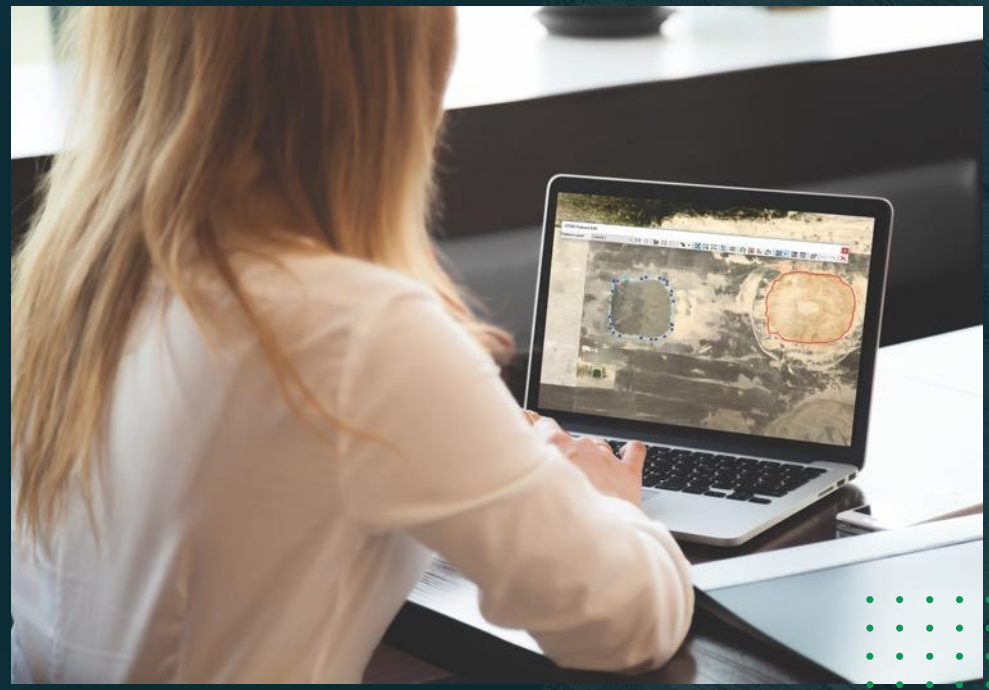
GEOCUE

Making Sense of Sensors, LiDAR, Software and Drones for Surveying



Purpose

- Planning to acquire a drone LiDAR system is a major decision that requires understanding the different solutions and technologies available. How do you evaluate the technology?
- There are a wide range of price and performance options available. How do you decide which is the best fit for your purpose?
- It takes the correct combination of hardware and software to be profitable/successful with a drone LiDAR program. What should you look for from a software suite? What about support services?
- Week in and week out, you face a multitude of projects and geospatial challenges. For one project, you need to use a drone to capture data from above to avoid danger on foot, and another you may need a mobile mapping rig to capture data in a populous area.
- For some projects, you may need the best of both drone and mobile LiDAR. With all of these options, geospatial professionals have more powerful tools than ever before, but prioritizing the right hardware and software to meet your business challenges can be a daunting task.
- We want to help you answer these questions by sharing what we have learned from more than 20 years in the LiDAR mapping business.

GEOCUE

About our company

PRESENTER NAME
TITLE

Our Early History

2001

- Udo Juerss invents the first modern quadcopter in Siegen

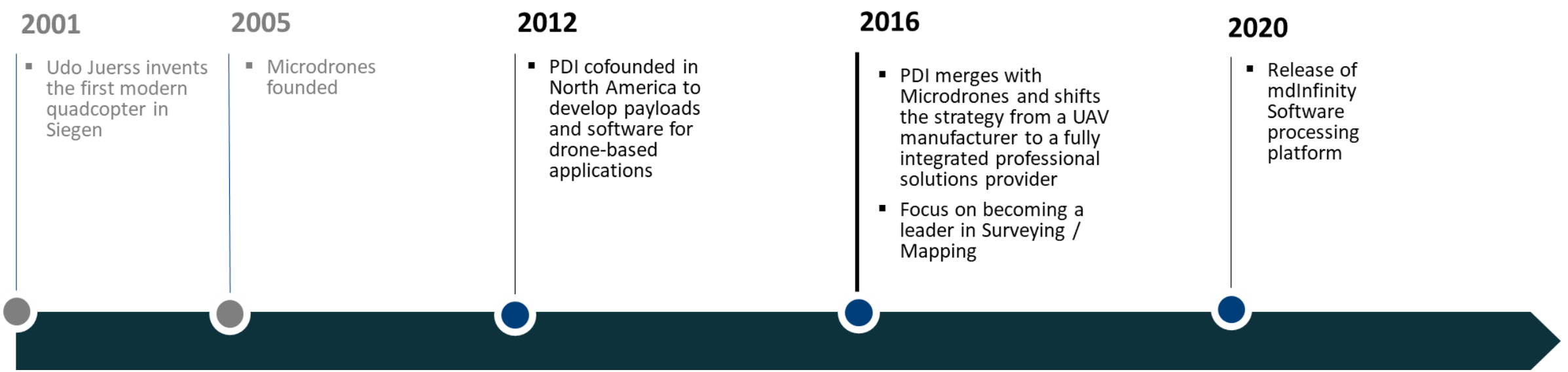
2005

- Microdrones founded

2012

- PDI cofounded in North America to develop payloads and software for drone-based applications

Our History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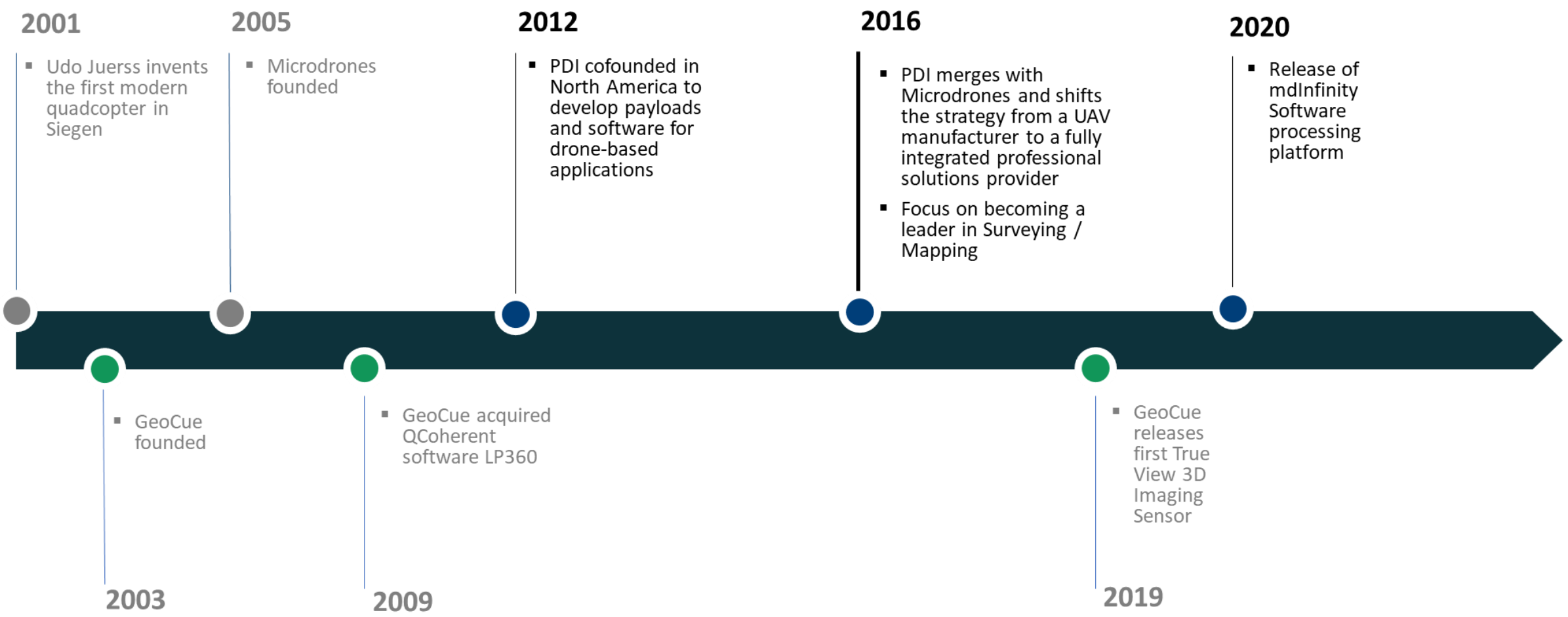
PDI merges with Microdrones and shifts the strategy from a UAV manufacturer to a fully integrated professional solutions provider
Focus on becoming a leader in Surveying / Mapping
2020
Release of mdInfinity Software processing platform

Our History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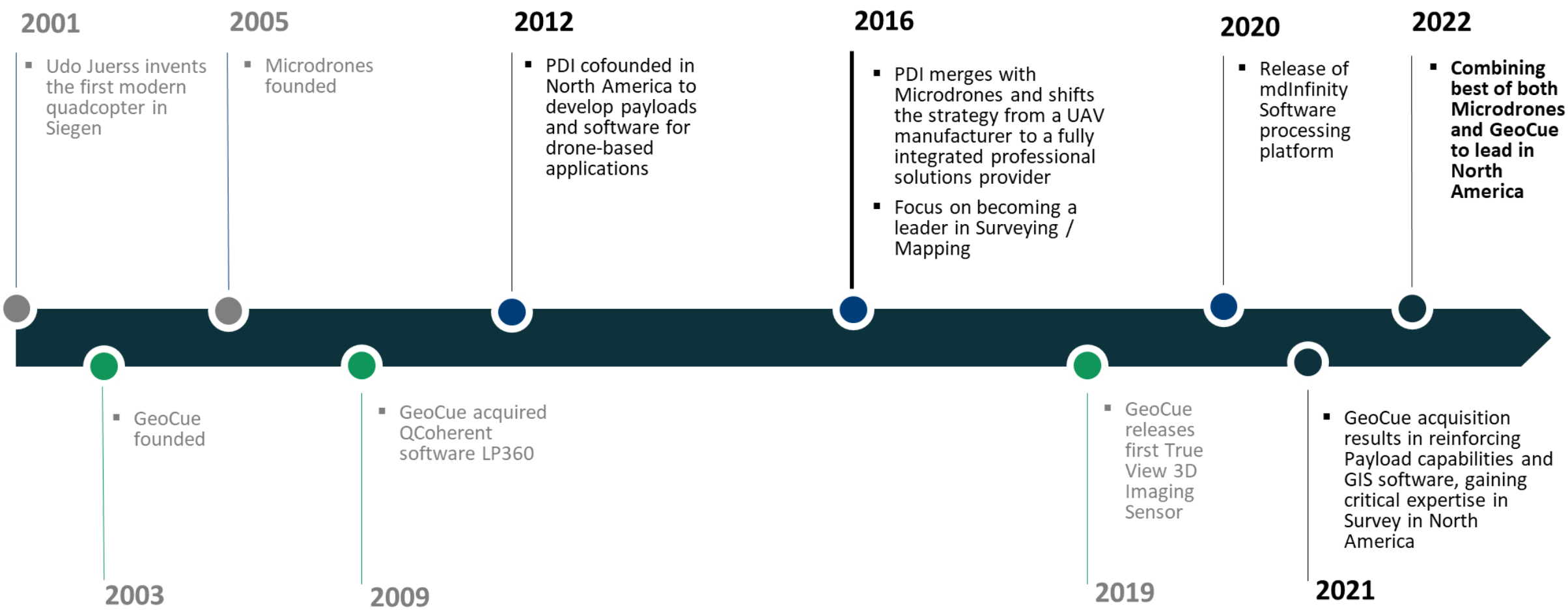
2003
GeoCue founded
2009
GeoCue acquired QCoherent software LP360
2019
GeoCue releases first True View 3D Imaging Sensor

Our History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2022
Combining best of both Microdrones and GeoCue to lead in North America
2003
GeoCue founded
2009
GeoCue acquired QCoherent software LP360
2019
GeoCue releases first True View 3D Imaging Sensor
2021
GeoCue acquisition results in reinforcing Payload capabilities and GIS software, gaining critical expertise in Survey in North America

Locations

GeoCue has strategically built a global footprint to efficiently distribute products; when you plug into the GeoCue distribution network, you are connecting with qualified professionals who can help you efficiently add the right LiDAR and drone mapping software and hardware for your business.

Locations

- Headquarters – Huntsville, Alabama USA
- GeoCue Australia (JV) – Brisbane, Australia
- GeoCue Brazil – Sao Paulo, Brazil

Our Focus – LIDAR and Imagery Technology

- Providing geospatial processing solutions
- Providing data management solutions
- Providing end-to-end drone mapping solutions

GEOCUE

Leaders in LiDAR Mapping hardware & software

We work with the industry’s leading companies to deploy and build scalable LiDAR and drone mapping software and hardware.

Our Main Brands / Products

LP360

Point cloud imaging data processing software

TRUEVIEW

Drone LiDAR/Imaging Sensors

Our Customers

GEOCUE

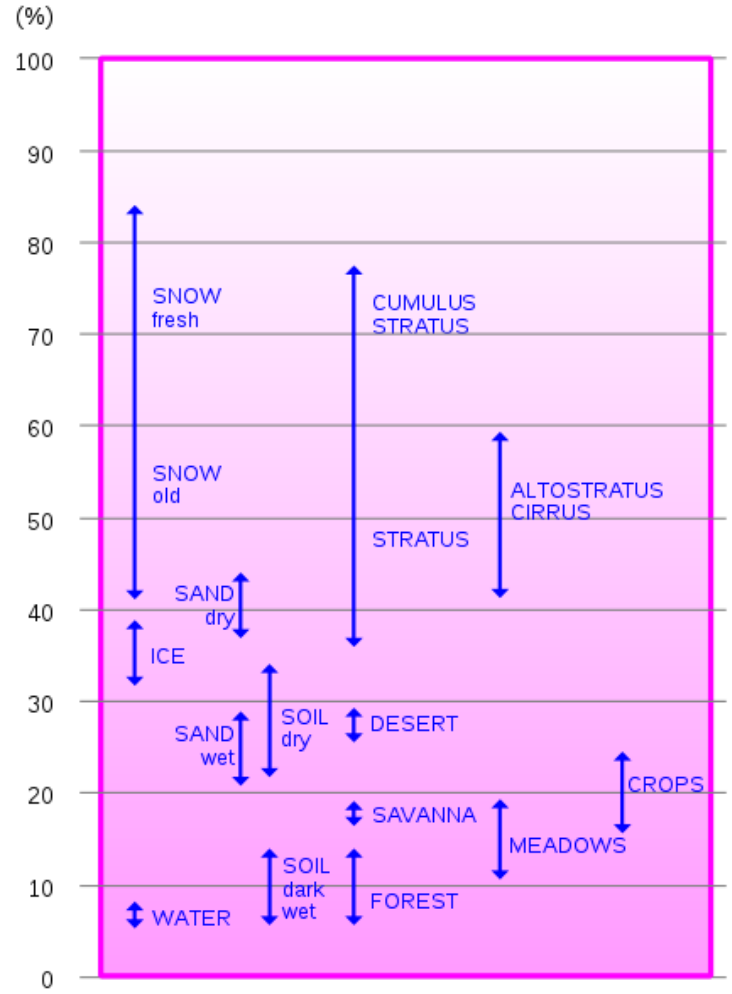
Drone LiDAR

Technical Considerations and Performance Metrics

PRESENTER
TITLE

A Few Opening Remarks …

- Beware of vendor specs that focus on ideal scenarios.
- Technical specifications, especially from automotive LiDAR vendors, are misleading for mapping applications:
  - A 300 kHz system with two returns listed as “600 kHz”.
  - A 270 m (885’) range listed but measured to an 80% reflectivity target.
- Range and precision specifications that do not specify the test methodology used.



Why Use a Drone At All?

- Fast turnaround on time-sensitive projects; hours/day not weeks/months. Can rapidly deploy on a site as needed. [Time]
- Cost-effective when project is too small (expensive) to fly with crewed aircraft and too large (expensive) to do with crews on the ground. (There is a sweet spot!) [Money]
- Wider availability to more end users. Small survey and engineering firms can invest in the technology. [Availability]
- Initial capital investment is lower and return on investment is higher than more expensive equipment. [Profit]

LiDAR or Photogrammetry?

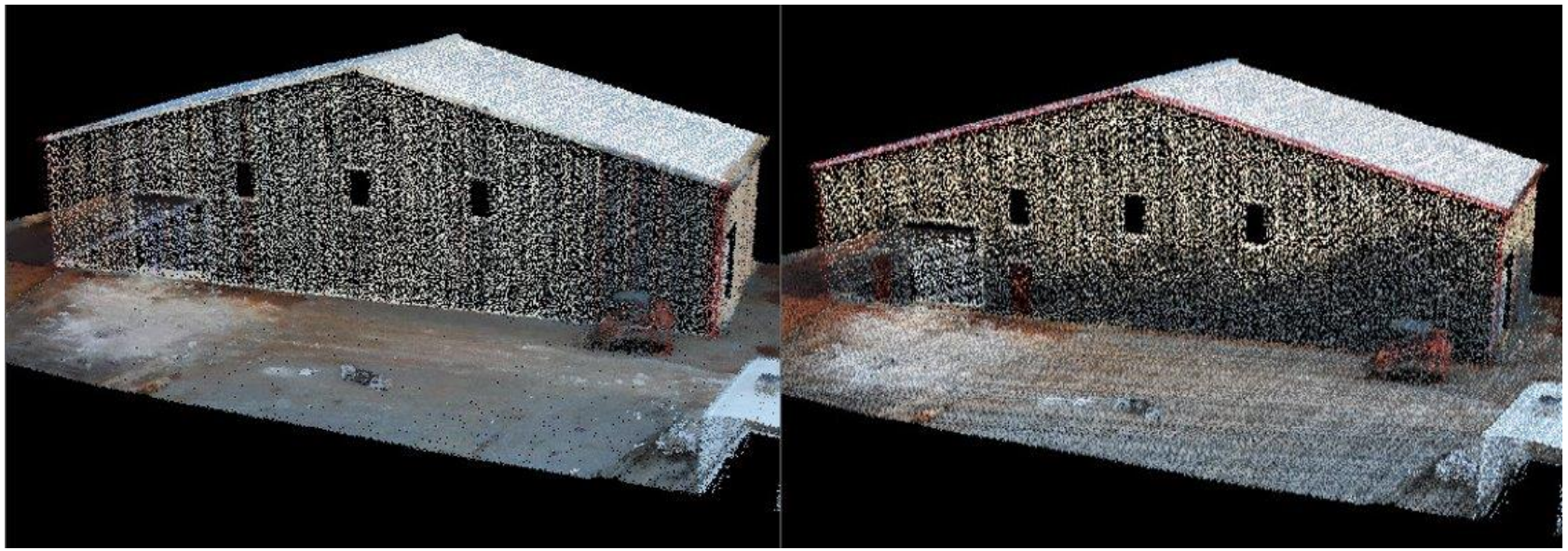
- Drone photogrammetric mapping systems are widely available and cheaper than most LiDAR payloads. (But a high-end camera system will still cost you more than a low-end lidar!)
- They work extremely well in most scenarios until you must deal with vertical complexity such as tree canopy, thin wires, tall building, or dense vertical surfaces.
- Drone LiDAR mapping systems are typically more expensive but offer all the benefits of LiDAR when dealing with vertical structures or complex target environments. Canopy penetration and wire extraction being the two most mentioned.
- Our recommendation is to always collect both; use a fully integrated 3D imaging system (3DIS) (LiDAR+Camera(s)).

LiDAR – Time of Flight (ToF), Kinematic Mapping

- LiDAR mapping sensors use direct georeferencing (position/orientation) and time-of-flight (laser ranging) to sample the target environment (typically for drones, the ground below).
- Quality of the laser rangefinder, the scanner, and the position/orientation system all impact the final data quality.
    - GNSS (GPS) + IMU gives position and orientation of the platform.
    - Laser rangefinder (lidar) gives range from platform to the to target.
    - Scanner increases efficiency by moving the laser beam(s) rapidly across the target.

What is a 3D Imaging System?

Fully integrated LiDAR + camera mapping system

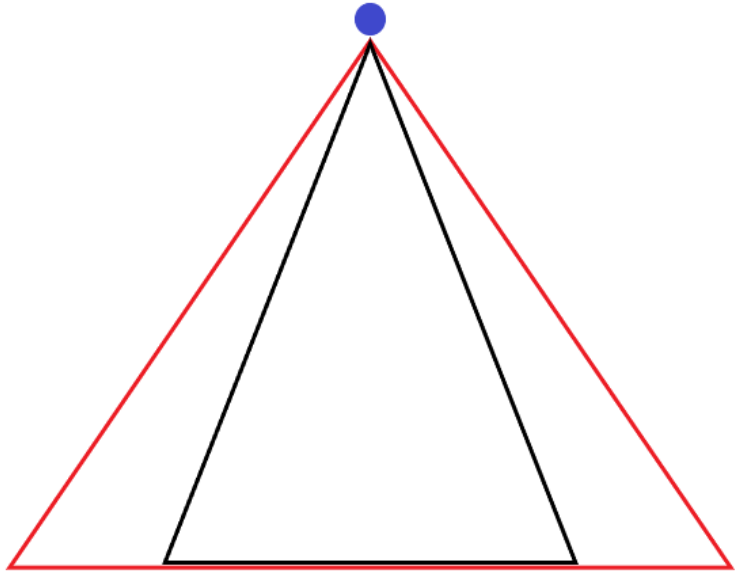


Scene colorized from an ortho – a single color for each vertical “slice.” Note the solid color vertical streaks.

