



**SLANTRANGE**

IMPROVING AGRICULTURE FROM ABOVE

**2017 Product Guide**

# SLANTRANGE

## Agricultural Information Systems

SLANTRANGE systems combine powerful analytics tools with accurate and reliable measurement sensors to deliver to **the most actionable and immediate crop information ever produced for agriculture.**

This, our all new Product Guide for 2017, shows you how.

### Immediate Analytics. Anywhere.



SLANTRANGE systems deliver the information you need at the time and place you need it.

That means pushing powerful analytics tools out and away from the cloud and into the field where your decisions need to be made.

The SLANTVIEW analytics platform delivers an entirely new approach to crop measurement and analysis – one that works for agriculture.

What does that mean for you?

- ⚙️ Valuable new classes of information enabled by low-altitude measurement
- ⚙️ Immediate, on-site results without any need for network connectivity
- ⚙️ Far more efficient collection and processing workflows for lower operational costs
- ⚙️ Exportable data to be consumed wherever, whenever, and however you'd like

### Powerful, Accurate New Measurement Systems

New for 2017, we introduce the most powerful on-board processing system in the industry for immediate, in-field results. Built around the Qualcomm Snapdragon processor, the SLANTRANGE 3p extends modern analytics to all of the world's agricultural acres, not just those within easy reach of a fast internet connection.

Invented by SLANTRANGE. Patented by SLANTRANGE. Every SLANTRANGE system includes on-board sunlight calibration for unmatched radiometric accuracy since 2014.



# The First in Information Accuracy

Good agricultural decisions and forecasts depend upon good information. So at SLANTRANGE we make **reliable, accurate measurements the cornerstone of product design** and a continuing area of innovation.

## Accuracy in Measurement

Changing sunlight conditions will affect your results. Clouds will appear like stressed areas. Measurements taken at noon will give different results from measurements taken later in the day. Without correction, forecasts and trends become highly inaccurate.



**SLANTRANGE's Patented Ambient Illumination Measurement System Corrects Data for Changing Sunlight Conditions**



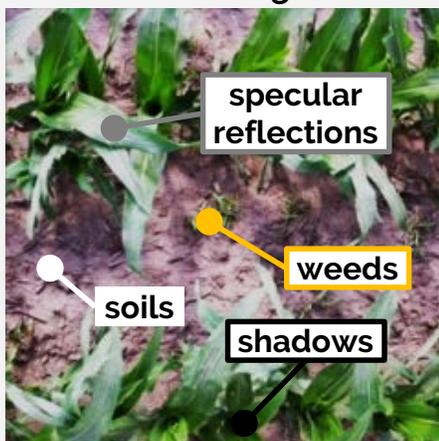
To address this, SLANTRANGE introduced an innovative solution with the first frame-to-frame, on-board, ambient illumination sensor back in 2014 – so all of your measurements can be trusted. No calibration panels necessary.

## Accuracy in Analytics

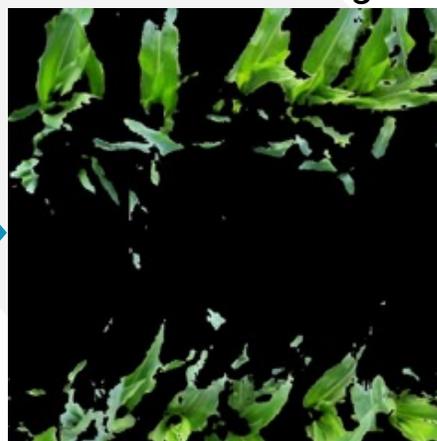
Accuracy involves more than correcting for sunlight conditions. It also involves carefully separating measurements of different objects in the field.

SLANTRANGE analytics take full advantage low-altitude platforms by *spatially and spectrally* separating crop vegetation signals from soil, specular reflection, shadows, or other signal types to get the most accurate measurements possible.

