



TerrAvion OverView Product Specifications	
Service	High resolution, multispectral imagery delivered overnight
RGB Natural Color	<18cm/pixel
Color Infrared	<18cm/pixel
NDVI	<18cm/pixel
Zoning	<18cm/pixel (NDVI with soil removed)
Thermal	2.2m/pixel
7-Channel Multiband	Calculating other indices (R1, G2, B, R2, G2, IR, Thermal) available upon request
Accuracy	<1m of basemap accuracy
Delivery Formats	TerrAvion imagery is available on web, iPhone, and Android app. Imagery can be downloaded into most GIS software, and our open API facilitates application integration.
<small>*Requires custom quoting. Please contact for more details.</small>	

General Operational Use of Data

TerrAvion OverView provides sufficient resolution to distinguish soil from vegetation. Our Digest statistical package allows parametric measurement of vegetation pixels separate from soil pixels at a block level. TerrAvion's standard reflectance calibration has over a year of data showing that it is stable and robust to most atmospheric conditions, presence of a cover crop, and discontinuous growth patterns. It accurately captures shadows which can be removed or ignored by Digest or one of the other pixel level methods. TerrAvion currently supports several dozen standard false color maps in NDVI, with several ranges of variation and posterization from continuous (256 levels) to three (3) functional levels. TerrAvion's false color product also accommodates custom lookup tables which will allow the user to set the color range to highlight structures of interest. Several of the pre-designed look-up tables are designed to highlight significant changes for viticulture. The look-up tables are absolute, so end users can pick an ideal value in the table and find that value across time and across blocks. All our images are georeferenced and timestamped to enable comparison over time. Our calibration procedure is explained below. We would be happy to provide additional detail under NDA. We have extensive evidence that our calibration procedure provides, robust, accurate measurements.

Calibration Procedure Outline

TerrAvion's reflectance band calibration procedure utilizes both instrument calibration and known target calibration. Calibration of VIS and IR channels are achieved by flying reflectance targets and radiometric characterization of the instruments. Instrument calibration consists of imaging known light sources and characterizing the camera's response. Combining the instrument and reflectance target measurements, TerrAvion is able to radiometrically calibrate each channel. Ground-truthed reflection targets are flown to provide relative reflectance calibration. We periodically measured with a portable spectrophotometer. The targets are then flown each week to verify the consistency of the calibration. We employ a variety of proprietary methods to correct for bi-directional reflectance distribution function errors, total down welling radiation corrections, sun angle, light haze, some cloud conditions, and achieve pixel level co-registration between bands for NDVI and color images. Thermal instruments are factory calibrated with an accuracy of 5 C, precision of 1 C, and a sensitivity of 0.1 C. We employ thermal flat fielding to increase precision beyond the factory specification and if the client is able to provide adequate ground thermal data, the measurements can be converted to absolute true temperature, to the accuracy of the provided data.

Georegistration Procedure



TerrAvion uses a proprietary feature matching process, derived from imagery alignment systems outside the geospatial realm, to align each cycle's imagery to the base imagery and the prior cycles' imagery. The chief limit on location accuracy is the accuracy of the underlying base map. There are registration workflows for both individual blocks and the clusters of blocks the client designates as ranches. These workflows are primarily automated, but we can intervene manually if the algorithm is not finding useful correspondences. We have both automated and manual processes for doing quality control on blocks and ranches. We typically find that there is an average of location imprecision of about a meter for blocks that we have studied. With an average 18cm GSD this means that it is not possible to do naïve pixel subtraction for change detection, but area and statistical approaches work well, and our precision exceeds most handheld navigation for walking out to inspect anomalies that are spotted in the imagery.