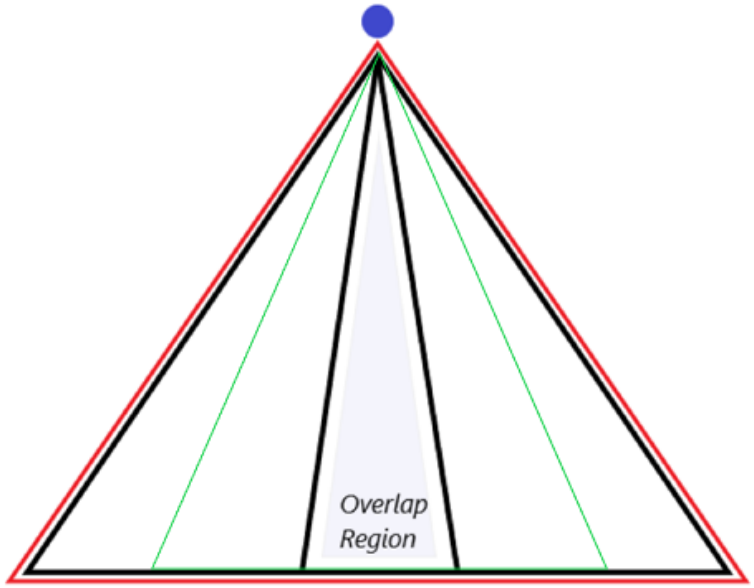
TrueView point projection colorization. Note the rich and true colorization within vertical slices such as the red service doors and trim.

TrueView 3DIS

Fully integrated LiDAR + camera mapping system



LiDAR with single camera



TrueView 3DIS

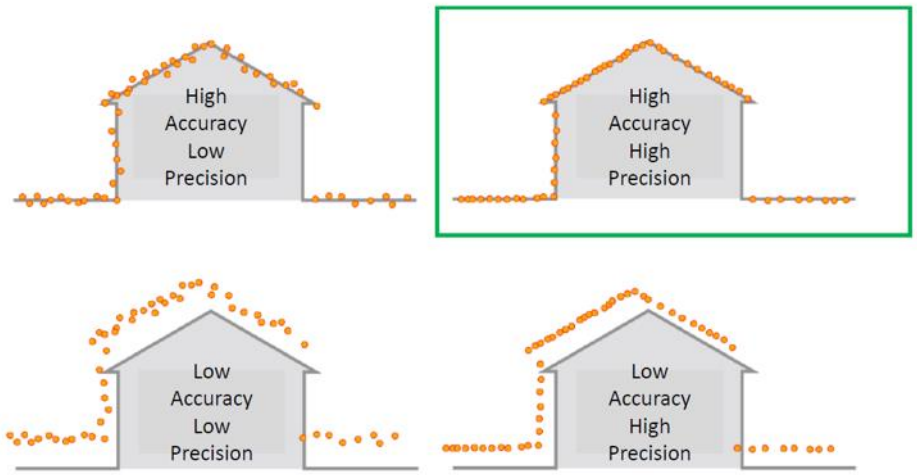
LIDAR FOV

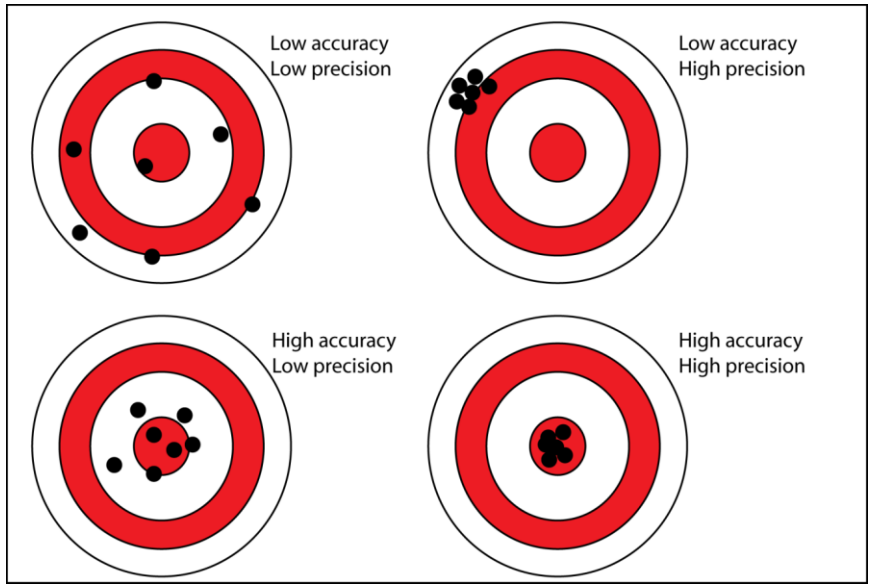
CAMERA FOV

NADIR CAMERA FOV

Reminder – Accuracy vs. Precision

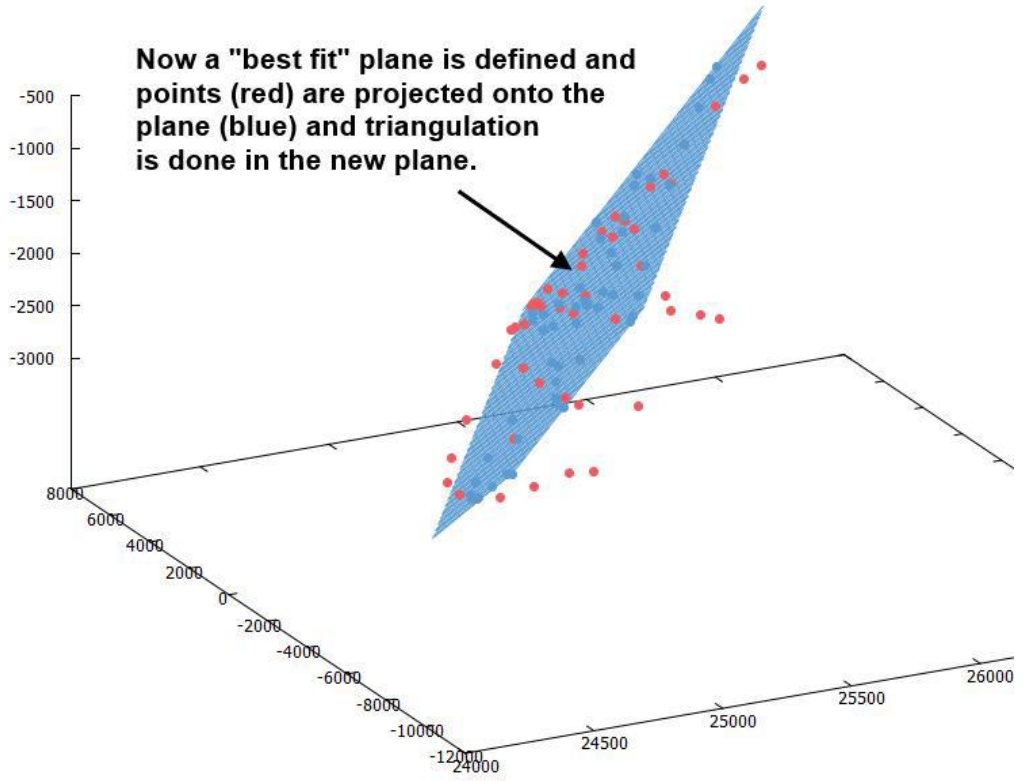
- For mapping, accuracy means absolute (network) accuracy.
- For drone lidar precision and noise are often used interchangeably to describe the “fuzziness” of the point cloud.





Precision Testing

- A practical measure of precision (noise) in a drone lidar is to look at hard surface repeatability.
- What is the best planar fit of the point cloud to a known hard surface?
- Standard statistical measures of the fit (standard deviation to the plane etc.) can be used to quantify the relative precision between systems.

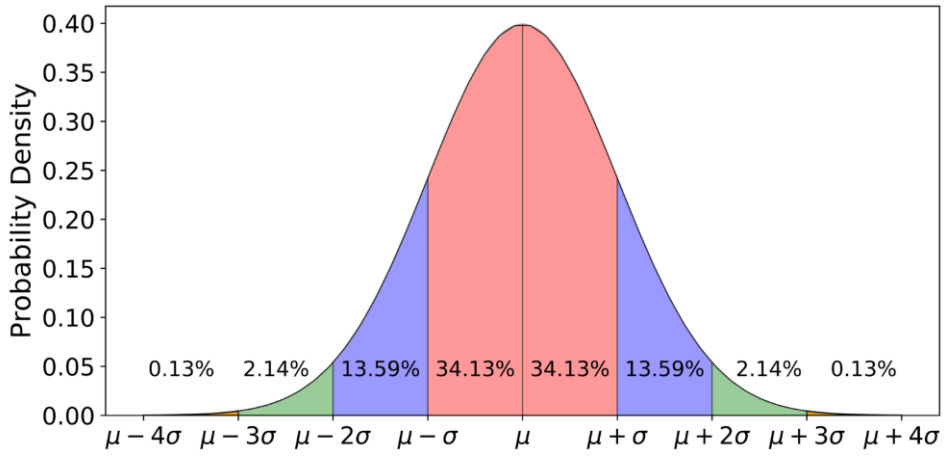


Accuracy Testing

- Accuracy assessment of a drone lidar should be done using established vertical and horizontal accuracy testing methods published by professional organizations such as ASPRS (Vert Acc Stand. …).
- Vertical accuracy of a LiDAR surface measured against check points provides both an absolute accuracy assessment along with a systematic correction (debias) for any residual error. Can be highly automated.
- Horizontal accuracy is measured like vertical, but often requires the identification of know targets (either manually or automatically) in the point cloud (checkerboards, chevrons, edge-of-curb, building corner etc.).

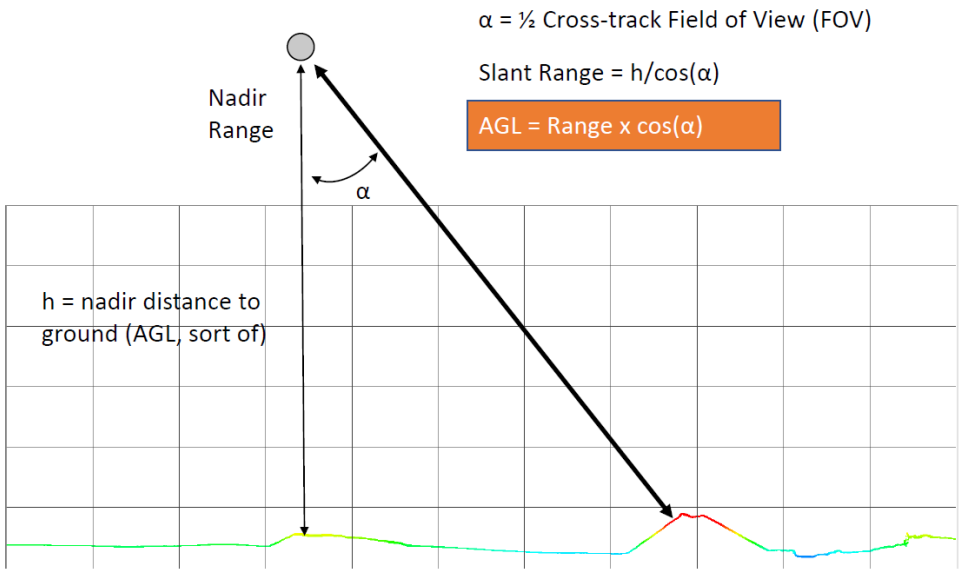
Standard Deviation vs. Peak-to-Peak

- Important to keep in mind that peak-to-peak noise values are not meaningful for mapping applications.
- Most LiDAR data on hard surfaces follows a Gaussian error distribution.
- Standard Deviation, RMSEz and similar statistical measures are needed when working with map accuracy standards.
- % Confidence intervals are used for non-Gaussian LiDAR error distribution, for example in/under canopy (see ASPRS Guidelines).



Slant Range

- A range specification should include the effective range for mapping applications taking in to account the maximum angle (slant range).
- Max Range and Max Altitude are often not the same value.



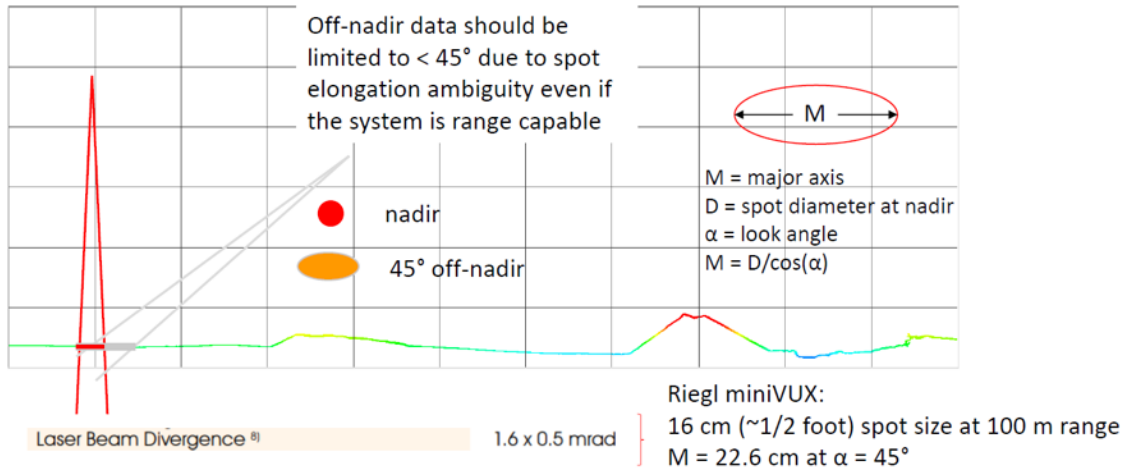
Example – 75 m AGL has a slant range of 106 m at a 45° cross-track look angle

Rolling/steep terrain requires 3D mission planning

AGL = Above Ground Level

Beam Divergence

- Beam divergence is an often-overlooked technical specification.
- Excellent beam quality and low beam divergence are often what differentiates higher-priced LiDAR systems form cheaper ones.
- Beam divergence impacts spot size, off-nadir error, effective canopy penetration, and thin object detectability.



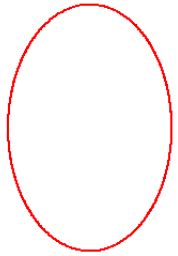
Beam Divergence

- Often overlooked
- Separates the higher end systems from cheaper ones.
- Beam divergence impacts:
  - spot size
  - off-nadir error
  - effective canopy penetration
  - thin object detectability

Livox Avia

48cm x
5.2 cm

Pandar XT



22 cm x
15 cm

RIEGL miniVUX3

16 cm x
5 cm

*Spot size @ 100m

Single vs. Multibeam Sensors

- Multibeam lidar (multiple channels) offer a cost-effective option for high sampling rates with multiple look-angles.
    - Higher noise
    - Lower beam quality
    - Lighter
- Single beam (traditional) lidar designs are (typically) more expensive but are inherently lower noise, have better quality (and larger) receiver optics providing greater detectability (effective range).
    - More expensive
    - Better beam quality
    - Heavier

Summary

A useful checklist to consider when evaluating competing drone LiDAR systems:

Property	Notes
Range	Consider Slant Range. Normalize to 20% reflectivity
Precision	Remember that Peak to Peak is at least 6 x σ
Point density on the ground	Consider a 90° FOV as the maximum (80° preferred) useable data thus 120° is the optimal scanner FOV
Field of View (FOV)	You need ~25% → 30% overlap between flight lines for geometric correction. A narrower FOV means more flight lines.
Network accuracy at nadir	You will probably have to test this. There is no industry standard
Network accuracy at 45°	Requires testing data
Conformance	*Requires testing. This is an area with little current research and no specifications, yet it is critically important*
At least 2 "solid" returns per pulse	Longer range systems have higher abilities to provide a useful 2nd return
System Mass ("weight")	Lower Mass → Longer flight time
Power Supply Duration	At least as long as the longest flight possible with your drone

GEOCUE

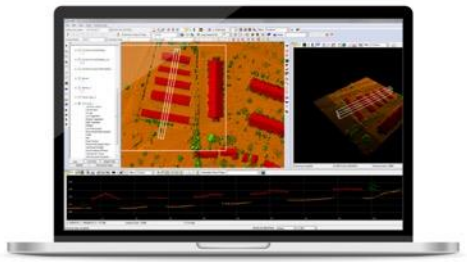
Our Product Family

PRESENTER
TITLE

Portfolio

microdrones

Your source for end-to-end fully integrated drone survey equipment.



LP360

Best-in-class point cloud and imaging data processing software suite. Supports our hardware or runs as a standalone desktop exploitation tool.

TRUEVIEW

Professional-grade drone LiDAR/Imaging payloads for use on your platform of choice.

LP360 Drone Integrates All Hardware Processing

Data Calibration

LP360 Drone

+

LP360

- **DG-Single Unlimited Trajectory Processing**
- **Photo Add-on**
- **StripAlign Add-on**

Products

- Accuracy Report
- Classification
- Geocoded photos
- Ortho
- LAS
- Contours
- DEM
- Catenaries
- Vegetation Management
- 3D Accuracy
- LPLAS
- LP360 Cloud
- Volumes

...

Full Product Family

TrueView Product Line

Professional-Grade Geomatics Sensors

TV515

UPGRADED

TV535

UPGRADED

TV540

NEW!

TV545

NEW!

TV585

NEW!

TV625

TV655/660

TV680/680LR

TV720

Accuracy Star

Concentric Target

UPGRADED

TrueView 515 3D Imaging System
Version C

GeoCue's TrueView 515 is simply the best performing LiDAR/Camera system in the mid price range. The Version C system is now upgraded with two new oblique 26 MP Cameras (Version C) .This compact 3D Imaging System has impeccable definition along wires, superior ground cover beneath vegetation and sensitivity like we've never seen in this class system. Dual drone and optional mobile mapping capability available.

MOBILE MAPPING CAPABLE

Ask About TrueView 515 FLEX

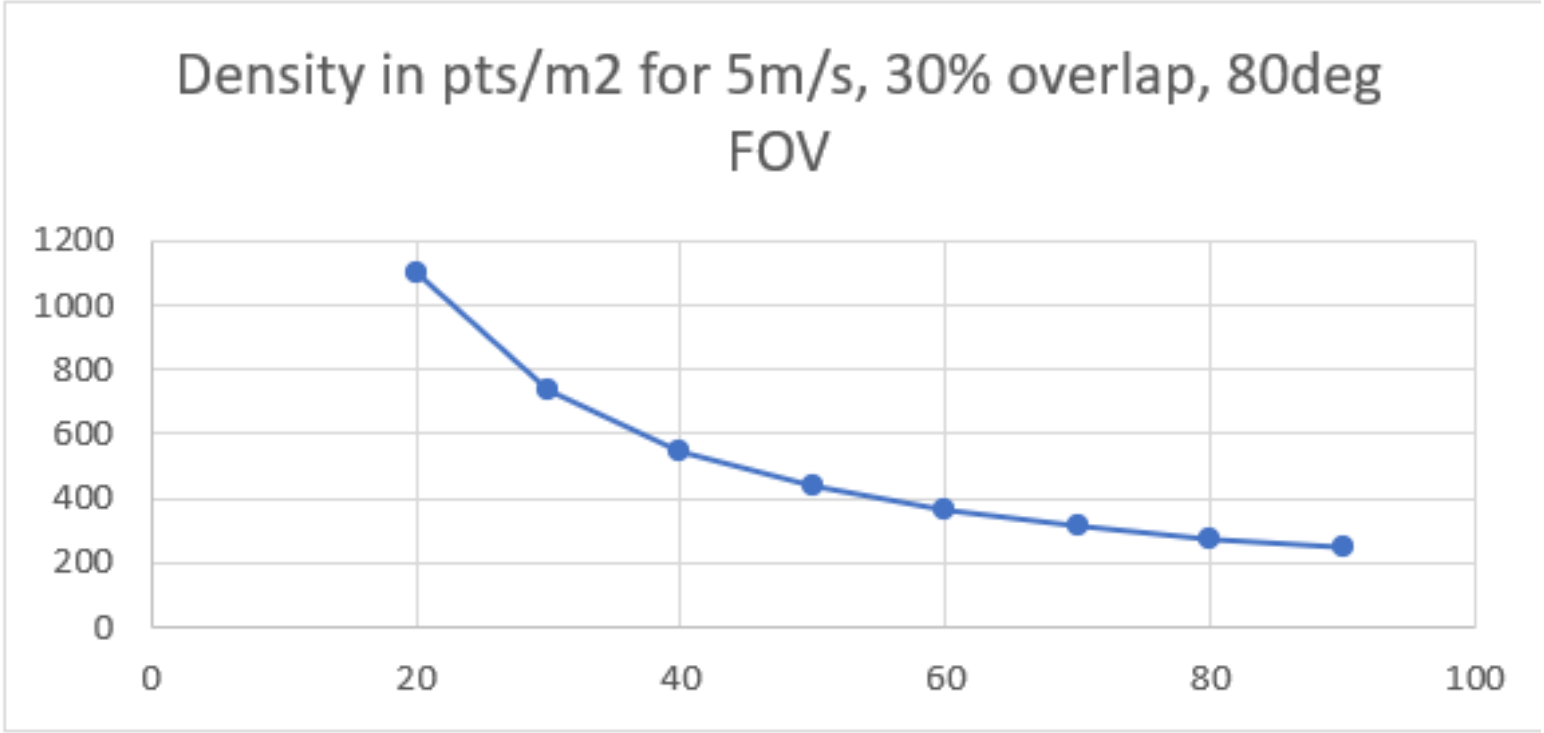
FLEX Offers Affordable Pricing and Flexible Software Subscription for GeoCue's TrueView 515

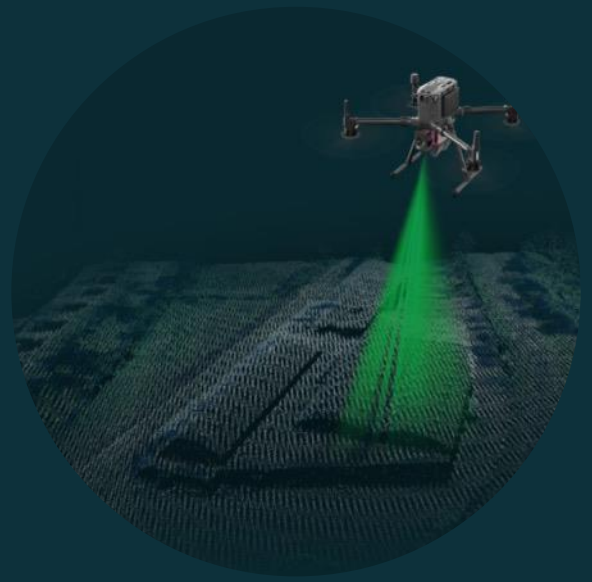
This innovative sales model brings flexibility and affordability to the TrueView 515 by providing users the opportunity to acquire the payload at an attractive price while introducing a simplified and efficient yearly subscription model for LP360 software.