**Raw Image**



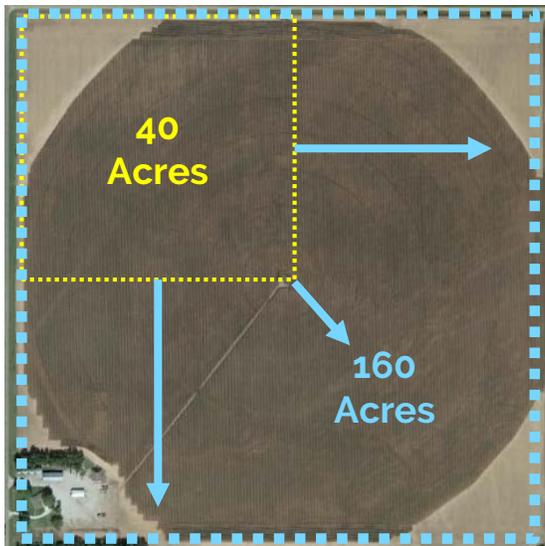
**Smart-Filtered Image**



**SLANTRANGE's Smart Filtering & Compression Algorithms Achieve New Levels of Data Accuracy through Selective Measurement (Patent Pending)**

# The First in Information Availability

Agronomic information is highly perishable, so making it available to the decision maker as efficiently as possible is a core focus for SLANTRANGE. To eliminate data collection and processing bottlenecks we've developed new technologies that **dramatically reduce the time spent collecting and processing data so results can be delivered in minutes, anywhere.**



## 4x Reduction in Collection Costs

SLANTRANGE's patent pending algorithms require only 20% overlap between images to generate maps, compared to traditional techniques which require up to 80%.

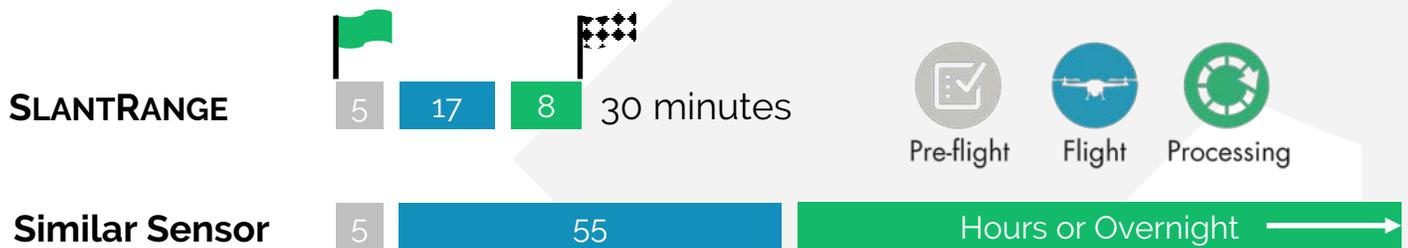
That's a 4x reduction in collection costs compared to a survey using the same sensor configuration but with a traditional processing technique – just by processing your data with a system designed for the task!

## No Network? No Problem.

The cloud just doesn't reach everyone – so uploading gigabytes of raw data for processing isn't always an option. SLANTVIEW processing is so much more efficient, it can be done in minutes. No network connection required. No additional work back at the office. Collect, analyze, and act all in one visit to the field.

## Compare the Difference!

Example times to collect and process 160 acres of multispectral data



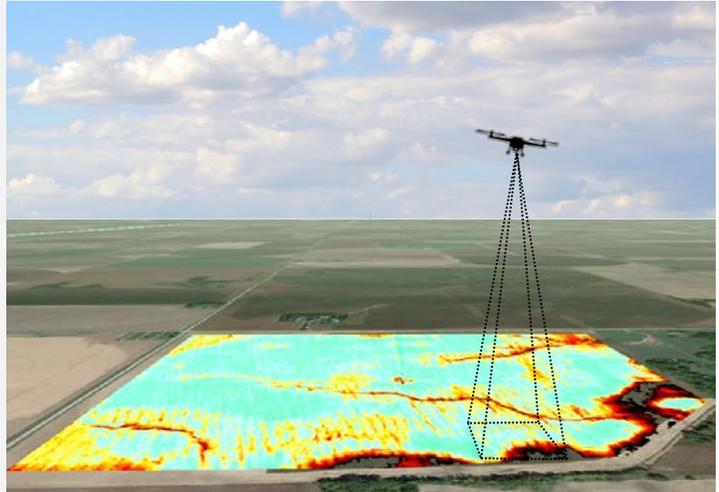
Times shown to collect 5 cm resolution imagery and deliver NDVI results on a 160-acre field @ 120 m AGL, 20 m/s flight speed including pre-flight (gray), flight (blue), and data processing (green), in minutes.

# Workflows That Work

Airborne agronomy creates a new information management challenge, which SLANTRANGE simplifies from collection to action.

