research as well as work for the world's leading agricultural companies.

As a result, our customers can access enterprise-grade aerial intelligence in a simple, turnkey service for actionable results.

Farmers can harness the same data to identify and correct areas of concern before a planting season, during the growing season, or before harvest.

➔ THE NUMBERS

Manual agricultural surveys require an average of 11 paid labor hours per acre.

PRECISIONHAWK'S AGRICULTURE SOLUTION

PrecisionHawk's solution goes beyond simple data collection, providing powerful processing and reporting tools in a streamlined platform. We've made it easier than ever to use aerial intelligence on farms and ranches.

Drone-based aerial intelligence with PrecisionHawk can make your agricultural data collection:

- ✔ **More accurate**
- ✔ **Standardized in one dashboard**
- ✔ **Scalable and repeatable:** drone pilots at the ready and a secure, online dashboard to archive your data.
- ✔ **More efficient:** counting plants using drones is faster than ground-based counting.

Manual surveys require an average of 11 paid labor hours per acre.

PrecisionAnalytics cuts out the guesswork so farmers can spend less time compiling and interpreting their data, and more time taking action with their data—making changes to fertilizer amounts or harvesting schedules. PrecisionHawk easily integrates with farm management systems for increased flexibility and ease of asset management. Agricultural companies can leverage aerial intelligence for use across multiple sites and in remote areas.



“At the end of the day, what we are really doing is helping with asset management.”

—Bobby Vick, PhD, Director of Agriculture, PrecisionHawk

Our Drone- Based Ag Solution

11...Discover

11...Collect

12...A typical mission

13...Flight Operations and Training

14...Process & Analyze

16...Report, Integrate, and Action

16...Export What you Need

16...Integrate with Your Data Management System

Your data collection and analysis is a value chain.

Each incremental professional, procedure, and tool that you incorporate into the process should add value for the end result.

Knowing this, we've designed our solution to strengthen every step your operations. From identifying sources of insight to processing, analyzing, and distributing information, **PrecisionHawk's drone-based solution is purpose-built for the entire data lifecycle.**

➔ DID YOU KNOW?

PrecisionHawk started as an agiculture business in 2010, collecting aerial images of plants and extracting crop data.



Here's what the process looks like:



DATA VALUE CHAIN
DISCOVER



Adopting an emerging technology can be daunting. But—having started as an agriculture business in 2010—**PrecisionHawk employs industry experts who can help you develop an approach to drones.** From proof-of-concept to global scale, our consultants can assist you in defining a comprehensive strategy, not just a point solution.

First, they'll learn what you aim to measure, identifying data to be collected or project parameters to be tested. Then, they'll help you choose which drones and sensors to use for collecting data. Finally, they'll assist you in developing processes and safety systems, fit for single family farms or a multi-national agriculture enterprises.



DATA VALUE CHAIN
COLLECT



Once an area of interest (AOI) has been identified, data must be collected. To execute missions, drone operators use our flight software, PrecisionFlight. The system's intelligent flight planning enables operators to quickly and easily deploy autonomous missions that are safe and comply with regulations.





A typical mission

1

Prior to a mission, the drone operator uses an intuitive drag-and-drop interface to define an area of interest. The software automatically optimizes the flight plan based on the objective, surrounding terrain, and no-fly zones.

2

Once on-site, operators load the plan (no connectivity required), deploy the drone, and monitor it—using flight telemetry—as it automatically captures data over the area of interest.

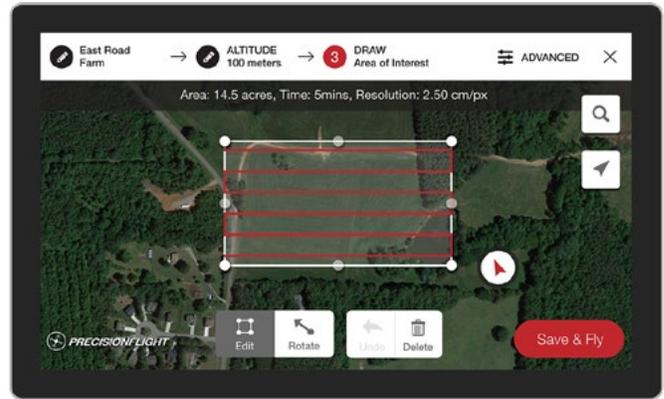
3

The drone captures imagery of the given field or asset. If issues requiring further inspection surface during autonomous flight, the operator can manually navigate to the area of concern.

4

After the mission, the pilot can “replay” the mission to assess mission efficacy and optimize the flight plan.

While capturing field conditions at a single point in time is useful, **you gain greater insight by tracking trends over a given period.** Using PrecisionFlight's repeatable flight plans, operators can capture multiple data sets, from separate missions, that precisely correlate.