TrueView 515 Specs (Version C)

Specification	Value
Data Collection	LiDAR + Imagery
Laser Scanner	Hesai Pandar XT32M1X
LiDAR Beams/Returns	32/2
LiDAR Range - Usable	80 m @ 20% reflectivity
Cross-track Field of View (FOV)/Combined	120°
Pulse Repetition Rate	640 kHz
Scanner Performance	• Precision: 5 mm • Accuracy: 20 mm
GNSS/INS Performance	• Position: 20–50 mm • Angle: 0.025° Roll/Pitch, 0.08° Heading
System Performance	• Precision observed on one Strip: Typical 20 mm, Less than 15 mm (1 sigma) observed at 75 m on concrete • Accuracy: Typical 3 cm RMSE, better than 5 cm 3D RMSE – depending on GNSS conditions, accuracy of control points and coordinate system
Camera Sensor	2 * 26 MP Sony mechanical leaf shutter, calibrated
Mass	1.99 kg (payload unit only - no accessories including battery, mount, antenna, power adapter)

Density Graph

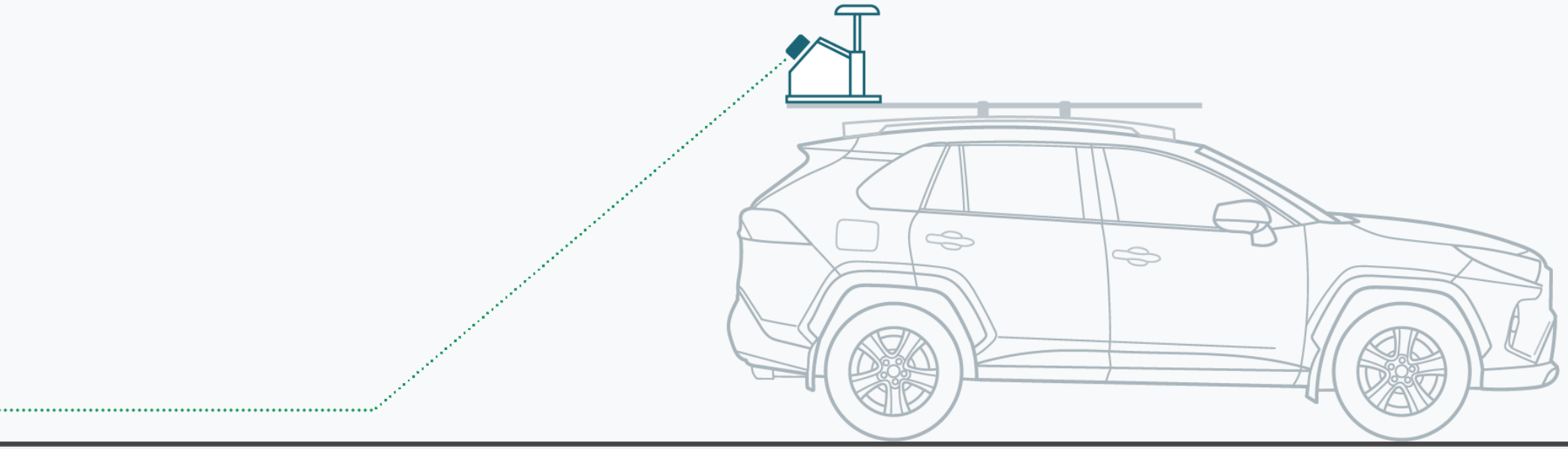




Dual purpose mobile mapping and drone LiDAR systems

The best of both worlds, to recreate your world! For some projects, you need drone LiDAR. For others, you need mobile mapping LiDAR. And for others you need multiple perspectives from both. Buy one sensor to work a multitude of projects.

Mobile Mapping Capable TrueView Sensors:
515, 535, 545, 625, 655, 660, 680, 680LR



Flexibility in field with optional mobile vehicle mount

In your mix of projects, do you encounter times when you cannot fly, perhaps due to busy high-population areas or other factors? Use this sensor in mobile mapping mode.

Or do you need multiple perspectives with greater detail? Use both drone and mobile LiDAR modes. It's the best of both worlds, to recreate your world!

UPGRADED

TrueView 535 3D Imaging System

Version C

The TrueView 535 builds upon the success of our best-selling TrueView 515. We've added a third LiDAR beam return to improve vegetation capture detail, two 26 MP oblique cameras and a third 26 MP nadir camera to improve photogrammetry deliverables (Version C.) Dual drone and optional mobile mapping capability available.

MOBILE MAPPING CAPABLE

Ask About TrueView 535 FLEX

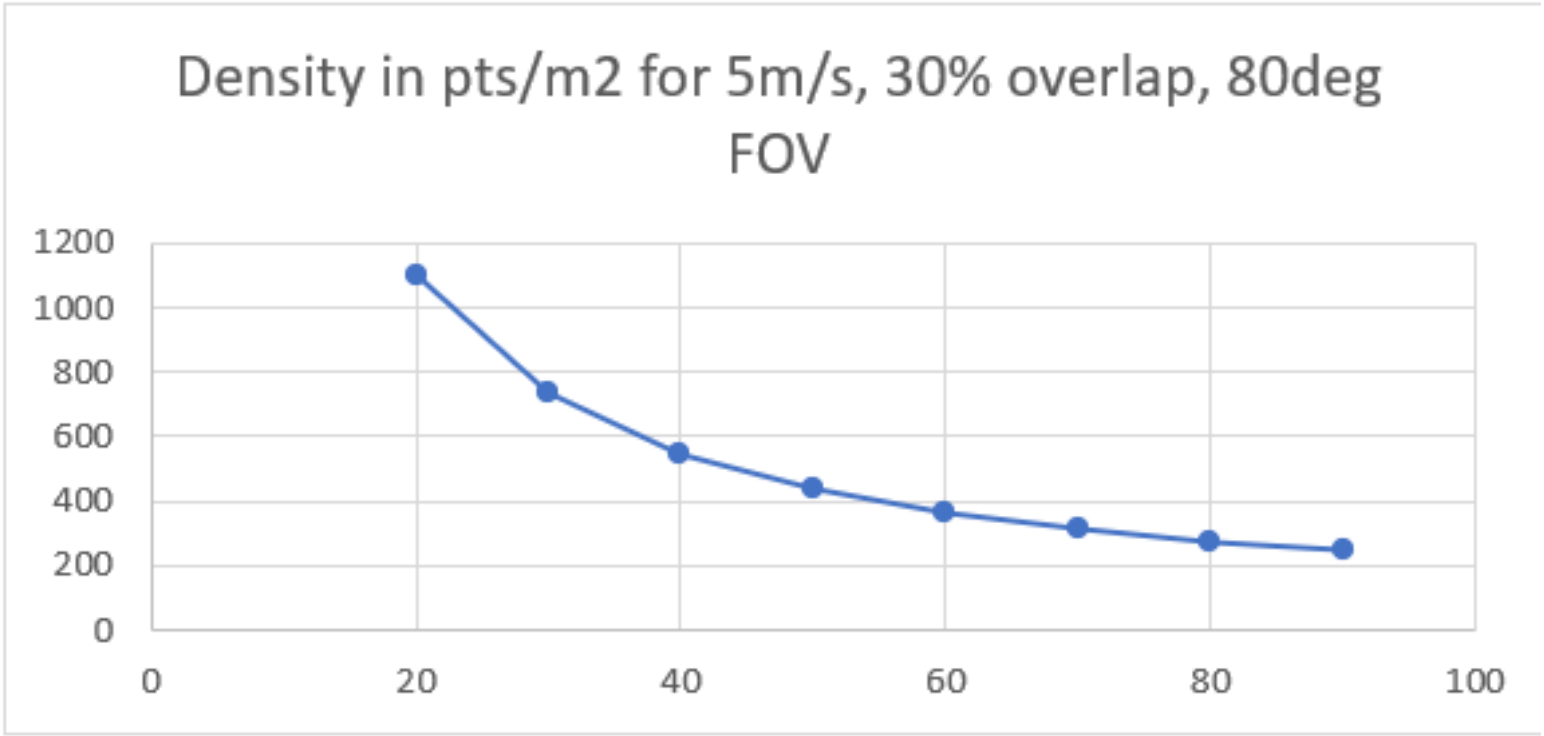
FLEX Offers Affordable Pricing and Flexible Software Subscription for GeoCue's TrueView 535

This innovative sales model brings flexibility and affordability to the TrueView 535 by providing users the opportunity to acquire the payload at an attractive price while introducing a simplified and efficient yearly subscription model for LP360 software.

TrueView 535 Specs (Version C)

Specification	Value
Data Collection	LiDAR + Imagery
Laser Scanner	Hesai XT32M2X
LiDAR Range - Usable	120 m @ 20% reflectivity
LiDAR Beams/Returns	32/3
Cross-track Field of View (FOV)/Combined	120°
In-track FOV	40.3° (-20° to +19.5°)
Pulse Repetition Rate	640 kHz
Scanner Performance	• Precision: 5 mm • Accuracy: 20 mm
GNSS/INS Performance	• Position 20–50 mm • Angle: 0.025° Roll/Pitch, 0.08° Heading
System Performance	• Precision observed on one Strip: Typical 20 mm, Less than 15 mm (1 sigma) observed at 75 m on concrete • Accuracy: Typical 3 cm RMSE, better than 5 cm 3D RMSE – depending on GNSS conditions, accuracy of control points and coordinate system
Camera Sensor	• 3 * 26 MP Sony mechanical leaf shutter, calibrated
System Operation Temperature Range	-15° to 50° C
Mass	1.75 kg (payload unit only - no accessories including battery, mount, antenna, power adapter)

Density Graph



TrueView 535 Specs (Version C)

The logical evolution of the TrueView 515

LiDAR:

M2 sensor with:

- 3 echo's (vs 2)
- Lighter
- Longer potential range (110m vs 80m but see comments)
- 40.3 in track FOV (vs 31°)

Cameras:

Addition of a 3rd 45 MP Camera, nadir (total 3 cameras)

PLI:

No need to remove the Gimbal attachment on M300, separate connector in the middle of the UAV

What does "longer range" mean for the deliverable?

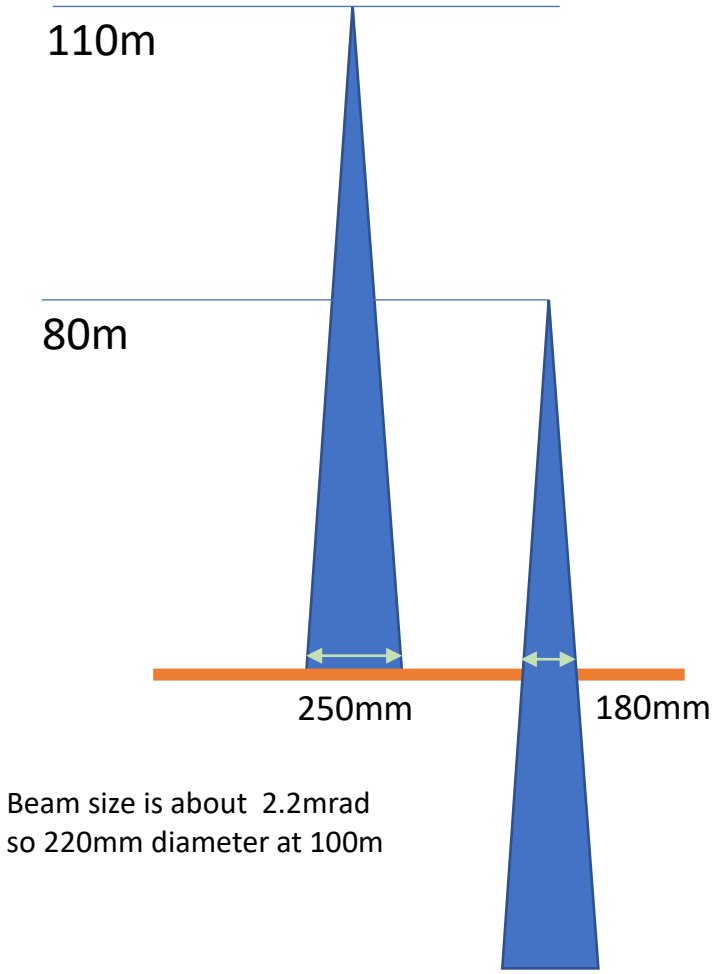
It means that, at the same height above ground, you might have more points. **You will be able to see targets that have lower reflectance.** For example, a black car would have more likelihood of being seen

What does "3 echos" means for the deliverable?

It will have more points below the canopy.

What longer range does NOT mean:

You can fly higher and cover larger area for the same quality. You can fly higher due to the range (110m), **but you get a different product**. Less conformance, meaning less detail will be captured.



Beam size is about 2.2mrad
so 220mm diameter at 100m

What longer range does NOT mean: you can fly higher and cover larger area for the same quality

Maybe the competition says that, but it is our job to be smarter.

- The conformance/resolution is tied to the side of the spot on the ground. For the same beam, the higher the flight, the larger the beam on the ground.
- So while you can fly higher and get the same number of points, the conformance of the results will be less.
- We don’t sell the system as “you can fly higher and cover more ground”. While this is true, it makes a different finished product.

TrueView 535 Specs (Version C)

Reliability:

UHR / 515vB was a big step up compared to HR / 410 / 515vA due to numerous changes and gain of experience:

- Less cabling
- More mature firmware (the same base is used over and over, so after several years, it becomes more stable)
- Better sensor (Hesai is more reliable than Quanergy/Velodyne)

We expect another step up in reliability in the 535 to do the following:

- Less components to assemble
- No more USB cable at all (all new technology FPC – Flat printed circuit)

NEW!

TrueView 540 3D Imaging System

The TrueView 540 Sets a New Standard for Accuracy and Quality in the 500 Series, Making High-end LiDAR More Accessible Than Ever

GeoCue and CHC Navigation bring the most efficient and flexible high-end LiDAR to North America with the new TrueView 540. This next generation of LiDAR elevates our mid-range sensor line, offering enhanced density, improved accuracy, and precision, thereby producing a superior point cloud. The TrueView 540 provides users with an engineering grade sensor powered by LP360 at a mid-range price, marking a significant advancement in LiDAR accessibility and performance.

Ask About TrueView 540 FLEX

FLEX Offers Affordable Pricing and Flexible Software Subscription for GeoCue's TrueView 540

This innovative sales model brings flexibility and affordability to the TrueView 540 by providing users the opportunity to acquire the payload at an attractive price while introducing a simplified and efficient yearly subscription model for LP360 software.

TrueView 540 Specs

Specification	Value
Data Collection	LiDAR + Imagery
Laser Scanner	CHCNAV single beam laser scanner - 1535 nm wavelength
LiDAR Returns	Up to 8
LiDAR Range - Usable	400 m for targets with > 20% reflectivity
Positioning and Orientation System	CHC
Pulse Repetition Rate	Up to 500 kHz
Scanner Performance	• Precision 5 mm • Accuracy: 15 mm
GNSS/INS Performance	• Position: 10-20 mm • Angle: 0.006° Roll/Pitch, 0.019° Heading • Ask for other IMU options available.
System Performance	The TV540 incorporates CHC's PPK navigation solution combined with the scanner's 5 mm repeated ranging accuracy, the system achieves exceptional absolute accuracy from 2 to 5 cm.
Camera Sensor	45 MP Global Shutter Full frame Camera
System Operation Temperature Range	-20° to 50° C
Mass	1.9 Kg for the payload only 2.15 Kg with accessories

NEW!

TrueView 545 3D Imaging System

Features a New 45 MP Full Frame Camera and Unlimited PP-RTX, No Base Station Needed

The TrueView 545 is a premium LiDAR system that builds upon the success of the TrueView 535 with 3 integrated cameras including a new higher performance 45 megapixel nadir camera, bringing unmatched levels of resolution to photogrammetry and LiDAR projects. The system also includes unlimited access to PP-RTX eliminating the time-consuming need to set up a base station in the field.

MOBILE MAPPING CAPABLE

TrueView 545 Specs

Specification	Value
Data Collection	LiDAR + Imagery
Laser Scanner	Hesai XT32M2X
LiDAR Range - Usable	120 m @ 20% reflectivity
LiDAR Beams/Returns	32/3
Cross-track Field of View (FOV)/Combined	120°
In-track FOV	40.3° (-20° to +19.5°)
Pulse Repetition Rate	640 kHz
Scanner Performance	• Precision: 5 mm • Accuracy: 20 mm
GNSS/INS Performance	• Position 20–50 mm • Angle: 0.025° Roll/Pitch, 0.08° Heading
System Performance	• Precision observed on one Strip: Typical 20 mm, Less than 15 mm (1 sigma) observed at 75 m on concrete • Accuracy: Typical 3 cm RMSE, better than 5 cm 3D RMSE – depending on GNSS conditions, accuracy of control points and coordinate system
Camera Sensor	Two 26 MP oblique and a 45 MP nadir camera in the center
System Operation Temperature Range	-15° to 50° C
Mass	1.88 kg (payload unit only - no accessories including battery, mount, antenna, power adapter)

NEW!

TrueView 585 3D Imaging System

Features three cameras and a higher point density for an entry level NDAA compliant system

The True View 585 extends GeoCue's portfolio of NDAA compliant systems with a high-resolution, longer-range survey grade LiDAR option that delivers superior object detection capabilities. This is our most affordable, NDAA compliant system.

NDAA Compliant

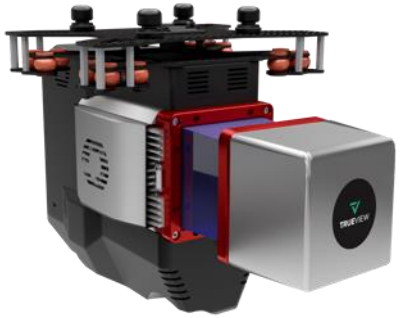
TrueView 585 Specs

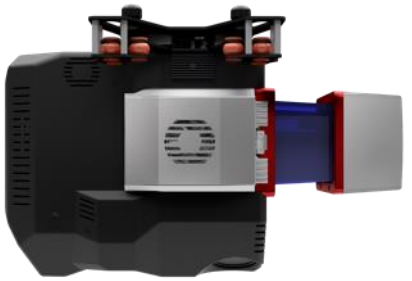
Specification	Value
Data Collection	LiDAR + Imagery
Laser Scanner	Ouster OS2
LiDAR Range - Usable	350 m @> 90% detection probability, 100 klx sunlight
Positioning and Orientation System	Applanix
Pulse Repetition Rate	1311 kHz
Scanner Performance	• Precision: 20 mm at 60 m distance • Accuracy: 25 mm at 60 mm distance
GNSS/INS Performance	• Position: 20–50 mm • 0.025° Roll/Pitch, 0.08° Heading
System Performance	• Precision observed on one strip: Typical 6 cm 1 sigma at 60m • Accuracy: Typical 5 cm RMSE – depending on GNSS conditions, accuracy of control points and coordinate system
Camera Sensor	Triple 1’’ mechanical shutter, hardware mid-exposure pulse, 60 MP combined, RGB
System Operation Temperature Range	-20° to 60° C
Mass	2.18 kg (payload unit only - no accessories including battery, mount, antenna, power adapter)

TrueView 625 3D Imaging System

TrueView 3D imaging system with three cameras and mobile mapping capability

Based on the RIEGL miniVUX-1UAV, similar to our TrueView 655/660, with triple cameras TrueView 625 is where price and performance meet. In addition, the TrueView 625, like all 600-series payloads, is NDAA-compliant. This is the most affordable high-end system combining high accuracy and precision in a budget friendly package.