## 1 Collect

SLANTRANGE sensor systems can be used on virtually any drone and require no connections other than power. No configuration. No ground calibration with panels. Just turn it on and take off. Full automation provides fast and easy data collection.



## 2 Analyze & Share

SLANTVIEW analytics reduce immense volumes of raw data to valuable information layers in minutes – on-location.

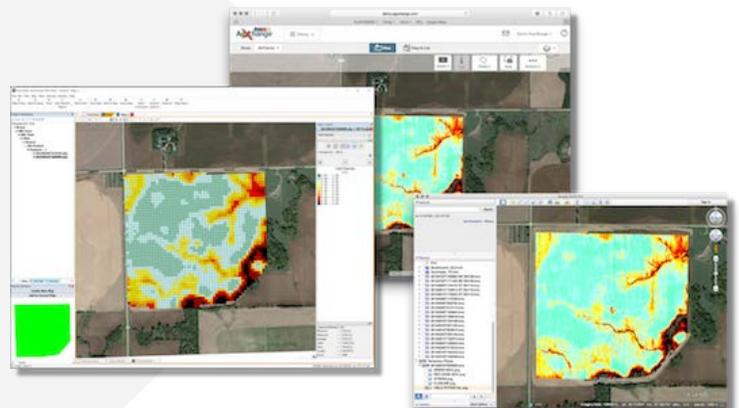


## 3 Decide & Act

Instantly portable results for more efficient scouting.



Easily export and combine your SLANTRANGE results with other field data for analysis & action.



# SLANTVIEW Analytics

## Post-Emergence Surveys

SLANTVIEW's in-field analytics tools include new data layers for critical post-emergence surveys when stand and weed pressure need to be evaluated. Using the latest in computer vision and machine learning techniques, individual plants are isolated and analyzed to deliver statistics on stand density, plant sizes, and weed pressure.

## Population Statistics

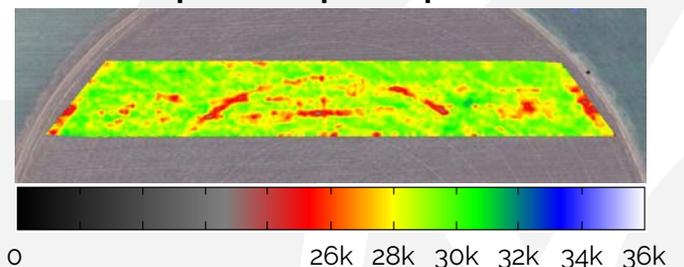
Unlike other techniques which simply estimate populations by searching for row gaps, SLANTVIEW's algorithms actually detect each plant in the field and segregate them into crop or weed populations for accurate measurement.

Populations are indicated in plants per acre and assist with critical replant decisions or assessing yield potential.

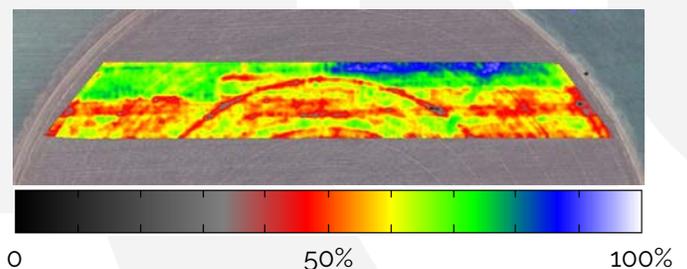
The Plant Size data layer is new for 2017 and shows relative biomass for individual plants across the field.

The combination of both plant population density and relative biomass are the best early season indicators for yield potential.

**Population (plants per acre)**



**Relative Plant Size (NEW!)**

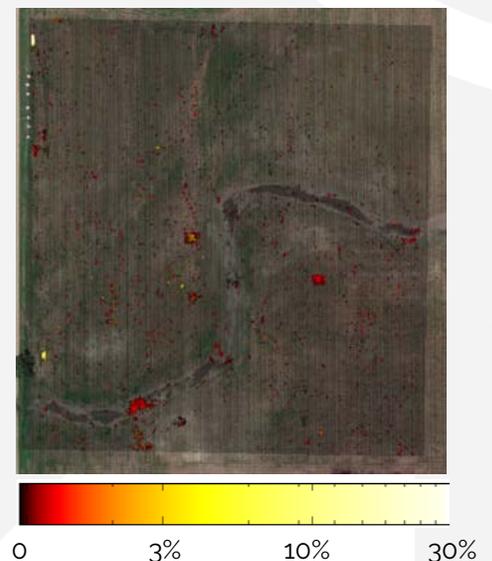


## Weed Density

The Weed Density layer provides indicators of invasive plant species within early-stage row crops for targeted treatment.