PRECISIONFLIGHT AGRICULTURE

PrecisionFlight's advanced features make drone-based crop assessments accessible. With limited training, anybody can conduct safe, fast, and effective missions.

FLIGHT OPERATIONS AND TRAINING

Choosing the right drone operations strategy is critical to limiting the time and money you spend collecting data. **Our consultants can help you determine whether outsourcing, insourcing, or a combination of both, is right for you.**

With PrecisionHawk, you get immediate access to drone operations on a global scale. The largest of its kind in the world, **PrecisionHawk's Drone Pilot Network boasts more than 15,000 licensed operators** who are available to fly any site in the United States within 24 to 72 hours.

If you'd prefer to insource your drone operations, we can help prepare you and your staff. Whether they're seasoned aviation professionals or workers who have never before flown an aircraft, our trainers can give them ground and flight training. **As a result, you'll get safe, efficient, and effective insourced drone operations.**



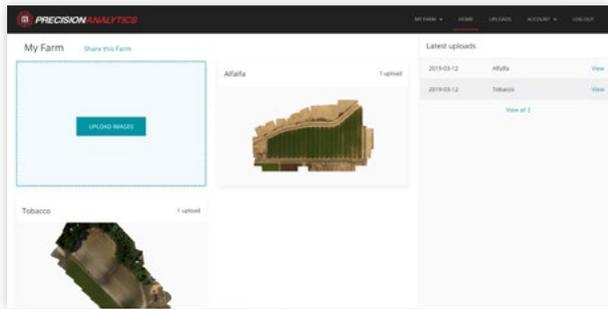
DRONE PILOT NETWORK HEATMAP

DATA VALUE CHAIN

PROCESS & ANALYZE



This stage is overseen by our data scientists as the sensor data is processed by our on-premise agriculture-specific algorithms that interpret the data and build actionable reports. Once uploaded, **you can call a number of on-demand analytics for instantaneous data visualization.** Easily apply analytics to count trees in an orchard or heads of cattle and evaluate their health.

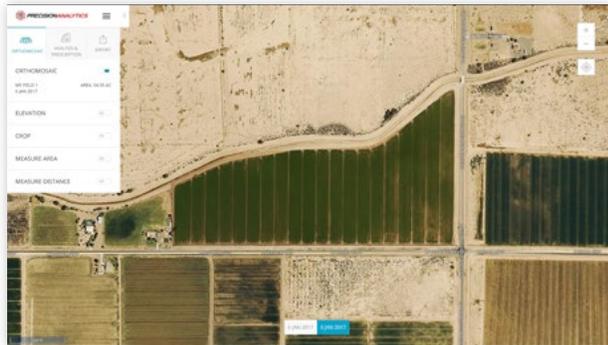


Multi-farm and -field management—

Navigate all your properties and associated data in a single, streamlined portal.

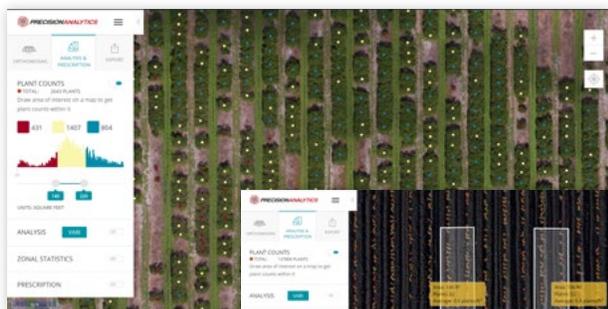
Crops at a glance—

Review overall health of plants to surface issues such as over-fertilization, flooding, or disease.



Detailed views—

View full-resolution imagery and zoom in on key issues.



Instant precision plant count—

Quantify the number of plants or livestock in an area.



Tree crown sizing:—

Delineate canopies for sizing larger plants, such as trees or vegetable crops.



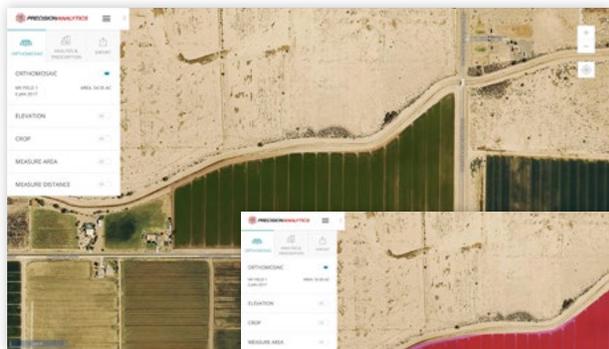
Vegetative indices on demand—

Select from GRVI, VARI, NDVI, NDRE, SAVI, and ENDVI based on the age of the crop and what kinds of damage you’re looking for. Use a simple slider to adjust the color scheme of an index to emphasize areas of stress.