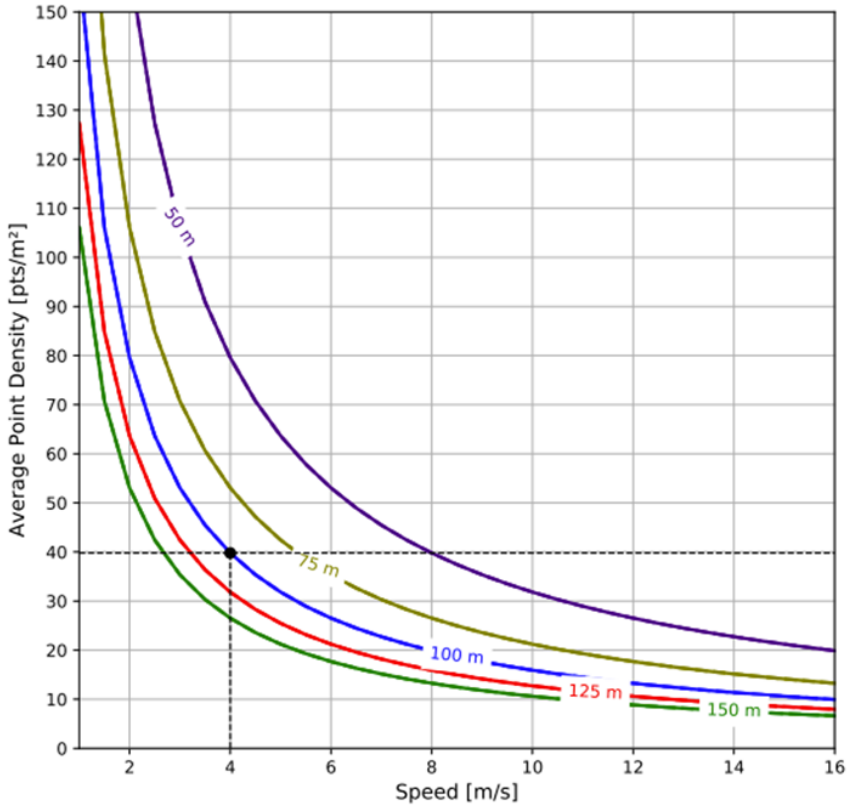
MOBILE MAPPING CAPABLE

NDAA Compliant

TrueView 625 Specs

Specification	Value
Data Collection	LiDAR + Imagery
Laser Scanner	RIEGL miniVUX-1UAV
LiDAR Beams/Returns	Up to 5 per outgoing pulse
LiDAR Range - usable	100 m for targets with > 20% reflectivity
Positioning and Orientation System	Applanix APX-15
Pulse Repetition Rate	Up to 100 kHz (selectable)*
Scanner Performance	• Precision: 10 mm • Accuracy: 15 mm
System Performance	• Precision observed on one Strip: Typical 20 mm, Less than 15 mm (1 sigma) observed at 75 m on concrete • Accuracy: Typical 3 cm RMSE, better than 5 cm 3D RMSE – depending on GNSS conditions, accuracy of control points and coordinate system
GNSS/INS Performance	• Position: 20-50 mm • Angle: 0.025° Roll/Pitch, 0.08° Heading
Camera Sensor	3 Sony IMX-183: 1”, 20 MP, RGB -> 60 MP per payload ***Optional upgrade to high-resolution Sony RX1R2 or Sony a7r. Ask your salesperson for details
Mass	2.44 kg (payload unit only - no accessories including battery, mount, antenna, power adapter)

Density Graph

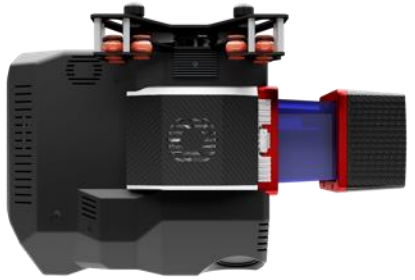


Example: miniVUX-1UAV at 100,000 pulses/second, speed = 4 m/s, range to target = 100 m, resulting point density ~ 40 pts/m²

TrueView 655/660 3D Imaging System

TrueView 655/660 3D Imaging System with three cameras, better point density and dual drone and optional mobile mapping capability

The TrueView® 655/660 is GeoCue's third generation RIEGL integration built with the miniVUX-3UAV and triple mapping cameras (right, left, nadir) for high accuracy mapping with excellent vegetation penetration and wire detection in a lightweight payload package. In addition, you can upgrade to high-resolution Sony RX1R2 or Sony a7r imaging camera for even higher performance.



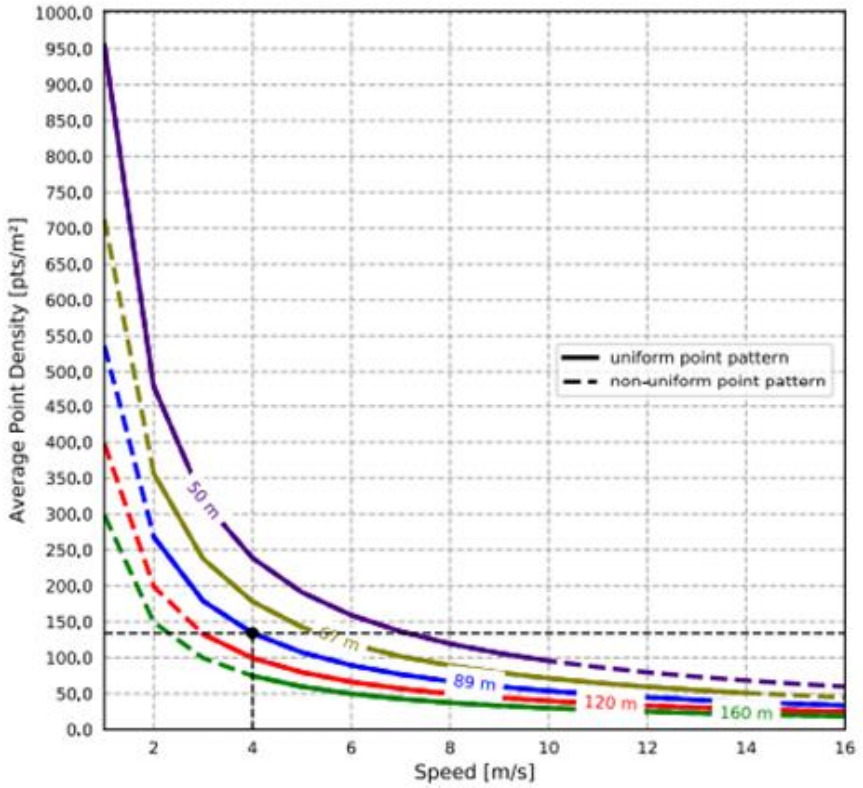
MOBILE MAPPING CAPABLE

NDAA Compliant

TrueView 655/660 Specs

Specification	Value
Data Collection	LiDAR + Imagery
Laser Scanner	RIEGL miniVUX-3UAV
LiDAR Beams/Returns	Up to 5 per outgoing pulse
LiDAR Range - usable	100 m for targets with > 20% reflectivity
Positioning and Orientation System	(655) Applanix APX-15 | (660) Applanix APX-20
Pulse Repetition Rate	Up to 300 kHz (selectable)*
Scanner Performance	• Precision: 10 mm • Accuracy: 15 mm
GNSS/INS Performance	**655** • Position: 20–50 mm • Angle: 0.025° Roll/Pitch, 0.08° Heading **660** • Position 20–50 mm • Angle: 0.025° Roll/Pitch, 0.08° Heading
System Performance	• Precision observed on one Strip: Typical 20 mm, Less than 15mm (1 sigma) observed at 75 m on concrete • Accuracy: Typical 3 cm RMSE, better than 5 cm 3D RMSE – depending on GNSS conditions, accuracy of control points and coordinate system
Camera Sensor	3 Sony IMX-183: 1”, 20 MP, RGB -> 60 MP per payload ***Optional upgrade to high-resolution Sony RX1R2 or Sony a7r. Ask your salesperson for details
Mass	(655) 2.44 kg | (660) 2.6 kg (IMU-90) or 2.8 kg (IMU-82) (with standard 3 camera package) (payload unit only - no accessories including battery, mount, antenna, power adapter)

Density Graph



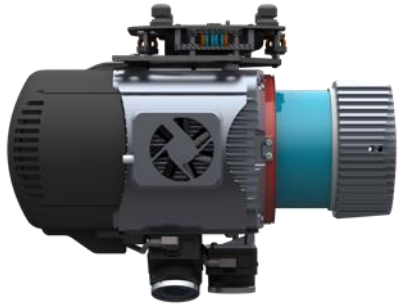
Example: miniVUX-3UAV at 300,000 pulses/second, speed = 4 m/s, range to target = ~ 90 m, resulting point density ~ 135 pts/m²

TrueView 680/680LR 3D Imaging System

Meet TrueView 680/680LR, with Three Cameras for Better Range and Point Density

The TrueView 680/680LR is GeoCue's best 360 degree field of view system, built with the Riegl VUX-1UAV and the 680LR integrates a Riegl VUX-1LR. Select the system that best suits your projects and trust that you will achieve incredible performance in terms of accuracy and point density.

All 600-series payloads are NDAA-compliant.



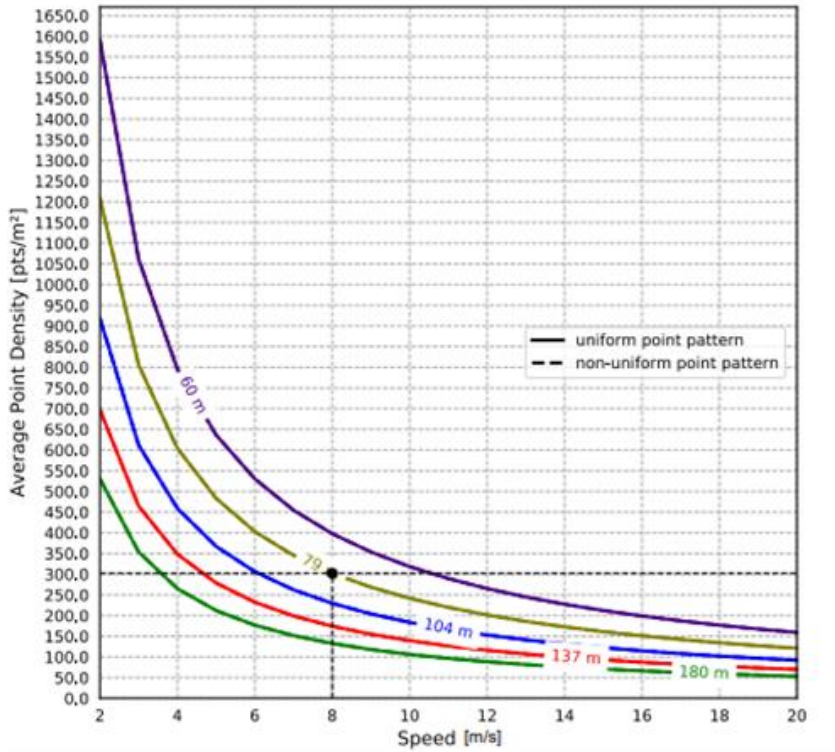
MOBILE MAPPING CAPABLE

NDAA Compliant

TrueView 680/680LR Specs

Specification	Value
Data Collection	LiDAR + Imagery
Laser Scanner	(680) RIEGL VUX-1UAV-22 | (680LR) RIEGL VUX-1LR-22
LiDAR Returns	Up to 7 (680) I 5 (680LR)
Positioning and Orientation System	Applanix APX-20
Pulse Repetition Rate	(680) 800 kHz @ 120 m | (680LR) 1500 kHz @120 m
Scanner Performance	**680** • Precision: 5 mm • Accuracy: 10 mm **680LR** • Precision: 5 mm • Accuracy: 15 mm
GNSS/INS Performance	• Position: 20–50 mm • Angle: 0.015° Roll/Pitch, 0.035° Heading
System Performance	• Precision observed on one Strip: Typical 10 mm, Less than 10 mm (1 sigma) observed at 80 m on concrete • Accuracy: Typical 3 cm RMSE, better than 5 cm 3D RMSE – depending on GNSS conditions, accuracy of control points and coordinate system
Camera Sensor	3 Sony IMX-183: 1”, 20 MP, RGB -> 60 MP per payload
Mass	4.97 kg (payload unit only - no accessories including battery, mount, antenna, power adapter)

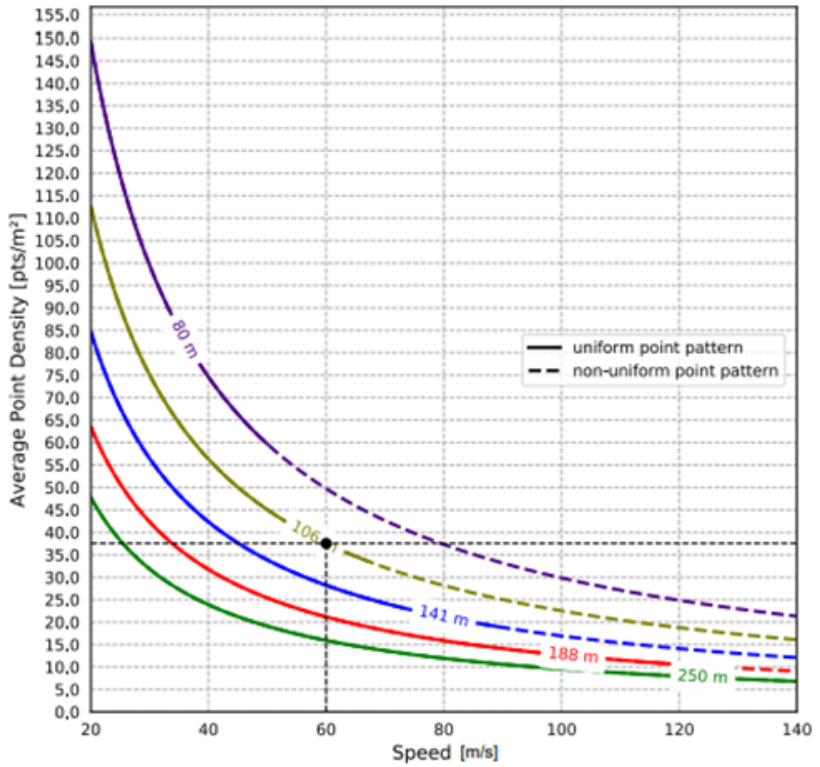
Density Graph



Example: VUX-1UAV[22] at 1,200,000 pulses/second, speed = 8 m/s, range to target = 79 m, resulting point density ~ 302 pts/m²

TrueView 680LR Specs

Density Graph at very high speed (60m/s). Multiply density by 10 for 6m/s typical drone



Example: VUX-1LR[22] at 1,500,000 pulses/second, speed = 60 m/s, range to target = 106 m, resulting point density ~ 38 pts/m²

TrueView 720 3D Imaging System

A New Class of System for New Challenges: TrueView 720 with 3 laser channels + imagery collection

TrueView 720 is our fourth generation RIEGL integration. This is the system for high point density corridor mapping. Using the RIEGL VUX-120 with 3 lidar scanners (oriented nadir and +10 degrees forward and -10 degrees backward) and 3 oblique/nadir cameras for extremely detailed data collection in one flight path. When scanning power lines, users will be able to capture the poles vertically, front and back. Ask about custom camera configurations to cover your specific needs.

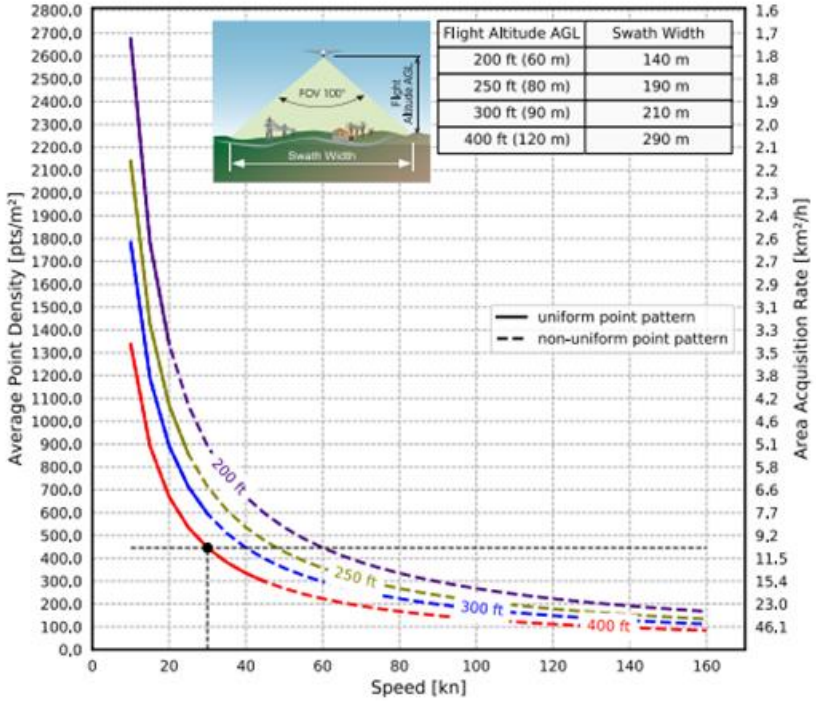
NDAA Compliant

TrueView 720 Specs

Specification	Value
Data Collection	LiDAR + Imagery
Laser Scanner	RIEGL VUX-120
LiDAR Returns	5
LiDAR Range - usable	720 m for targets with > 20% reflectivity
Positioning and Orientation System	Applanix APX-20, ask about other IMU options
Pulse Repetition Rate	Up to 2.4Mhz (selectable)*
Scanner Performance	• Precision: 5 mm • Accuracy: 10 mm
GNSS/INS Performance	• Position 20–50 mm • Angle: 0.015° Roll/Pitch, 0.035° Heading • Ask about other IMU options
System Performance	• Precision observed on one Strip: Typical 10 mm, Less than 10 mm (1 sigma) observed at 80 m on concrete • Accuracy: Typical 3 cm RMSE, better than 5 cm 3D RMSE – depending on GNSS conditions, accuracy of control points and coordinate system
Camera Sensor	Triple 1” sensor with mechanical shutter, hardware mid-exposure pulse, 60 MP combined, RGB. Ask for further custom camera integration.
System Operation Temperature Range	-10° to 40° C
Mass	3.4 kg (payload unit only - no accessories including battery, mount, antenna, power adapter)

TrueView 720 Specs

Density Graph at very high speed (15m/s). Multiply density by 3 for typical 5m/s drone



Example: VUX-120[23] at 2,400,000 pulses/sec, laser power level 100%
Altitude = 400 ft AGL, Speed 30 kn, resulting point density ~ 450 pts/m²

TrueView 720 Specs

- A completely different ball game
- 1.6Gb of data by min of flight
- A density and conformance unheard of for UAV flight. A level of details that opens a new world of possibilities.

TV720 - VUX120

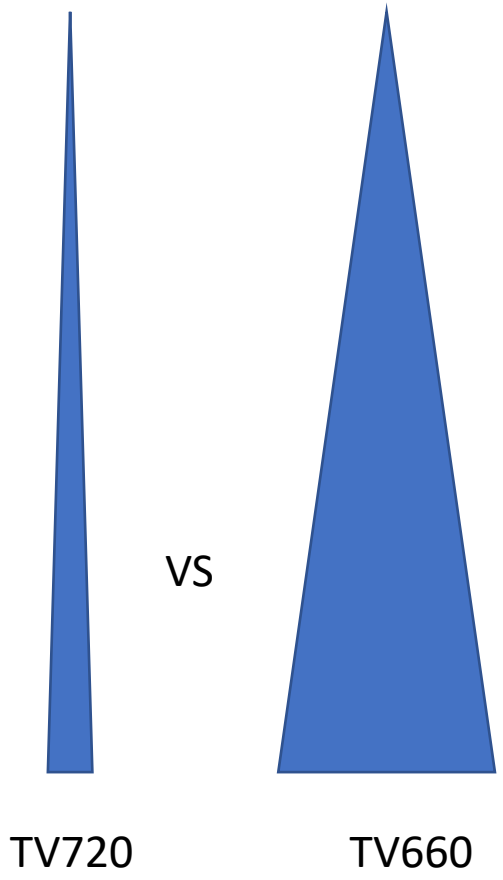
- laser pulse repetition rate up to 2.4 MHz
- Up to 2,000,000 points per second
- 3 beam (NFB, +10,0,-10)
- Laser Beam Divergence 0.4 mrad, which means the beam is 40 mm at 100 m
- Number of returns (with our settings): 5
- FOV 100°

TV660 - MiniVux 3

- laser pulse repetition rate up to 300 Khz
- Up to 100,000 points (at 120°)
- Single beam
- Laser Beam Divergence is 1.6 x 0.5 mrad which means that the beam is 160 mm at 100 m
- Number of return (with our settings): 5
- FOV up to 360°

FOV explanation

- The 3 beams are vertical (green), one forward (blue) and one backward (red). This allows the system to see the face of a building perpendicular to the direction of the flight. 20° FOV on track
- Each beam goes 100° (50left/right), which is 100° across track.
- This is really designed to be an aerial sensor. It would NOT be appropriate for Mobile Mapping/Dual configuration



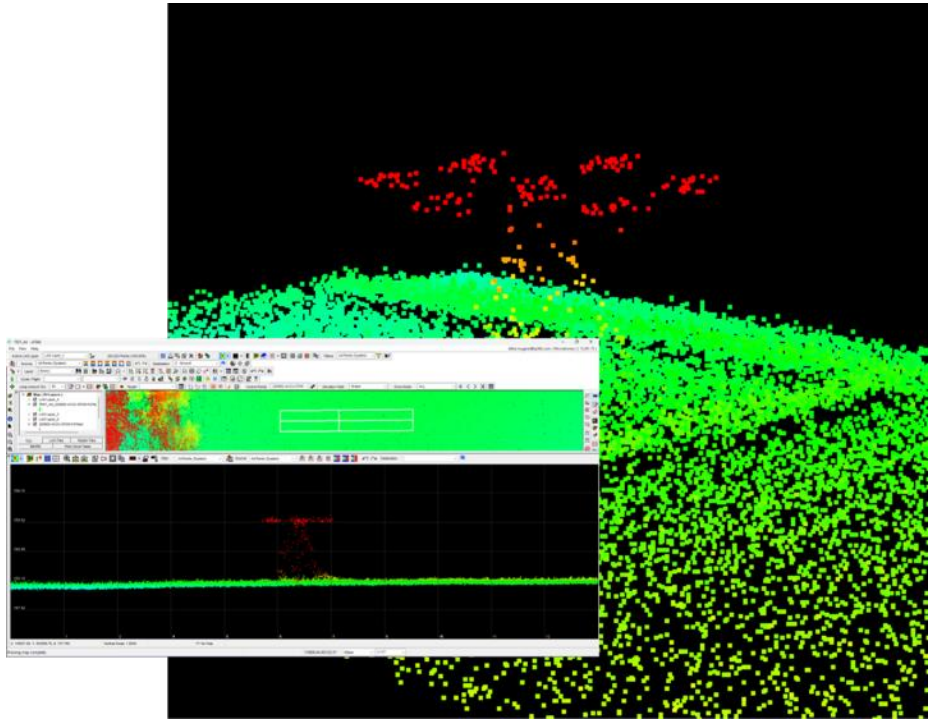
Beam Divergence / Spot size / Conformance

What advantage does that give:

- Better penetration thru Canopy
- Better conformance / rendering of details

This level of density and this tight beam spot size, flown at UAV altitude gives data that are simply unheard of.