Weed densities are indicated according to the fraction of local field area they cover.

This data layer is designed for use in specific row crops under pre-defined conditions of measurement.



# SLANTVIEW Analytics

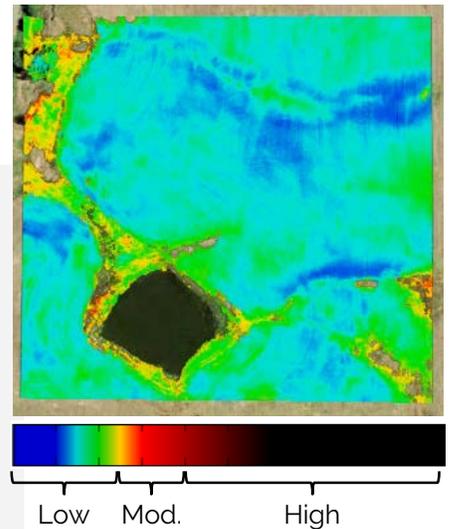
## Full Season Health Surveys

For maturing or mature crops, SLANTVIEW includes multiple information layers that each provide a unique and valuable new measure of status for growers.

### Plant Stress

The Plant Stress layer combines multiple spectral bands across the visible and near infrared to measure pigment absorbance and cellular integrity that are markers for nutrient deficiencies, pest infestations, or dehydration conditions.

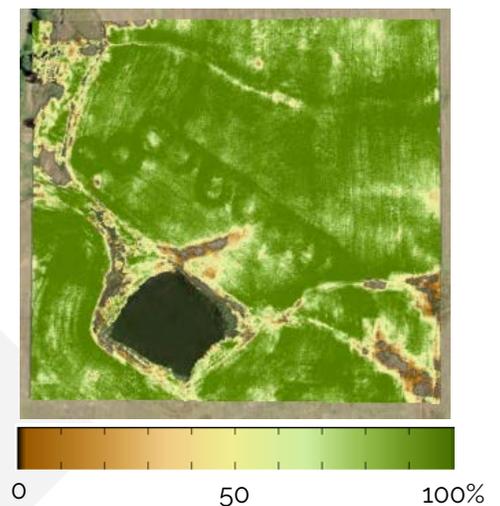
This data layer enables more efficient and accurate scouting by providing earlier and more comprehensive detection of stress conditions than possible with simple 2-band indices like NDVI. Contact us to discuss custom tuning for specific crops or conditions.



### Vegetation Fraction (Closure)

The Vegetation Fraction layer indicates the percentage of the field that is covered with the growing crop. Through the early weeks of the season this value will increase from zero until the fully developed canopy closes.

This data layer is valuable for locating mis-planted or thin coverage areas, or for measuring damage from weather or other events.