Zonal and plot statistics—

Shape your analysis to the unique characteristics of a field by defining custom zones or creating automatic and custom-defined plots. You can then calculate aggregated statistics on an area-by-area basis— from large zones to small plots—and export statistics for each one.



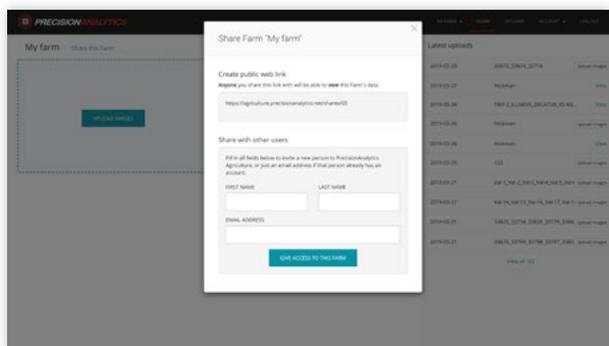
Comparison view—

Toggle between multiple datasets to analyze trends in crop growth.



Optional downsampling—

Low connectivity while on-site is common; upload lower resolution imagery to speed the process in areas with poor connectivity or slower connection speeds.

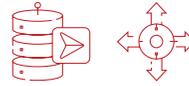


Shareable web links—

Easily share data with your customers to foster transparency and customer satisfaction. Customers can interact with the data.

DATA VALUE CHAIN

REPORT, INTEGRATE, AND ACTION



Once you've used PrecisionAnalytics to produce findings, it's time to take action. But how do you give cross-functional and external stakeholders the insights they need—without exposing them to overwhelming detail? And how can you integrate your aerial data into other systems?

By using PrecisionAnalytics Agriculture's flexible reporting and integration features.

Export What You Need

PrecisionAnalytics Agriculture lets you quickly export files, reports, and maps. For example, you can download an orthomosaic at whatever resolution you choose; a shape or CSV file of your zonal or plot statistics; a plant health map; an elevation map; prescription reports; or PDF reports of map views with your selected vegetative indices, zoomed into areas of interest.

Integrate with Your Data Management System

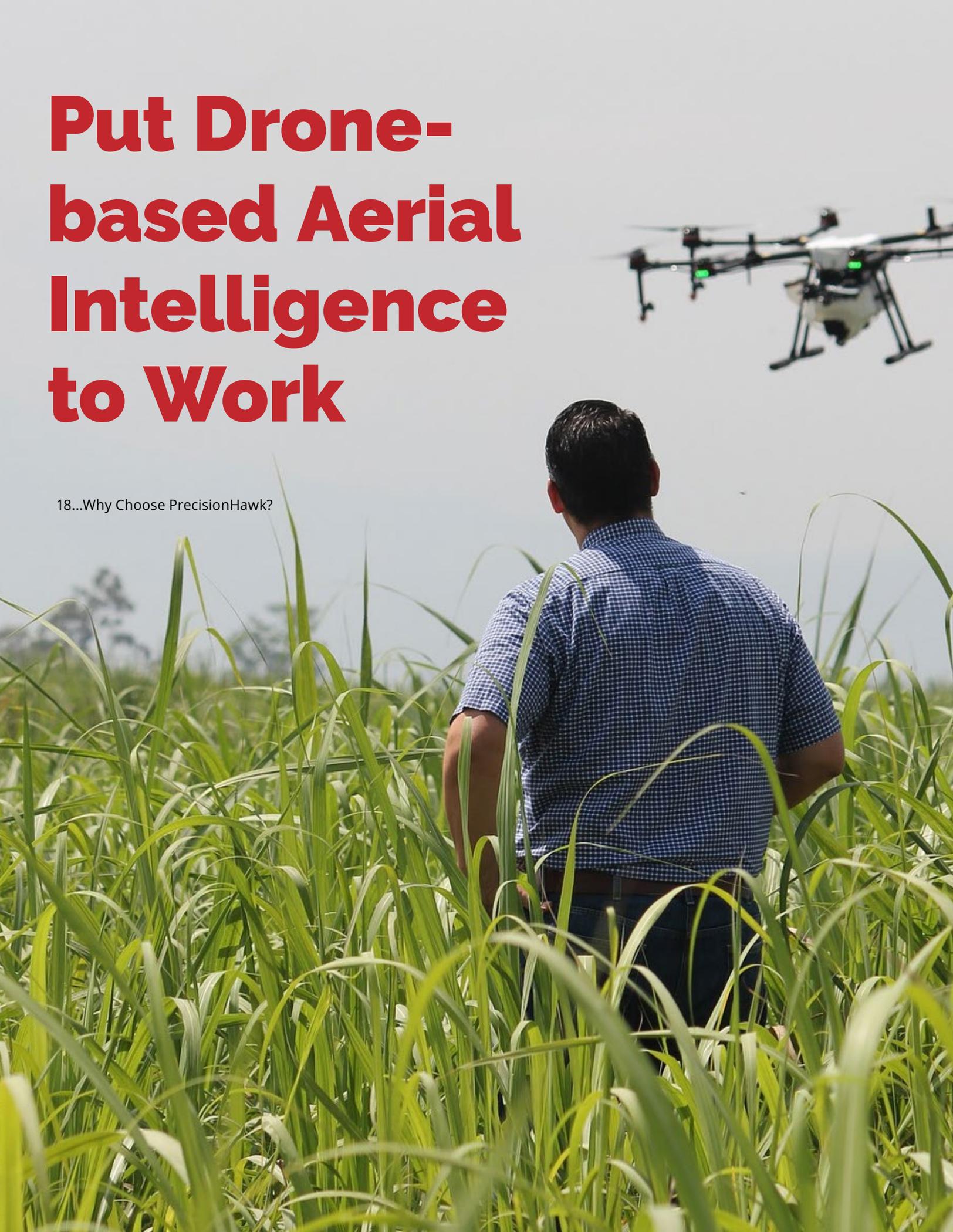
Our web interface lets you export data into your farm management system, enabling you to automatically turn data into action. Deliver prescription files into automated fertilizer and irrigation systems. Blend aerial intelligence with other field statistics to forecast yield. Ultimately, you own your data—take it anywhere you need it.