Powerline, curbs…everything that was “hard to see” is not off limit anymore.



Accuracy Star

Accuracy Star is a target specially designed for drone LiDAR projects to be installed on your tripod. When used with 3D Accuracy Add-on in LP360, you can achieve automated vertical and horizontal accuracy checks and improvements.

- Install one or multiple Accuracy Star units as a target on the flight area.
- Set-up over known survey nail locations or can act as a base station (when GNSS is added on top of the Accuracy Star)
- Easy Workflow in LP360

Accuracy Star

Use with Your Own Tripod/Base Station (not included)

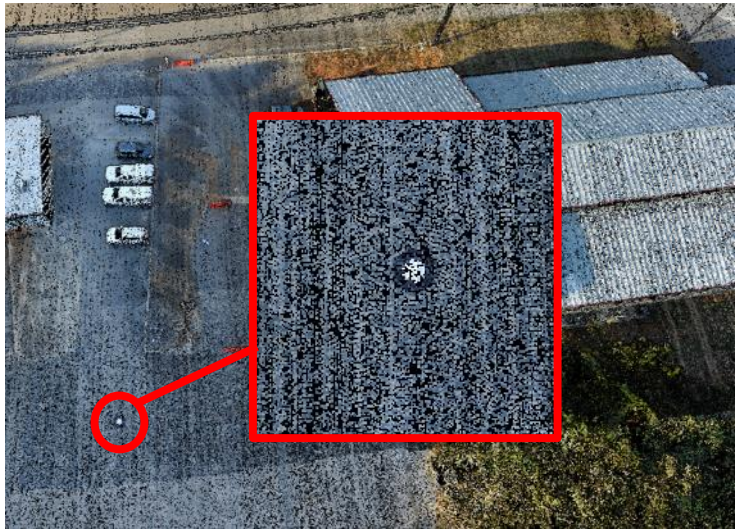
Base station optional at user’s discretion based on project needs. Accuracy Star does not include a tripod or base station, but it is compatible with your preferred equipment.

Concentric Target

The GeoCue Concentric Target are targets specially designed for drone LiDAR projects. When used with 3D Accuracy Add-on in LP360, you can achieve automated vertical and horizontal accuracy checks and improvements.

Benefits of using GeoCue Concentric Target:

- Streamline post-processing and QC of your data
- Automate target measurement and 3D corrections value
- Attain dependable and measurable outcomes
- Optionally Increase accuracy by applying 3D transformation to the point cloud



Convenient and Easy

The GeoCue Concentric Target proves exceptionally convenient, effortlessly installing or uninstalling in mere seconds with its five easily snap-able pieces, featuring a lightweight design for effortless transport, dense construction to resist wind-induced movement, and a simple alignment mechanism via the nail hole at its center.

TRUEVIEW

FLEX and Traditional Pricing

New Pricing: FLEX

A New Sales Model for TrueView 515, 535, and 540 3D Imaging Systems.
FLEX Offers Affordable Pricing and Flexible Software Subscription for GeoCue's TrueView 515, 535, and 540.

GeoCue proudly presents FLEX, an innovative sales model designed to bring unprecedented flexibility and affordability to the TrueView 515, 535, and 540 3D Imaging Systems. FLEX provides users the opportunity to acquire TrueView payloads at an attractive price while introducing a simplified and efficient yearly subscription model for LP360 software.

TV515

TV535

TV540 NEW!

Why Choose FLEX

In response to industry trends, GeoCue introduces FLEX as a strategic move to meet customer demands for a comprehensive solution. FLEX is not just about pricing; it's about empowering our customers with a seamlessly integrated hardware and software solution.

Improve Competitive Advantage

FLEX leverages field-proven technology, giving you a distinct edge in your operations.

Seamless Workflow Integration

Effortlessly integrate UAS into your workflow with the TrueView 515, 535, and 540, ensuring a smooth transition.

Optimize Working Capital

Conserve working capital and enhance cash flow with FLEX's flexible payment schedule.

Strong Return on Investment

FLEX provides a business model that not only meets your needs but also ensures a robust return on your investment.

Selecting a Drone Platform

- TrueView systems can be mounted on any platform capable of carrying the weight of the system, the landing gear needs to be out of view of both sensors.
- GeoCue is an Enterprise DJI distributor.
- GeoCue resells DJI alternatives including; Freefly, Harris, Skyfront, Inspired Flight, Microdrones (with special integration).
- A power adapter will be delivered with each mounting kit.

TrueView 660 Mounted on DJI M300

Additional Requirements

Survey Equipment

The minimum requirement base station must include:

- Static observations recorded to some media
- Dual frequency L1/L2
- Ability to transform the observation file to RINEX format, version 2.11 or later
- We solve the location of the base station using the National Geodetic Survey (NGS) Online Position User Service (OPUS).

Recommendations:

Base/Rover Kit

- Shoot sufficient check shots to cover the extent of the site and land cover types. These will be used to assess accuracy and determine debias values.
- Optional: Set a pattern of photo identifiable ground control targets and measure their locations.


GEOCUE
Microdrones EasyOne Systems

Drone Survey Products

EasyOneLiDARUHR+

EasyOneLiDARUHR
& UHR Lite

EasyOneLiDAR NDAA

LiDAR Specs

	LiDAR Range - useable	LiDAR Beams/Returns	Vertical Accuracy	Pulse Repetition Rate	Cameras
EasyOneLiDARUHR+	120 m @ 20% reflectivity	32/3	Typical 3 cm	640 kHz	1x26mp
EasyOneLiDARUHR	80 m @ 20% reflectivity	32/2	Better than 5 cm RMSE	640 kHz	1x26mp
EasyOneUHRLiDAR Lite	80 m @ 20% reflectivity	16/2	Better than 5 cm RMSE	320 kHz	1 x26mp
mdLiDAR1000UHR	80 m @ 20% reflectivity	32/2	Better than 5 cm RMSE	640 kHz	1x26mp
mdLiDAR1000UHR Lite	80 m @ 20% reflectivity	16/2	Better than 5 cm RMSE	320 kHz	1 x26mp
mdLiDAR1000HR	60 m @ 20% reflectivity	16/2	Better than 5 cm RMSE		1 x5mp

Microdrones Portfolio

End-user price

$105,000 USD

EasyOneLiDAR UHR+

Includes Everything you Need in One Box:

- EasyOne Platform
- 1 Battery
- 1 RC with mdCockpit (embedded)
- 1 UHR+ LiDAR Payload (Hesai M2X)
- Processing software includes LP360 Drone + Strip Align + Desktop Photo add-ons
- One year of hardware, firmware and software maintenance
- Delivered with 5 LP360 Drone Explorer license to visualize the data (inside the same organization)

End-user price

$94,000 USD

EasyOneLiDAR UHR

Includes Everything you Need in One Box:

- EasyOne Platform
- 1 Battery
- 1 RC with mdCockpit (embedded)
- 1 UHR LiDAR Payload (Hesai Pandar XT-32)
- Processing software includes LP360 Drone + Strip Align + Desktop Photo add-ons
- One year of hardware, firmware and software maintenance
- Delivered with 5 LP360 Drone Explorer license to visualize the data (inside the same organization)

End-user price

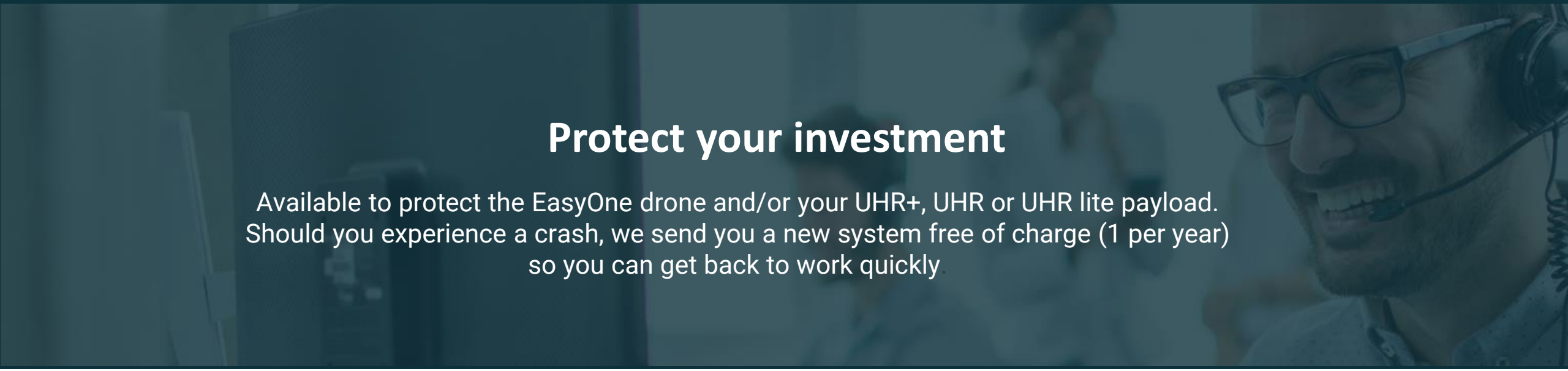
$79,000 USD

EasyOneLiDAR UHR Lite

Includes Everything you Need in One Box:

- EasyOne Platform
- 1 Battery
- 1 RC with mdCockpit (embedded)
- 1 UHR Lite LiDAR Payload (Hesai Pandar XT-16)
- Processing software includes LP360 Drone + Strip Align + Desktop Photo add-ons
- One year of hardware, firmware and software maintenance
- Delivered with 5 LP360 Drone Explorer license to visualize the data (inside the same organization)

Easy Replacement Program



Protect your investment

Available to protect the EasyOne drone and/or your UHR+, UHR or UHR lite payload.
Should you experience a crash, we send you a new system free of charge (1 per year)
so you can get back to work quickly

The best part?

If you don't have an incident that requires a claim, you get a 50% discount on subsequent years until you have an incident

End-user price

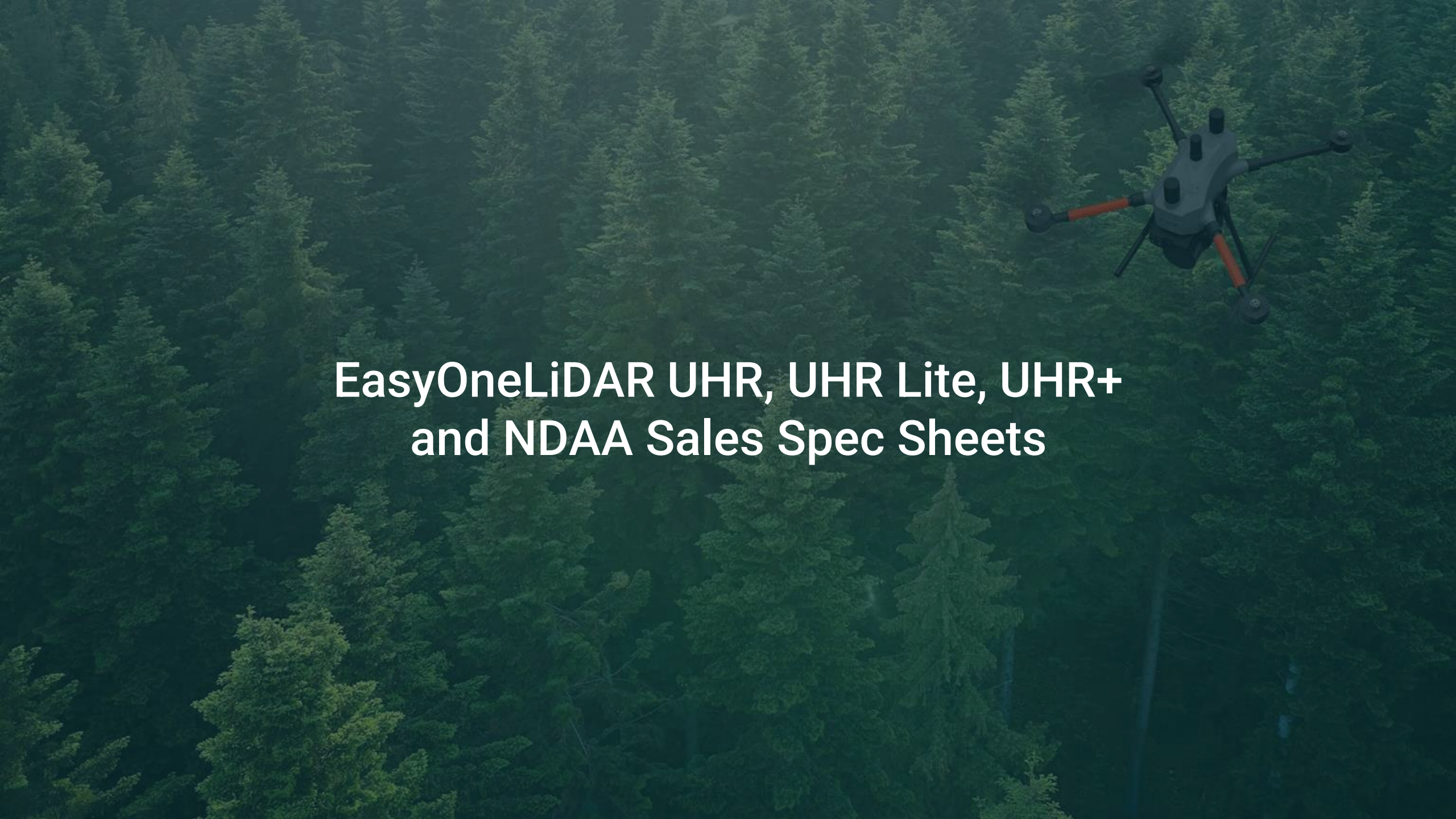
Easy Replacement EasyOneLiDAR UHR Lite	**$22,000**
Easy Replacement EasyOneLiDAR UHR	**$26,000**
Easy Replacement EasyOneLiDAR UHR+	**$29,500**

The most compact survey-grade LiDAR available on the market

EasyOne is ALL in One: the controller is completely integrated with mdCockipit

- EasyOne is easier to transport: drone, payload, controller & battery in one single box
- Real Time Terrain Follow option is available with all EasyOne models: follow the terrain using your LiDAR payload

Easy Replacement Program: purchase this option and get a free replacement of your complete system if you crash



EasyOneLiDAR UHR, UHR Lite, UHR+ and NDAA Sales Spec Sheets

EasyOneLiDAR

EasyOneLiDAR NDAA

- New NDAA GCS
- Microhard radio communication link

EasyOneLiDAR NDAA

Everything you need in one box

EasyOneLiDAR

Ground Control System

- RC with 7-inch integrated tablet
- mdCockpit 2
- FPV camera
- Radio: 2.4 GHz
- Tx power: up to 23dB
- Encryption: AES-128

Payloads available:

- UHR Lite
- UHR
- UHR+

All in one small hard case

- Carrying case to carry your full EasyOne System

NEW EasyOneLiDAR NDAA

Ground Control System

- RC with 8-inch integrated tablet (Samsung Galaxy Tab Active3)
- mdCockpit 2
- NO FPV camera
- Radio: 2x2 MIMO 2.4 GHz (Microhard)
- Tx power: up to 30dB
- Encryption: up to AES-256 (optional)

Payloads available:

NEW NDAA compliant payload with

- Triple 1" mechanical shutter, hardware mid-exposure pulse, 60 MP combined, RGB
- NEW Ouster OS1 LiDAR sensor (128 channels)

All in one small hard case

- Carrying case to carry your full EasyOne System

EasyOneLiDAR NDAA Technical Specs

Solution components

Platform
- EasyOne

Payload
- Triple 1’’ mechanical shutter, hardware mid-exposure pulse, 60 MP combined, RGB
- NEW Ouster OS1 LiDAR sensor (128 channels)
- Georeferencing: Trimble APX-15 UAV

Software
- mdCockpit
- LP360 Drone

Technical specifications

Takeoff Weight (TOW)
- 5.2 kg

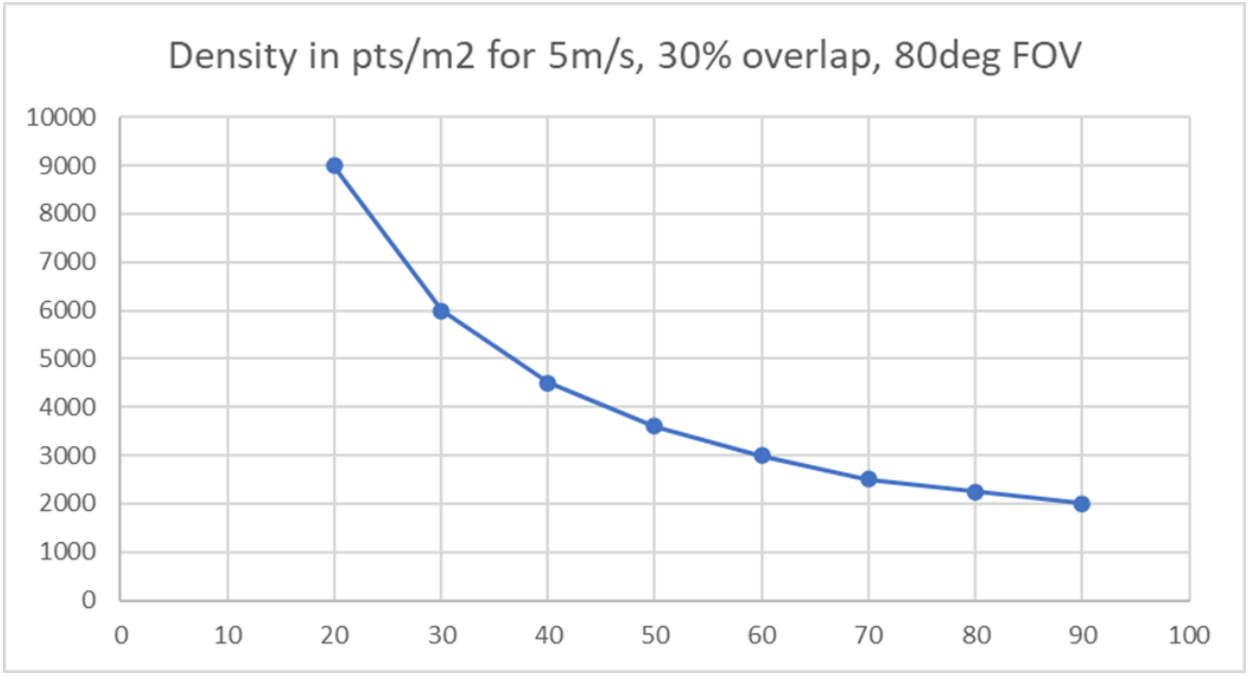
System Operation Temperature
- -10 °C to 40 °C
- 14 °F to 104 °F

Scanner Performance
- Precision 20mm at 60mm distance
- Accuracy: 25mm at 60mm distance
- Number of returns: 2

GNSS/INS Performance
- Position 20-50mm
- Angle: 0.025deg Roll/Pitch, 0.08deg Heading

System Performance
- Precision observed on one strip: Typical 6cm 1 sigma at 60m
- Accuracy: Typical 5cm RMSE – depending on GNSS conditions, accuracy of control points and coordinate system

Density Graph



NEW EasyOne NDAA compliant payload

A real improvement from the HR…

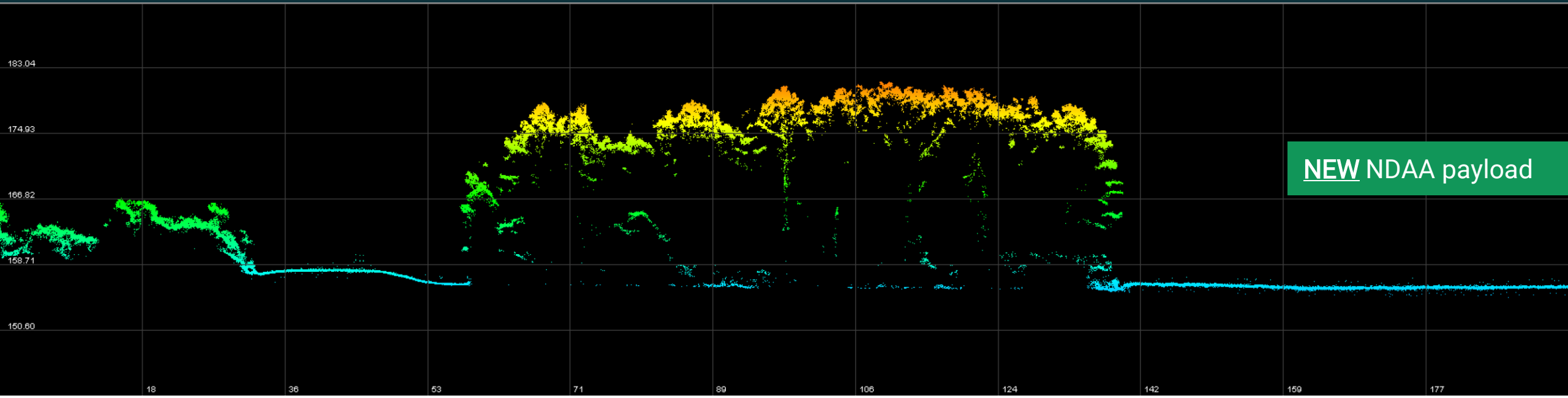
The New NDAA compliant features:

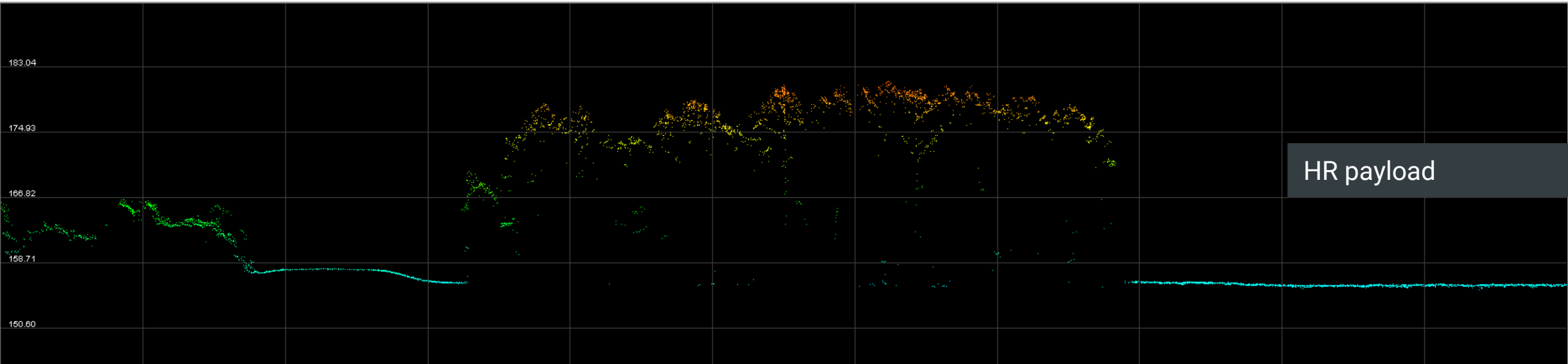
- 3x 20MPx cameras (same as the TV535)
- 128 channels LiDAR sensor (NEW Ouster OS1)

NDAA Compliant

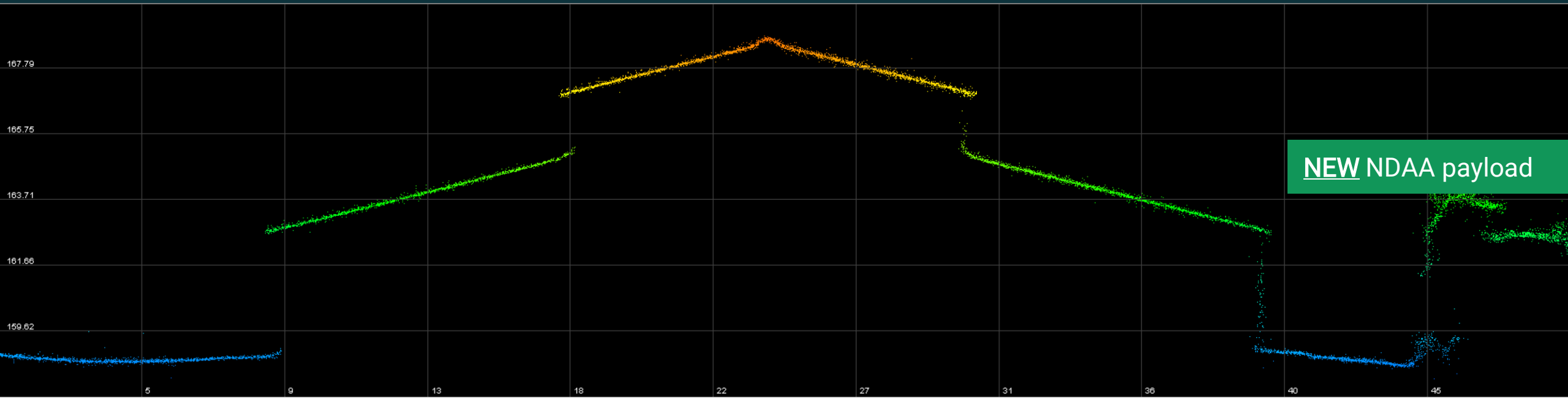
NEW EasyOne NDAA compliant payload

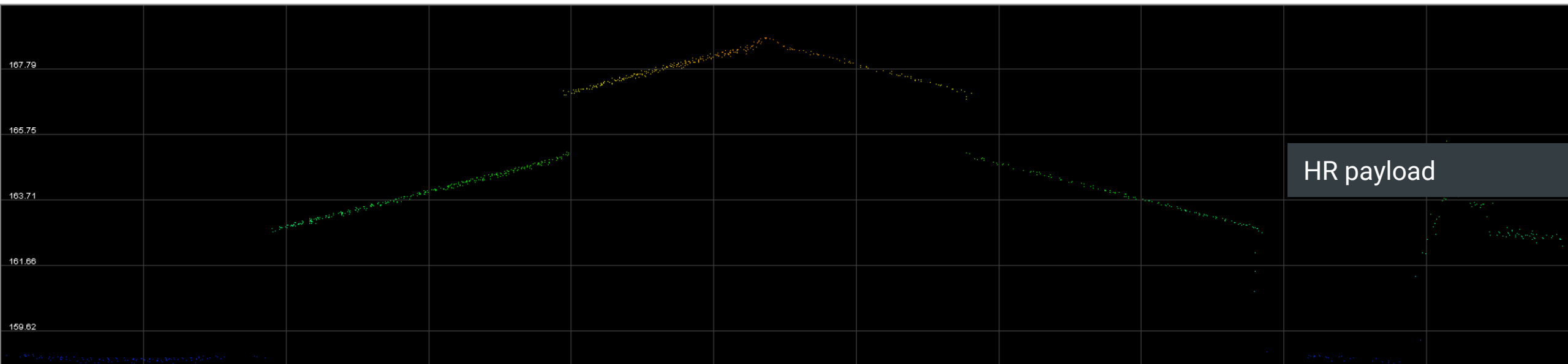
NEW NDAA payload versus HR under the trees





NEW NDAA payload versus HR (noise level)





NEW EasyOne NDAA compliant system

Availability:

- Official release: beginning of September during Commercial UAV Expo
- First deliveries: End of October

Pricing:

- Online version: $115k
- Offline version: $125k

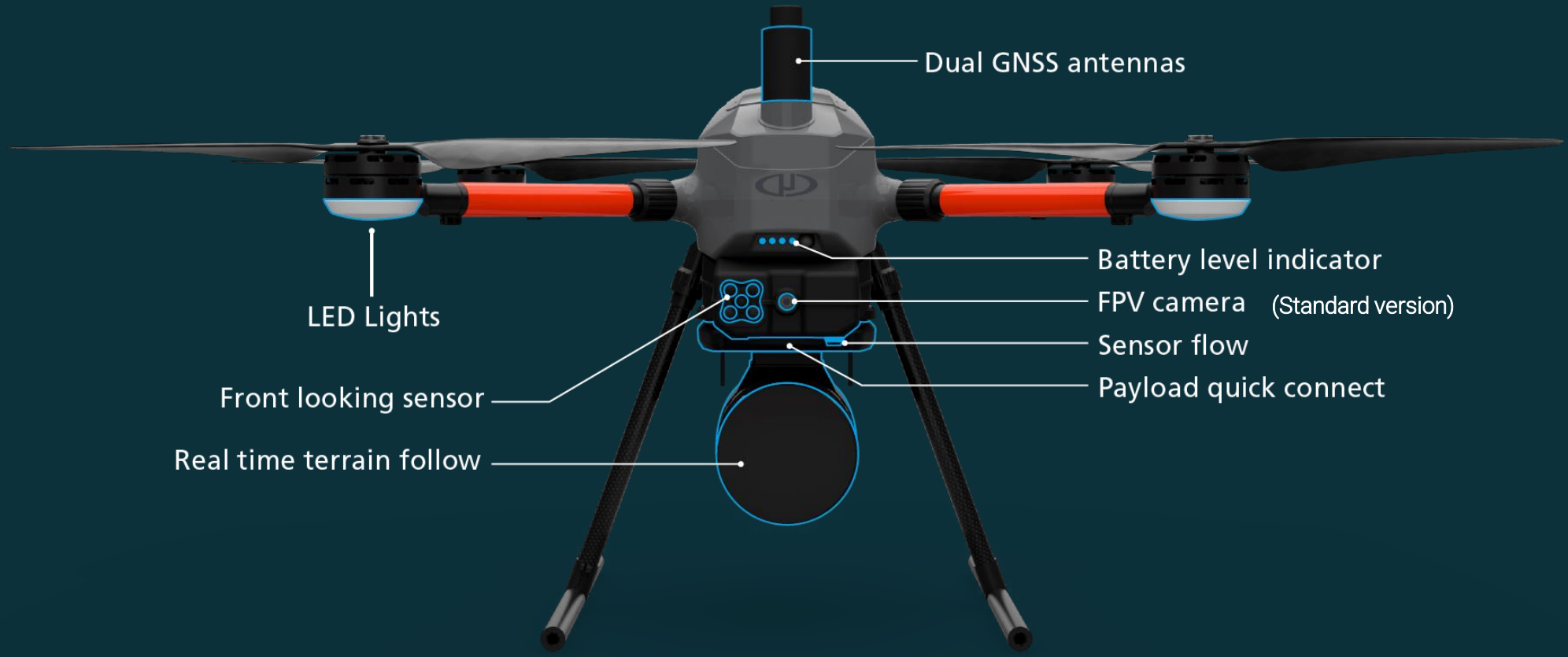
The most compact survey-grade lidar available on the market

EasyOne is ALL in One: the controller is completely integrated with mdCockipit

- EasyOne is easier to transport: drone, payload, controller & battery in one single box that is 31.69” x 15.94” x 15.75” (805 mm x 405 mm x 400 mm)
- Real Time Terrain Follow option is available with all EasyOne models: follow the terrain using your LiDAR payload

Easy Replacement Program: purchase this option and get a free replacement of your complete system if you crash

EasyOne - Overview



Size
•circle with 70 cm diameter to include all motor nacelles
•495 mm x 495 mm from nacelle to nacelle
•955 mm x 955 mm rotor tip to tip
•454 mm height to top of the antenna

Flight time (estimated)
app. 40 min with UHR payload at our location (app. 300 m ASL)

Platform
2000 g

Payload
1400 g

Packaged weight
5500 g

Battery
2100 g

Max take off mass
5700 g

EasyOnLiDAR UHR+

EasyOneLiDAR UHR+

Includes Everything You Need in One Box:

- EasyOne Platform
- 1 Battery with new battery management system
- 1 RC with mdCockpit (embedded)
- 1 UHR+ LiDAR Payload (Hesai M2X)
- Processing software includes LP360 Drone + Strip Align + Desktop Photo add-ons
- One year of hardware, firmware and software maintenance
- Delivered with 5 LP360 Drone Explorer license to visualize the data (inside the same organization)

EasyOneLiDAR UHR+ Technical Specs

Solution components

Platform
- EasyOne

Payload
- LiDAR Sensor: Hesai Pandar XT32M2X
- Camera Sensor: 1x Microdrones
- CMOS APS-C 26 MP
- Georeferencing: Trimble APX-15 UAV

Software
- mdCockpit
- LP360 Drone

Technical specifications

Takeoff Weight (TOW)
- 5.2 kg

System Operation Temperature
- -10 °C to 40 °C
- 14 °F to 104 °F

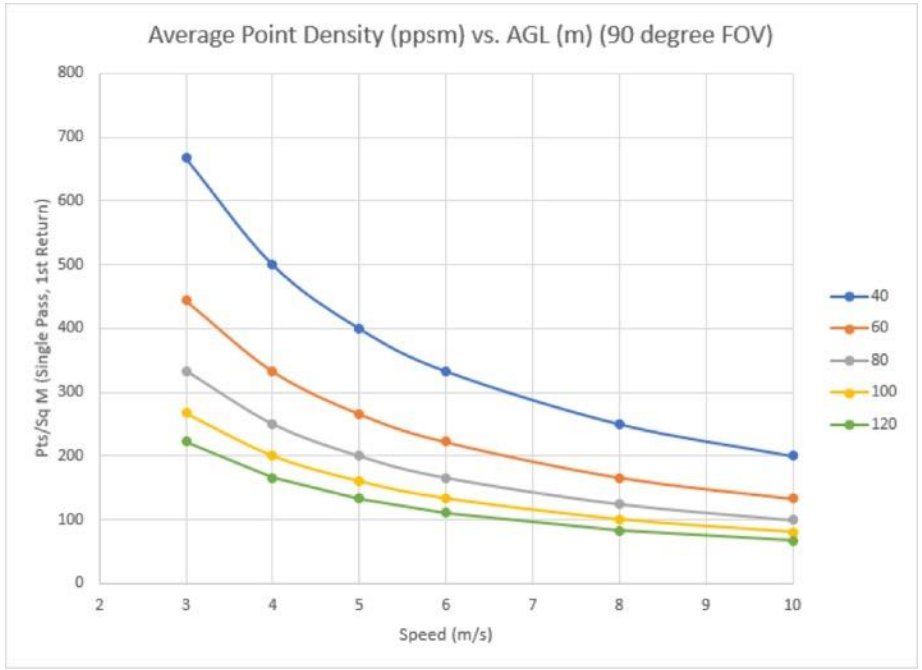
Scanner Performance
- Precision 5 mm
- Accuracy: 20 mm
- Number of returns: 3

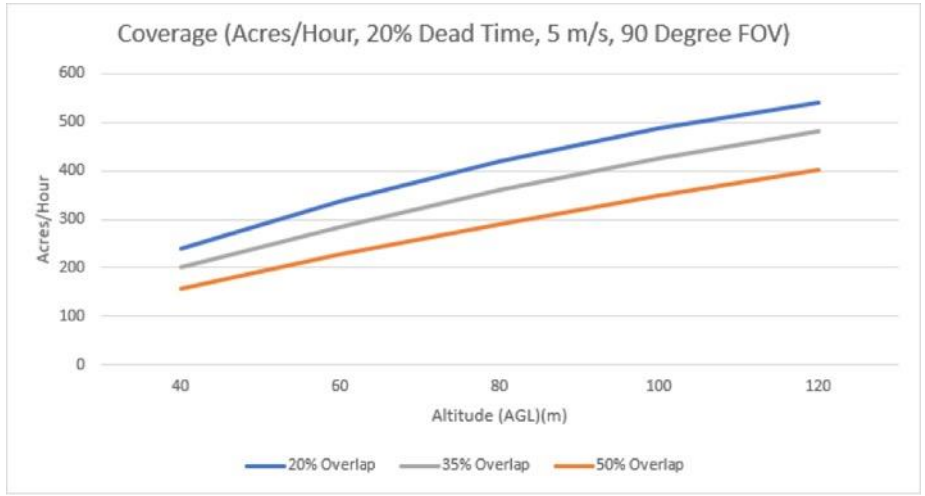
GNSS/INS Performance
- Position 20-50 mm
- Angle: 0.025 deg Roll/Pitch, 0.08 deg Heading

System Performance
- Precision observed on one strip : Typical 20mm, Less than 15 mm (1 sigma) observed at 75 m on concrete
- Accuracy: Typical 3 cm RMSE, better than 5cm 3D RMSE – depending on GNSS conditions, accuracy of control points and coordinate system

Photogrammetry
- Horizontal: 2 – 3 pixels | Vertical: 3 – 5 pixels

EasyOneLiDAR UHR+ Technical Specs





EasyOneLiDAR UHR & UHR Lite

EasyOneLiDAR UHR

Includes Everything You Need in One Box:

- EasyOne Platform
- 1 Battery with new battery management system
- 1 RC with mdCockpit (embedded)
- 1 UHR LiDAR Payload (Hesai Pandar XT-32)
- Processing software includes LP360 Drone + Strip Align + Desktop Photo add-ons
- One year of hardware, firmware and software maintenance
- Delivered with 5 LP360 Drone Explorer license to visualize the data (inside the same organization)

EasyOneLiDAR UHR Technical Specs

Solution components

Platform
- EasyOne

Payload
- LiDAR Sensor: Hesai Pandar XT-32
- Camera Sensor: 1x Microdrones CMOS APS-C 26 MP
- Georeferencing: Trimble APX-15 UAV

Software
- mdCockpit
- LP360 Drone

Technical specifications

Takeoff Weight (TOW)
- 5.6 kg

System Operation Temperature
- -10 °C to 40 °C
- 14 °F to 104 °F

Scanner Performance
- Precision 5 mm
- Accuracy: 20 mm
- Number of returns: 2

GNSS/INS Performance
- Position 20-50 mm
- Angle: 0.025 deg Roll/Pitch, 0.08 deg Heading

System Performance
- Precision observed on one strip: Typical 20 mm, Less than 15 mm (1 sigma) observed at 75 m on concrete
- Accuracy: Typical 3 cm RMSE, better than 5 cm 3D RMSE – depending on GNSS conditions, accuracy of control points and coordinate system

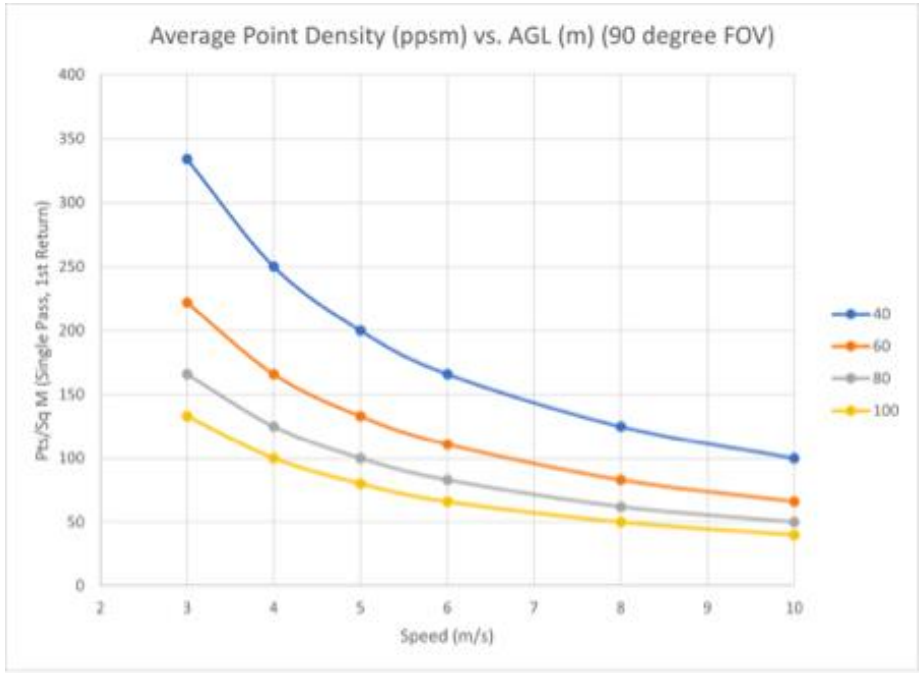
Photogrammetry
- Horizontal: 2 – 3 pixels | Vertical: 3 – 5 pixels

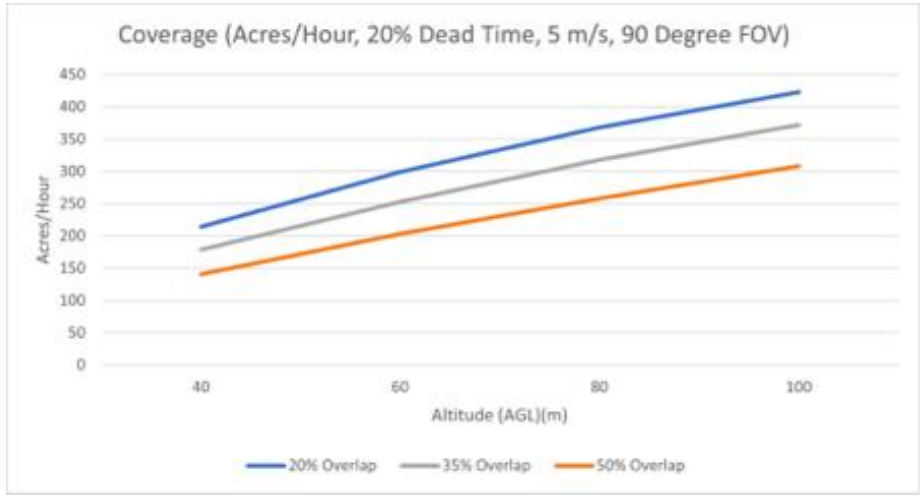
EasyOneLiDAR UHR Technical Specs

Payload technical specs

Flight Altitude AGL [1,2] (m/ft)	40/130	60/200	80/260	100/330
Area Coverage at 20% Overlap (hectare/acres)[3]	87/214	121/299	149/368	171/423
Area Coverage at 35% Overlap (hectare/acres)[3]	72/179	102/253	129/318	150/372
Area Coverage at 50% Overlap (hectare/acres)[3]	57/141	82/203	104/258	124/308
Speed (m/s)	Average Point Density in pts/m^2 [2,3] (Single Pass, 90 degree FOV, 1st Return Only)			
3	667	444	333	267
4	500	333	250	200
5	400	266	200	160
6	333	222	166	133
8	250	166	125	100
10	200	133	100	80
Camera GSD (mm)	9.4	14.1	18.8	23.5
Swath width (m/ft) at 56° FOV	42/138	63/207	85/279	106/348
Swath width (m/ft) at 90° FOV	80/262	120/394	160/525	200/656
Swath width (m/ft) at 110° FOV	114/374	171/561	229/751	285/935
Number of Laser Returns	2	2	2	2

EasyOneLiDAR UHR Technical Specs





EasyOneLiDAR UHR Lite Technical Specs

Solution components

Platform
- EasyOne

Payload
- LiDAR Sensor: Hesai Pandar XT-16 (upgradeable to XT-32 via firmware)
- Camera Sensor: 1x Microdrones CMOS APS-C 26 MP
- Georeferencing: Trimble APX-15 UAV