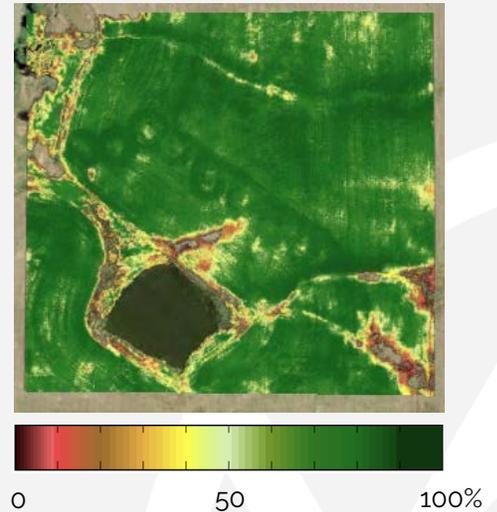


# SLANTVIEW Analytics

## Full Season Health Surveys

### Yield Potential

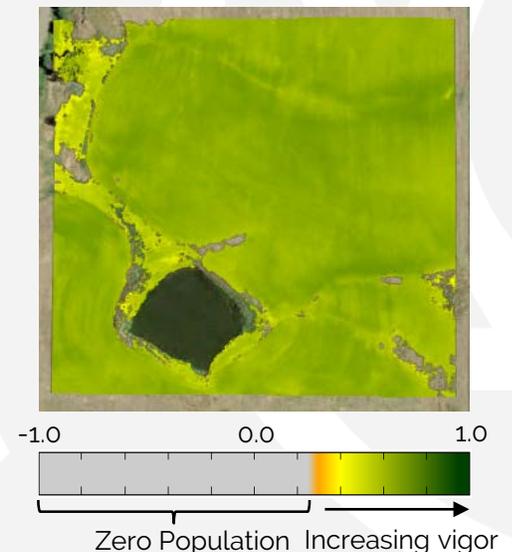
Multiple crop metrics are combined to assess future performance in the Yield Potential layer. This is the producer's highest level assessment tool and includes the contributions of numerous independent factors that ultimately contribute to yield.



### Simple Vegetation Indices

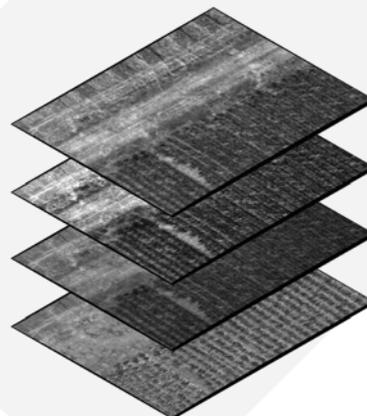
SLANTVIEW also produces traditional vegetation indices including:

- ⚙️ Red NDVI (RNDVI)
- ⚙️ Green NDVI (GNDVI)
- ⚙️ Red Edge NDVI (RENDVI)



### Research Applications

Many users in the research community have their own analytics tools. To support custom analysis, SLANTVIEW exports raw or pre-calibrated reflectance images with embedded time, position, and attitude metadata for easy import and use in 3rd party tools.



# SLANTVIEW Analytics

## Customized Data Layers

At SLANTRANGE, we recognize that grower information needs are incredibly diverse, and that generic measures such as NDVI maps rarely supply actionable information. In 2016 we introduced **an incredibly powerful new tool for instantly customizable data layers**. The potential applications are immense.

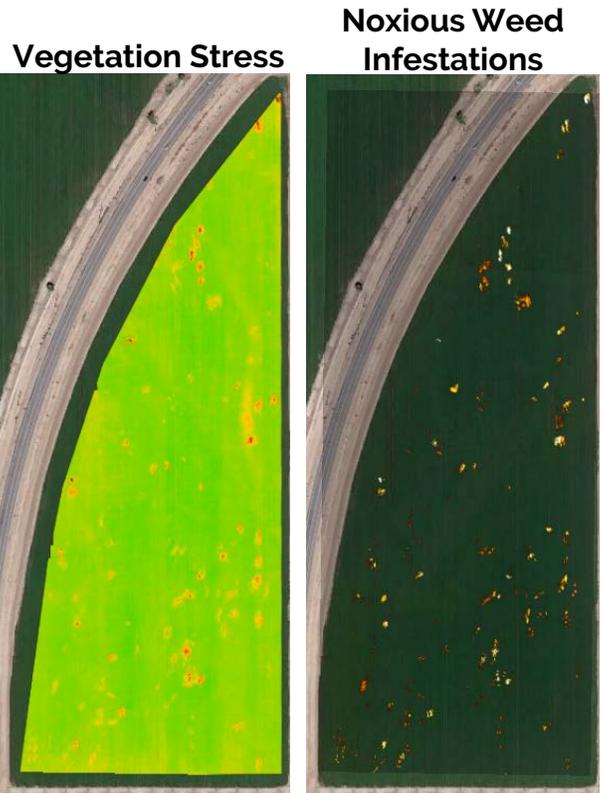
### Smart Detection™

What is your specific information need?

- 🌿 How large is my greensnap/lodging problem?
- 🌿 Which stress areas are due to this infection?
- 🌿 Where is a particular noxious weed emergent?

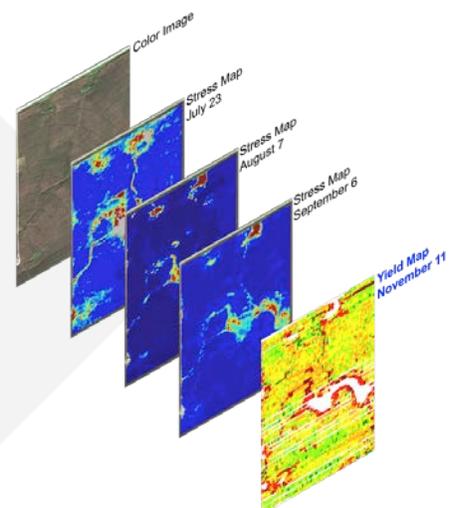
Algorithms newly embedded into SLANTVIEW enable signals training and classification for a wide range of specialized capabilities. In the example at right, the software was trained to separate generic "low-NDVI" areas from areas with an outbreak of a specific weed type, all with just a few clicks by the user.