➔ THE NUMBERS

View fully rendered orthomosaics, with all accompanying statistics, one hour after data upload.

Put Drone-based Aerial Intelligence to Work

18...Why Choose PrecisionHawk?



As data collection and analytic methods develop over time, and environmental unknowns become standard operating procedures, farmers will require a more accurate understanding of their assets to stay competitive.

They will rely on data analysis provided by drone-based imagery to make smarter decisions in less time to ensure the optimized performance of their crops. PrecisionHawk enables that flexibility for our agricultural customers who are taking the first steps in growing a more reliable data collection and analytics program.

And we're ready to help. **PrecisionHawk is committed to stewarding smarter, safer, and economic farming practices.** Our agricultural experts will assist in your evaluation of when, where, and how to incorporate drone-based aerial intelligence into your operations. Our global network of drone operators is ready to execute flights on your behalf. And our engineers are continuously optimizing PrecisionAnalytics to better automate and accelerate your analysis.

PrecisionHawk provides highly accurate agronomic data that is both cost-saving and time-efficient, enabling smarter decision-making in days instead of weeks. From the small family farm to enterprise operations with multiple sites, agricultural professionals are using drones to get a more holistic view of their farms.

Learn more about PrecisionHawk:

WWW.PRECISIONHAWK.COM



WHY CHOOSE PRECISIONHAWK?



Experience—We specialize in serving enterprises, including Fortune 100 companies, and federal and state government agencies, however, we got our start in agriculture and understand its nuances and challenges.



Increased Accuracy—Data collected by drone imagery is more accurate than that collected by manned aircraft or by manual survey methods.



Objectivity—PrecisionAnalytics provides proven algorithms that are tailored for individual sensors and crops.



Seamless Data Management—Our easy-to-use dashboard allows for easy transfer of data to farm management systems so that records and prescriptions can reside in a single system.



Efficiency—A drone can image 500 to 1,000 acres a day; compared to a human collector ensuring you're getting clean data, faster.



Machine Intelligence—PrecisionAnalytics runs on the newest artificial intelligence platforms, trained using terabytes of data from thousands of drone missions.



Hardware Expertise—Career pilots, engineers, and data analysts maintain PrecisionHawk's portfolio of cutting-edge drones, sensors, and ground-based equipment.



Scale—More than 15,000 licensed pilots are available to fly any site in the United States within 24 to 72 hours.



Safety and Operational Excellence—Our flight operations are founded on Naval aviation principles, earning an A-rating from ISNet.



To speak with one of our consultants about agricultural solutions, [contact us](#):

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PrecisionHawk was founded in 2010 and got its start in viticulture, flying drones over vineyards to keep pests away.

From there, collecting aerial imagery of plants to extract crop data was a natural next step.

Today, PrecisionHawk is dedicated to changing the way businesses view their assets and manage resources. To extract the true commercial value of drones, we must continue to advance a multifaceted technology that includes advanced robotics, robust data collection and analytics software, and cutting-edge sensor technology.



CEO, MICHAEL CHASEN



PRECISIONHAWK DRONE PILOTS