Software
- mdCockpit
- LP360 Drone

Technical specifications

Takeoff Weight (TOW)
- 5.6 kg

System Operation Temperature
- -10 °C to 40 °C
- 14 °F to 104 °F

Scanner Performance
- Precision 5 mm
- Accuracy: 20 mm
- Number of returns: 2

GNSS/INS Performance
- Position 20-50 mm
- Angle: 0.025 deg Roll/Pitch, 0.08 deg Heading

System Performance
- Strip precision: Typical 20 mm, Less than 15 mm (1 sigma) observed at 75 m on concrete
- Accuracy: Typical 3 cm RMSE, better than 5 cm 3D RMSE – depending on GNSS conditions, accuracy of control points and coordinate system

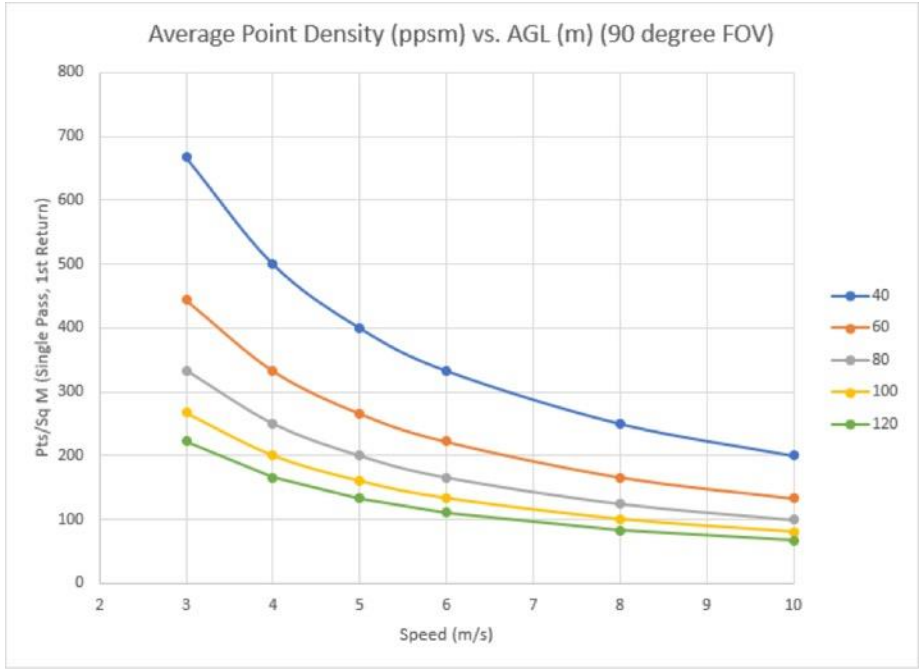
Photogrammetry
- Horizontal: 2 – 3 pixels | Vertical: 3 – 5 pixels

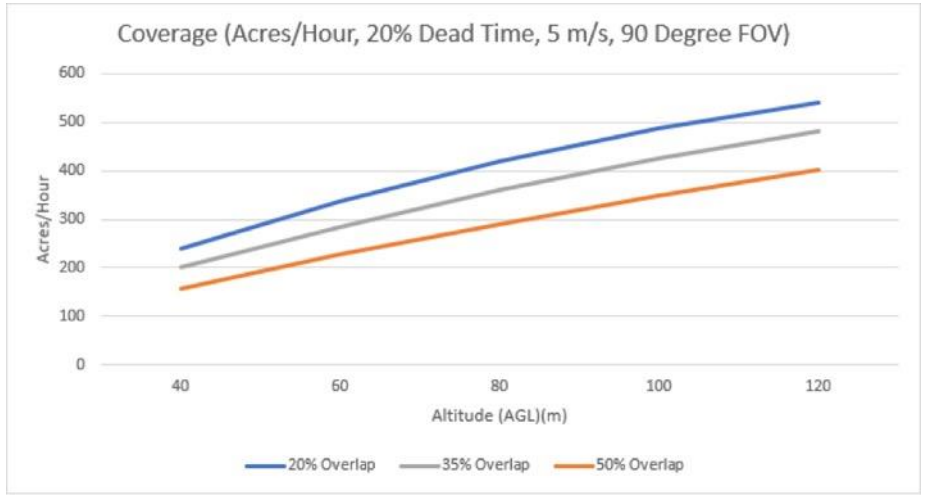
EasyOneLiDAR UHR Lite Technical Specs

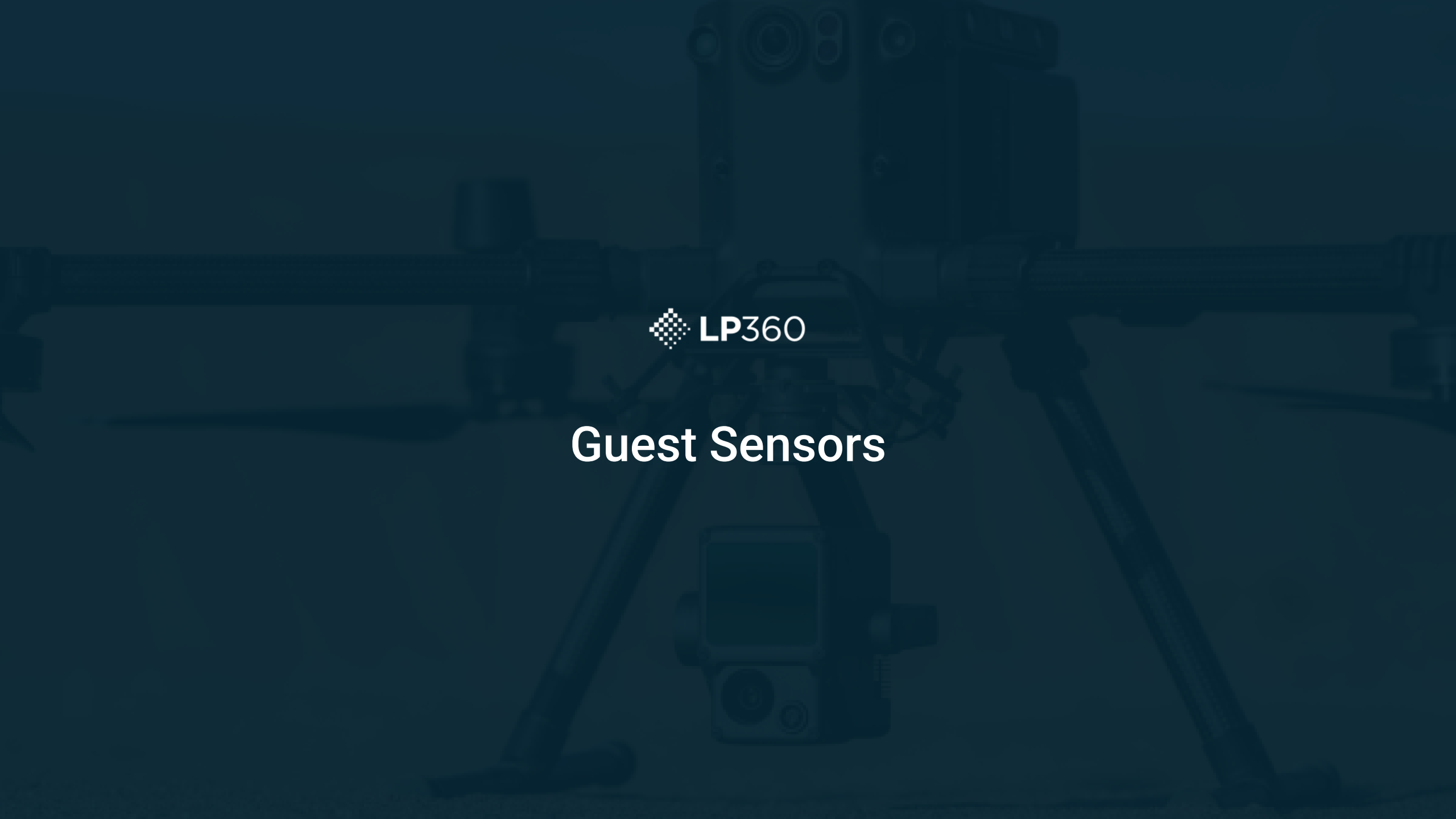
Payload technical specs

Flight Altitude AGL [1,2] (m/ft)62	40/130	60/200	80/260	100/330
Area Coverage at 20% Overlap (hectare/acres)[3]	87/214	121/299	149/368	171/423
Area Coverage at 35% Overlap (hectare/acres)[3]	72/179	102/253	129/318	150/372
Area Coverage at 50% Overlap (hectare/acres)[3]	57/141	82/203	104/258	124/308
Speed (m/s)	Average Point Density in pts/m^2 [2,3] (Single Pass, 90 degree FOV, 1st Return Only)			
3	334	222	166	133
4	250	166	125	100
5	200	133	100	80
6	166	111	83	66
8	125	83	62	50
10	100	66	50	40
Camera GSD (mm)	9.4	14.1	18.8	23.5
Swath width (m/ft) at 56° FOV	42/138	63/207	85/279	106/348
Swath width (m/ft) at 90° FOV	80/262	120/394	160/525	200/656
Swath width (m/ft) at 110° FOV	114/374	171/561	229/751	285/935
Number of Laser Returns	2	2	2	2

EasyOneLiDAR UHR Lite Technical Specs



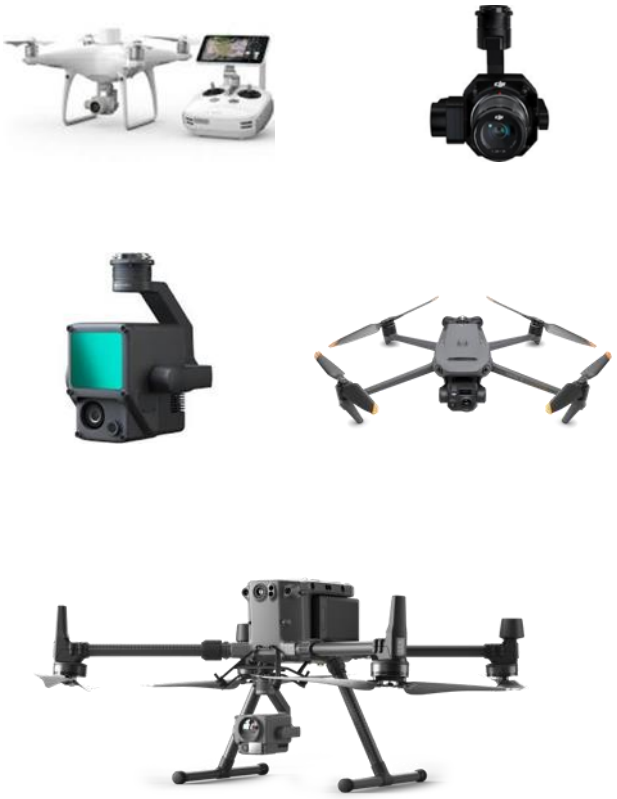




Guest Sensors

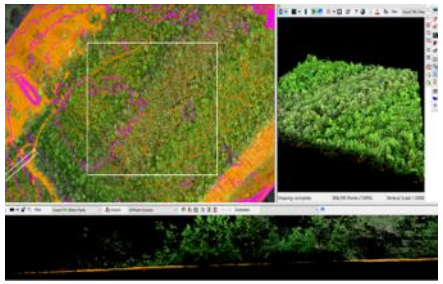
Support for Non-GeoCue Systems

DJI Platforms

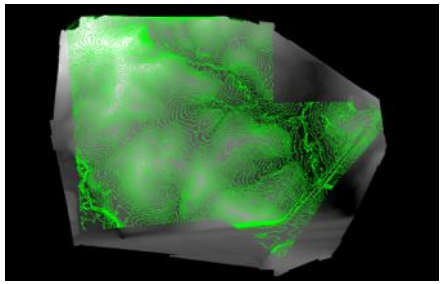


Guest Sensors

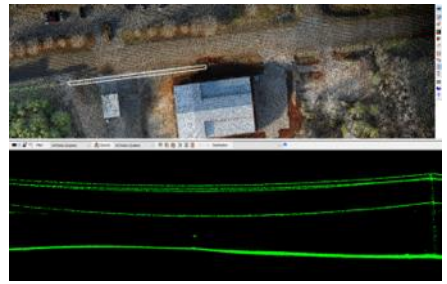
- LP360 software can process data from any system (UAV, airborne)
- Once data is in standard LAS format, import into LP360 for:



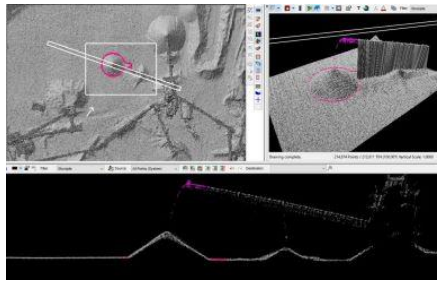
Classification



Generating DEMs

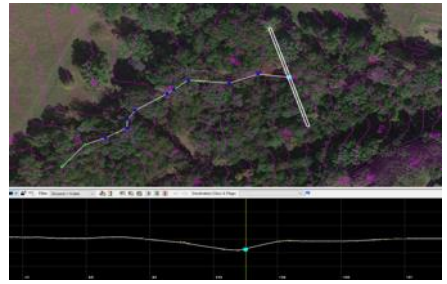


Transmission Modeling



Volumetrics

Cross Sections



Preparing Data for CAD

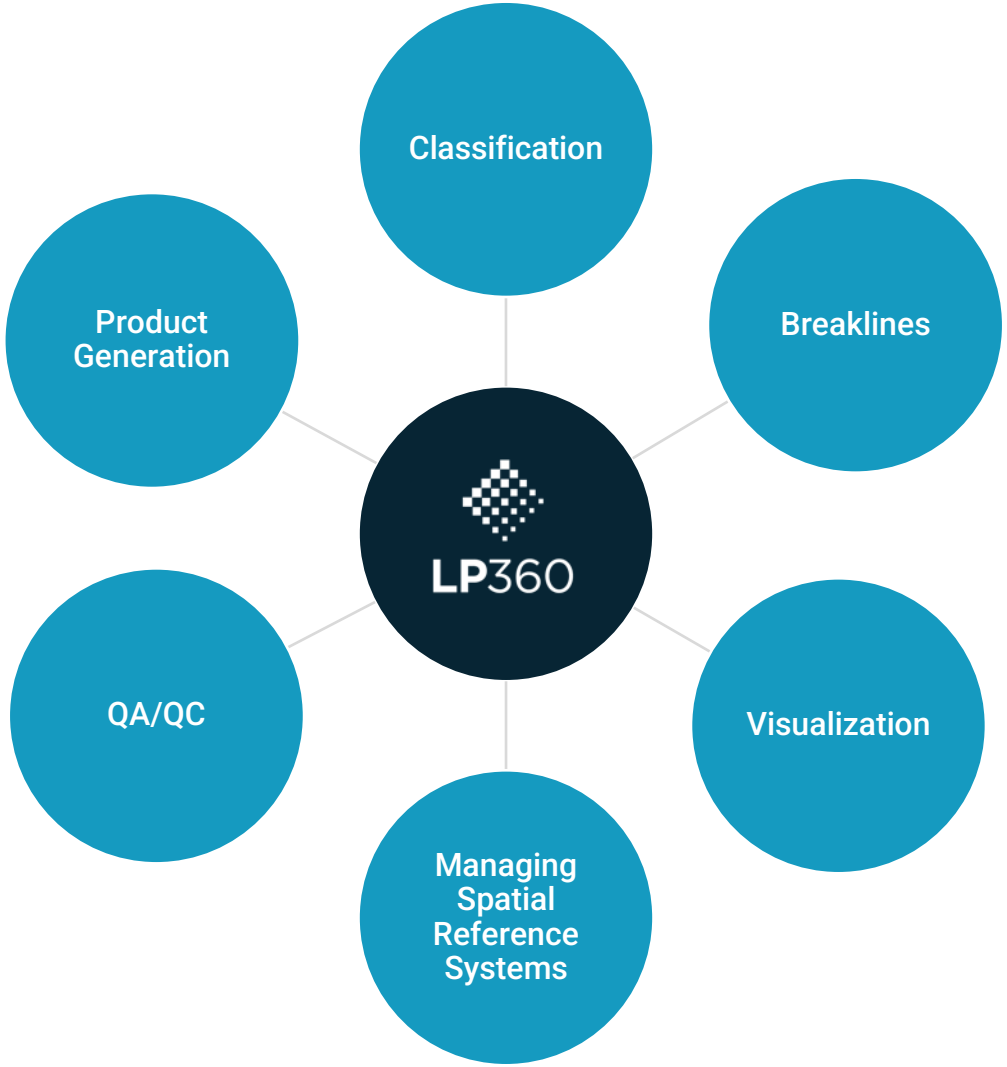
Data Processing Software

LP360 Drone

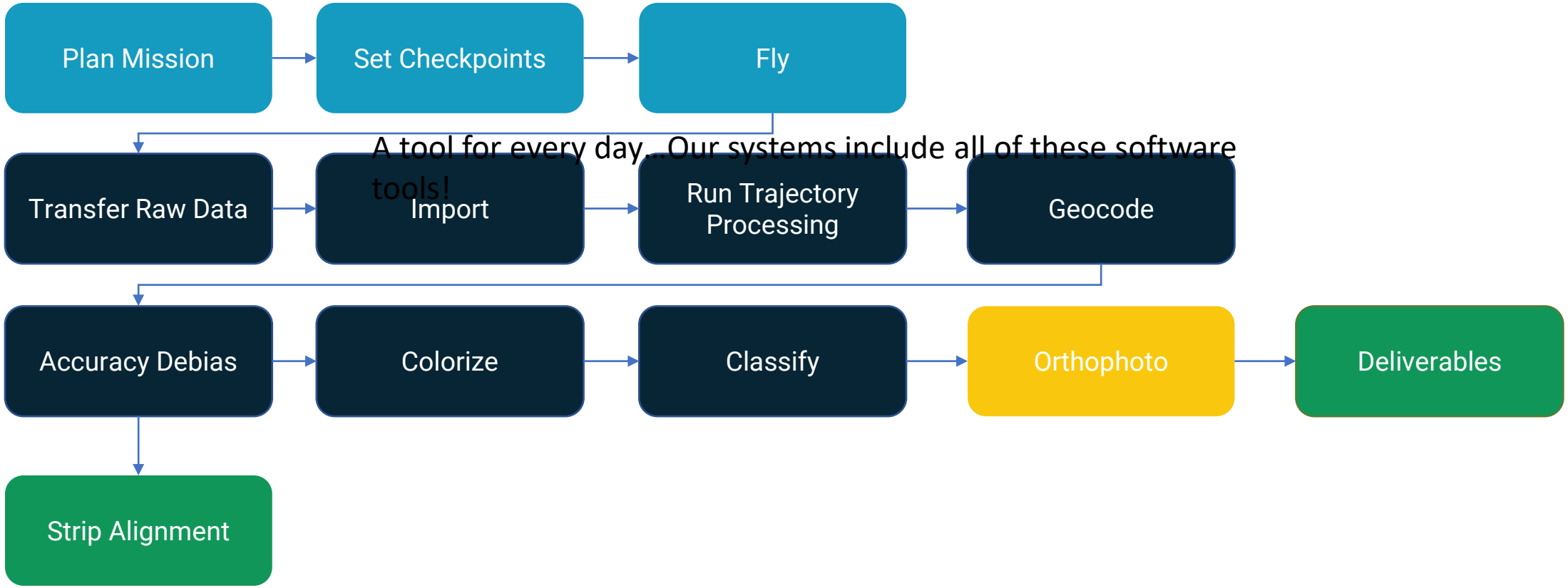
What to Look For in Your Processing Software

- Ease of Use
- Integrated Position/Orientation Tools
- Robust Geocoding with Error Correction
- Strip Matching/Block Adjust Included
- 3D Colorization (Ray Tracing)
- Direct Orthophoto Generation
- Extensive Support for Spatial Reference Systems inc. Transformations
- Visualization
- Point Cloud Classification Library
- Surface Modelling with Breaklines
- Contour Generation
- DEM/DTM Creation
- Value-Add Tools (Power Lines, Stockpile Volumes)

A tool for every day…Our systems include all of these software tools!



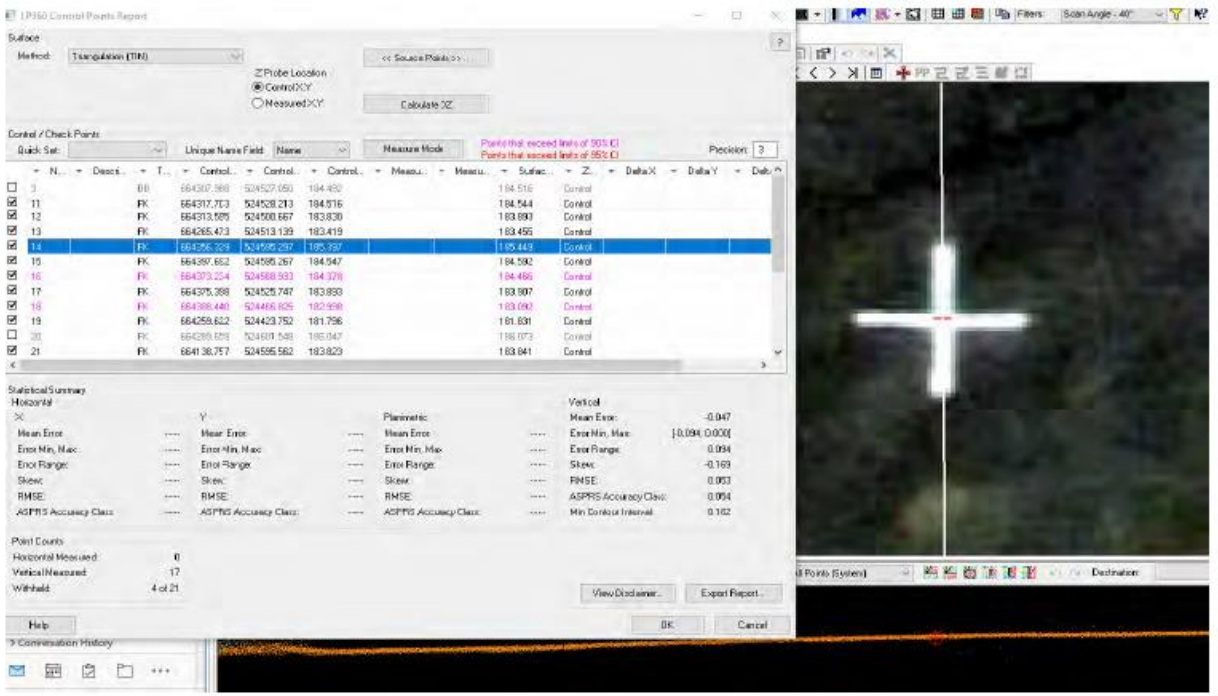
The typical workflow after downloading the data post-flight is as follows:



A tool for every day...Our systems include all of these software tools!