Similar signals training and classification has been used on numerous applications in different crop types. What is it you're looking for?



### Customized Information Products

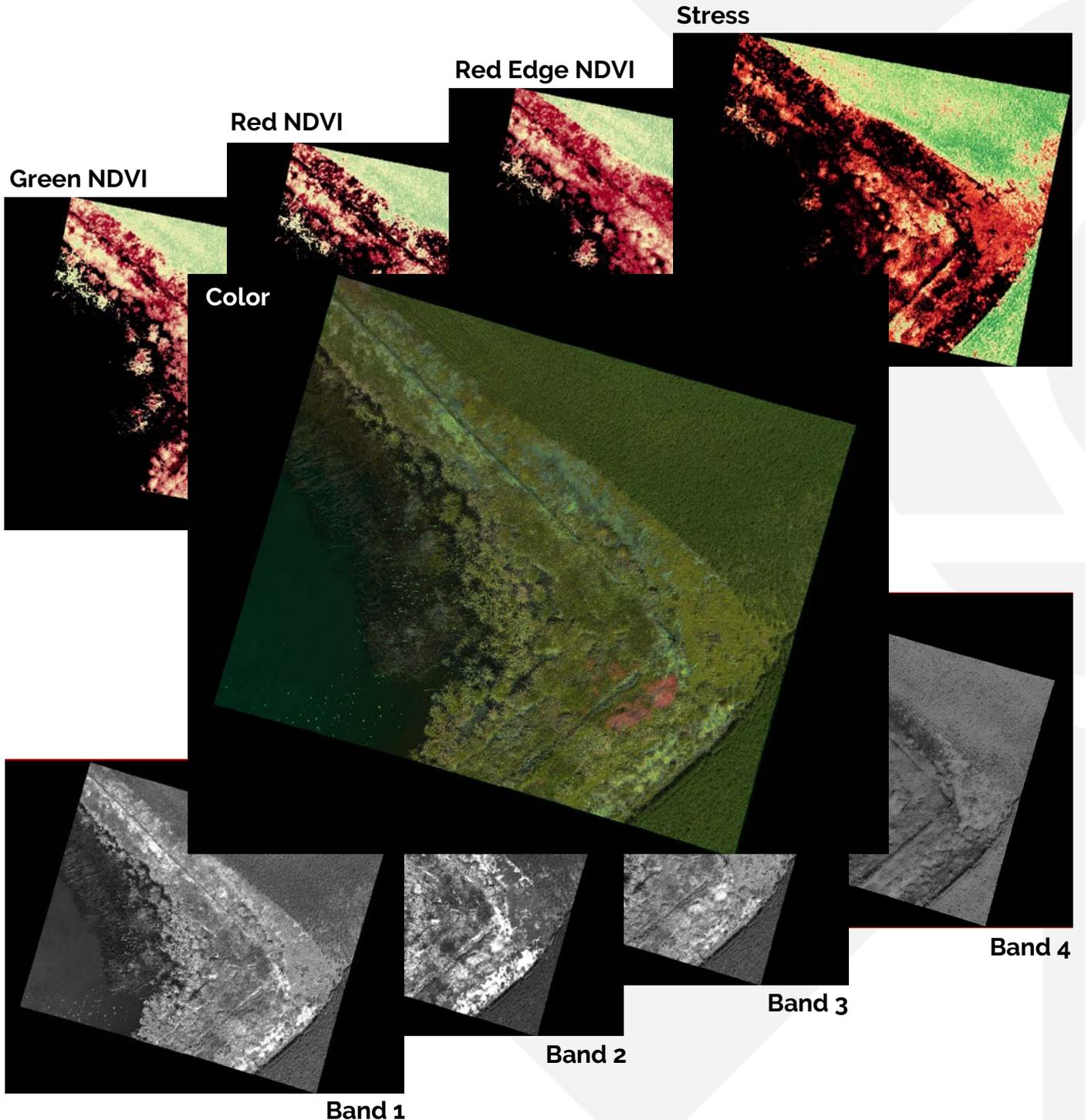
Have a specific need for a new information layer? We work closely with agronomists and growers in multiple crops and regularly develop customized solutions for unique needs. Contact us for more information.



# SLANTVIEW Analytics

## High Resolution Imagery

It's hard to beat centimeter-resolution imagery for perspective in diagnosing field conditions. In addition to our information layers, **SLANTVIEW also delivers your full-resolution results** without the image compression that compromises other techniques. See an area of concern in your maps? Instant zoom provides the complete picture on conditions in your field.



# SLANTVIEW Analytics

## All New Options to Meet Your Needs

New for 2017, SLANTVIEW is available with multiple tiers of capability to match your needs to your budget.

### SLANTVIEW Lite

Just looking for a true calibrated multispectral sensor and already have your preferred processing solution? SLANTVIEW Lite exports either raw imagery or calibrated reflectance images from your SLANTRANGE sensors so you can process them as you'd like.

### SLANTVIEW Basic

Our Basic package provides all the capabilities of Lite plus the ability to produce Vegetation Stress and multiple NDVI products from SLANTRANGE sensors – all with as little as 20% overlap and fast in-field processing.

### SLANTVIEW Pro

Our complete suite of information products and processing capabilities which adds powerful new computer vision and machine learning based tools to deliver much more specific and valuable crop information.

	Lite	Basic	Pro
No Network Connection Required	✓	✓	✓
Export Calibrated Reflectance Images	✓	✓	✓
Instant Coverage/Quality Check	✓	✓	✓
Process Images with 20% Overlap		✓	✓
Rapid In-Field Processing		✓	✓
Annotations		✓	✓
Statistics Reports		✓	✓
High-Resolution Imagery		✓	✓
NDVI (GNDVI, RNDVI, RENDVI)		✓	✓
Vegetation Stress		✓	✓
Population Density <sup>1</sup>			✓
Population Size Distribution <sup>1</sup>			✓
Weed Coverage <sup>1</sup>			✓
Vegetation Fraction			✓
Yield Potential			✓
User-Defined Smart Detection™			✓

<sup>1</sup> Subject to crop type and stage of growth. Please call for details.

# SLANTRANGE 3p

*The Most Powerful Information Tool the Farm Has Ever Seen*



SLANTRANGE introduced radiometrically accurate multispectral sensors to the industry with the first on-board ambient light calibration sensor in 2014. The patented system enables accurate and repeatable measurements across varying conditions throughout the day or the season.

Spectral Channels (Vegetation Sensor)	4
Spectral Channels (Ambient Illumination Sensor)	4
Processor Type	Qualcomm Snapdragon 801
Processor Speed	Quad-Core 2.26 GHz
On-Board RAM	2 GB
Detector Type	Si CMOS
Available Spectral Range	410 – 950 nm
Band Positions	Standard (550, 650, 710, 850 nm) or Selectable <sup>1</sup>
Shutter Type	Global
Positioning & Pointing	Integrated GPS / IMU with Extended Kalman Filter
GSD @ 120 m AGL	4.8 cm
Recommended Image Overlap	20%
Linear coverage rate @ 120 m AGL, 20 m/s	1,000 acres/hour
160 acre survey @ 120 m AGL, 20 m/s (fixed)	17 minutes
160 acre survey @ 120 m AGL, 12 m/s (rotary)	25 minutes
Available Data Layers	All SLANTVIEW processing options
On Board Data Storage	64 GB (4 hours)
Output Formats	KML, SHP, GeoTIFF
Size (Vegetation Sensor)	14.6 x 6.9 x 5.7 cm
Size (Ambient Illumination Sensor)	8.1 x 3.5 x 1.7 cm
Weight	350 g
Power	11 W @ 9.0-28.0 VDC

<sup>1</sup> Band positions are selectable at time of order between 410-950 nm, and may be reconfigured by factory. Some conditions apply, please call for details.

Australia and New Zealand Resellers  
**Southern Cross Drones Pty Ltd**  
101 Miller Street, L32  
North Sydney NSW 2060  
Australia

T. +61 2 9953 8366  
E: [info@southerncrossdrones.com](mailto:info@southerncrossdrones.com)  
W: [www.southerncrossdrones.com](http://www.southerncrossdrones.com)



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