Accuracy Assessment

- Control reports check for horizontal and vertical accuracy against known control (check points).
- Statistical analysis to determine and apply debias.
- Adaptive point cloud smoothing.
- Tested and reported to ASPRS accuracy guidelines.

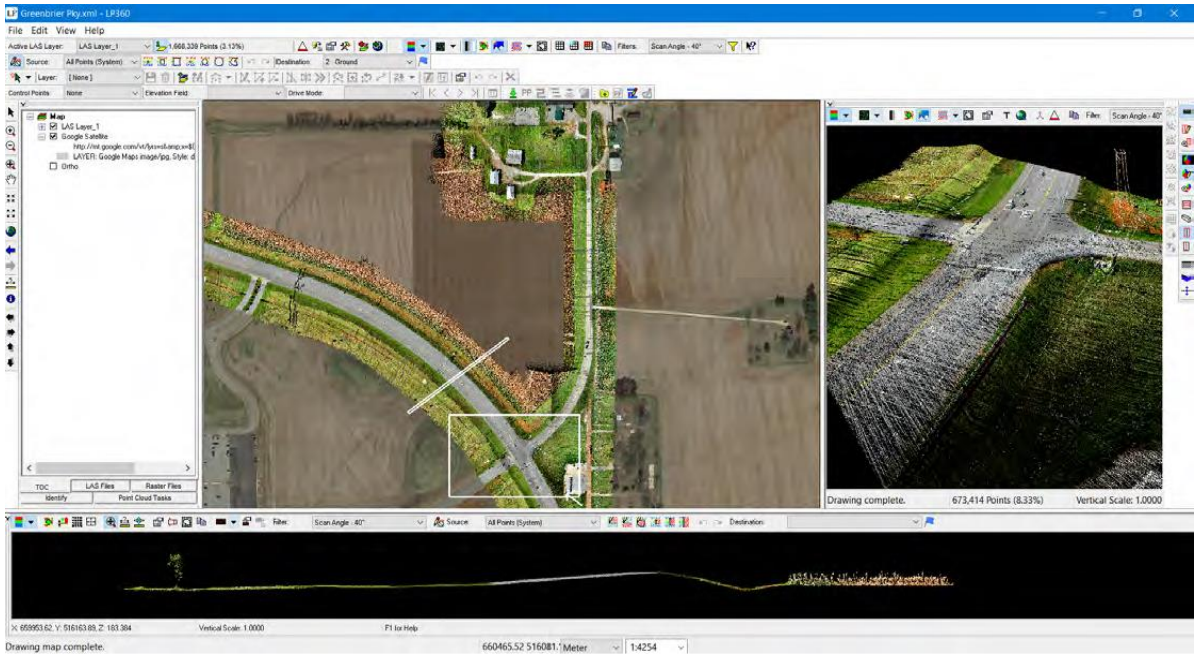


Point Cloud Classification

- Ground classification (bare earth) is usually done via a variation of an adaptive TIN algorithm.
- Extensive library of other classification algorithms available for other downstream workflows.
- Manual editing and automated clean-up tools help withpost-classification QA/QC.

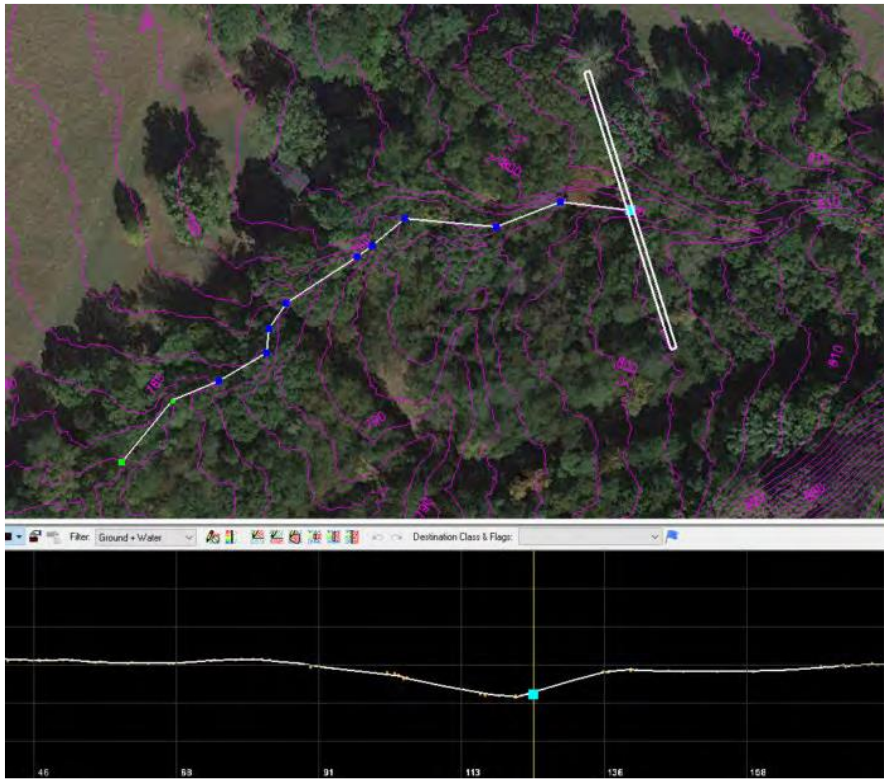
Grid-to-Ground

- Grid-to-Ground fully supported for users of local coordinate reference systems.
- Full support for coordinate reference systems and datums.
- Built-in reprojection tools for points, features, and rasters.



Surface Modeling With Breaklines

- Surface models can enforce breaklines stored as feature layers.
- Breakline compilation fully-supported with a suite of editing tools to aid in creation and editing.
- Enforcement of conflation rules (draping) to lidar surfaces.
- Tools for checking and enforcing downstream constraints for hydro enforcement of surface models.
- Retaining wall enforcement.
- Allows for surface enhancement and reduction for CAD applications.



Product Generation (Deliverables)

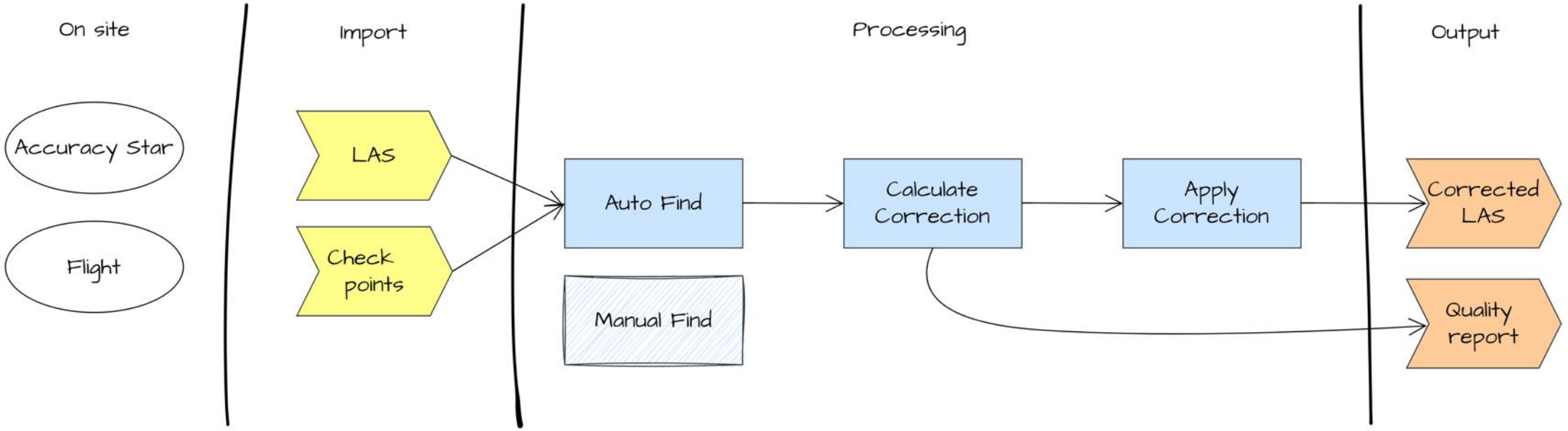
- A classified point cloud is often just the source for other derived products as deliverables:
  - Contours
  - DTM/DEM
  - Sdafa
- Prepping data for CAD/Contour generation.

Advanced Workflows

LP360 supports multiple additional advanced workflows for point cloud classification, analysis and feature extraction:

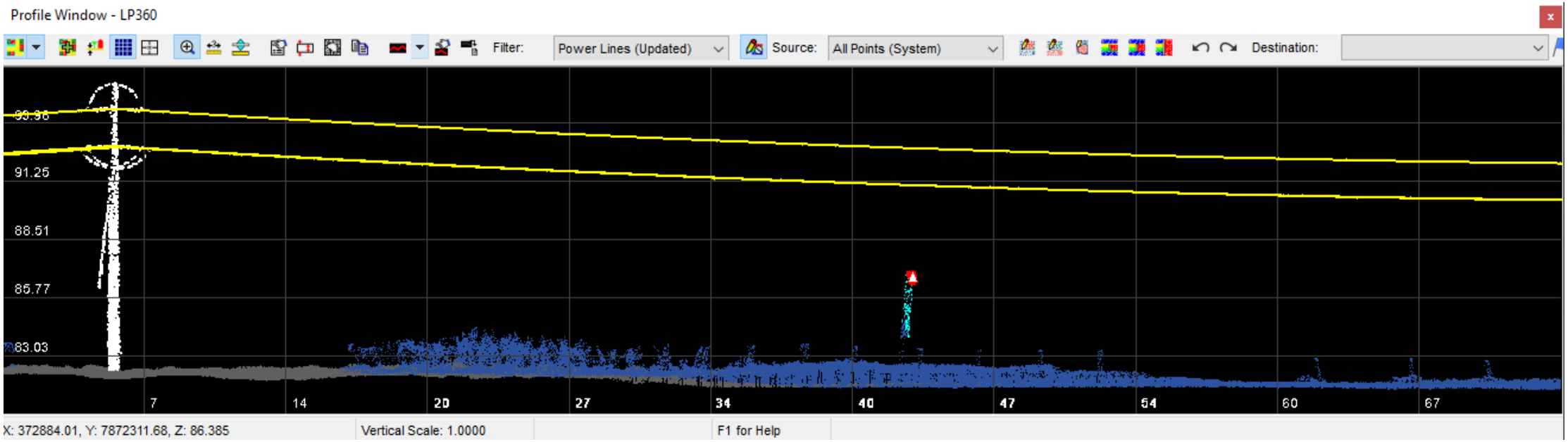
- Buildings (Planar Surfaces)
- Power Lines (Wires and Encroachments)
- Volumetrics
- Rail
- Affine Transforms
- Classify By Features
- Model Key Points

LP360 Workflows



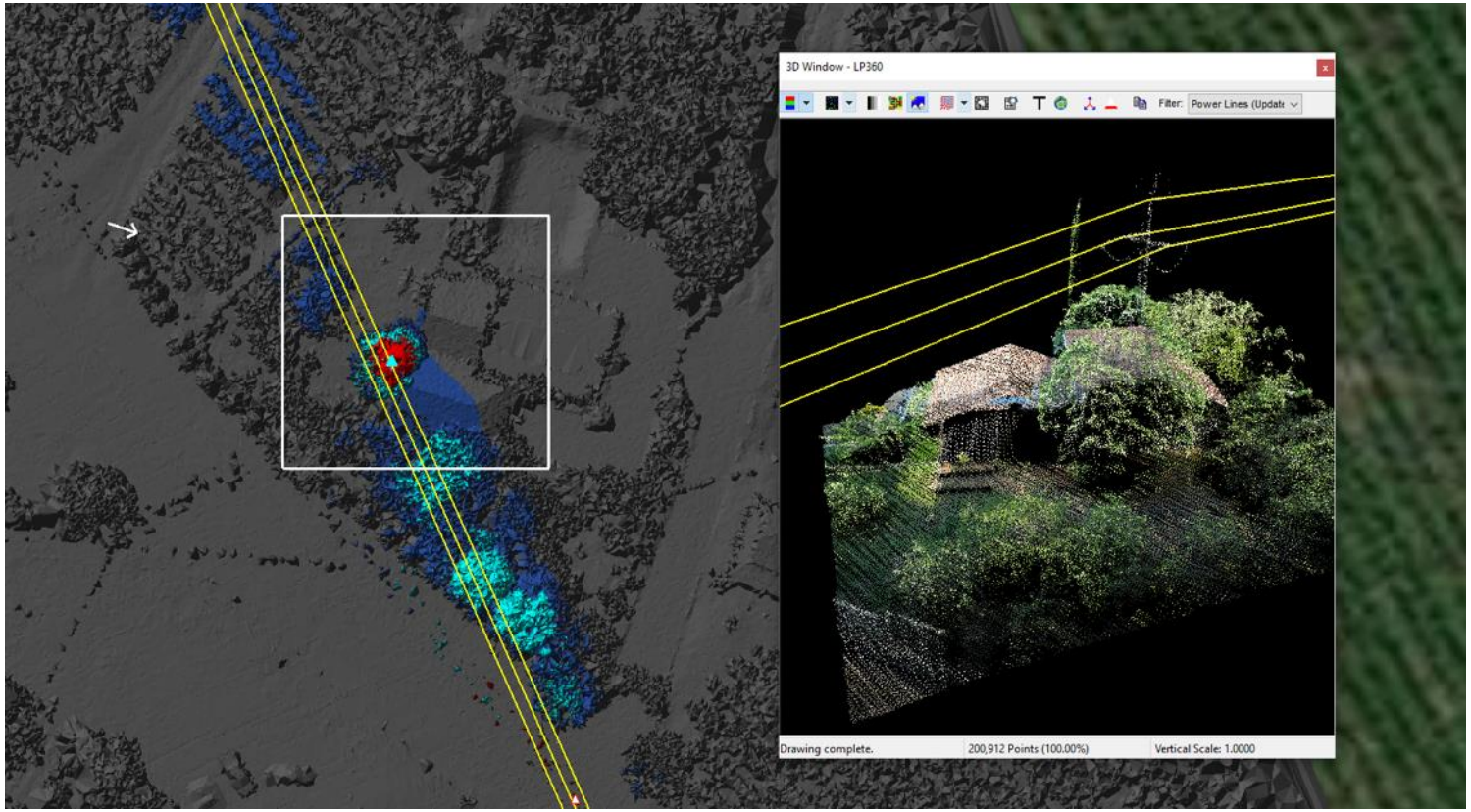
Case Study – Transmission Line Encroachment

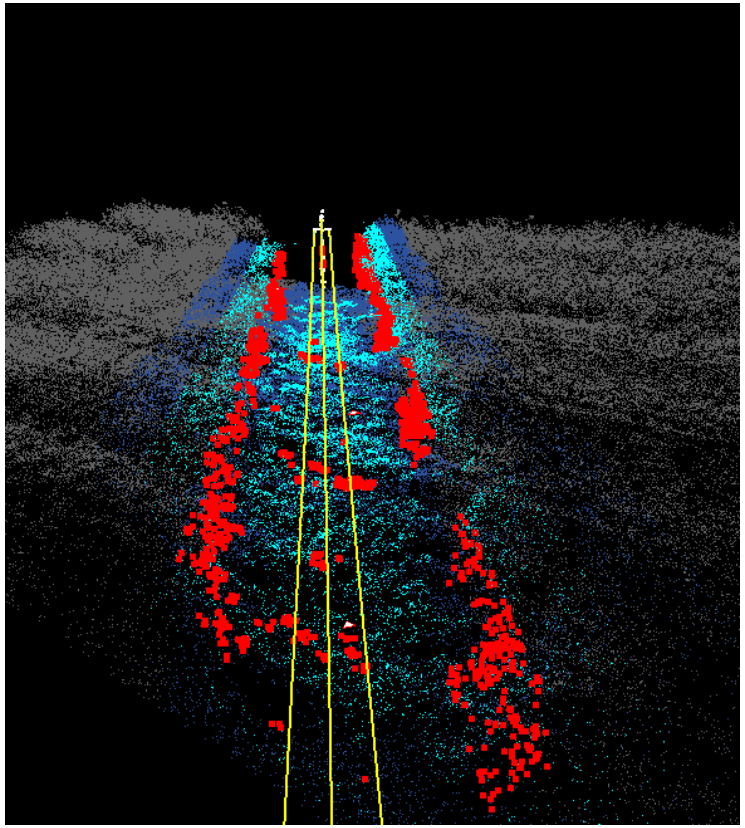
- 220 kms surveyed with TrueView 515 and processed through LP360 Drone.
- 128 Flights
- 746 Towers classified and geolocated with updated heights.



Case Study – Transmission Line Encroachment

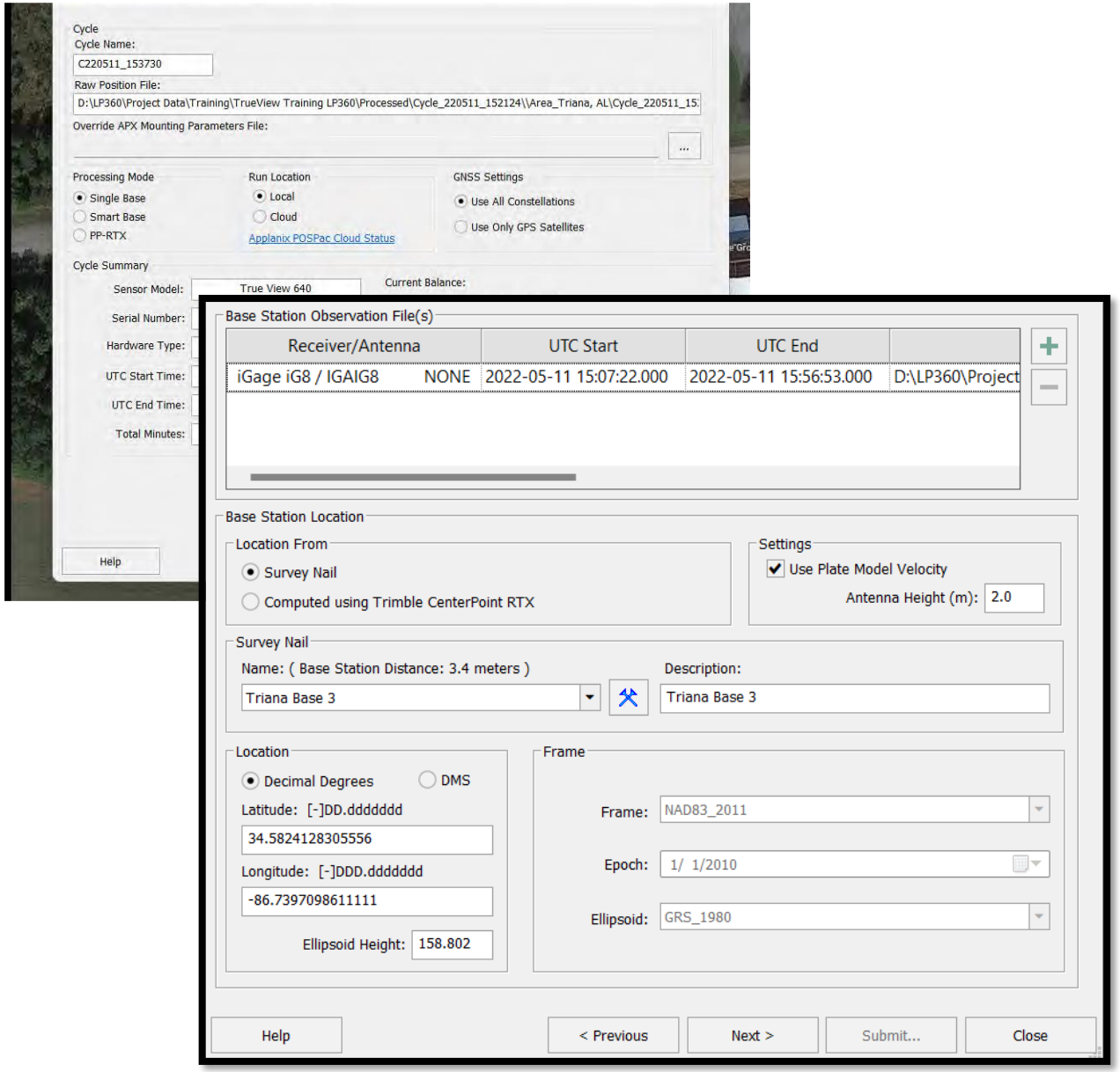
- 922 danger encroachments (< 5 m) identified including 45 critical encroachments (requiring immediate remediation).





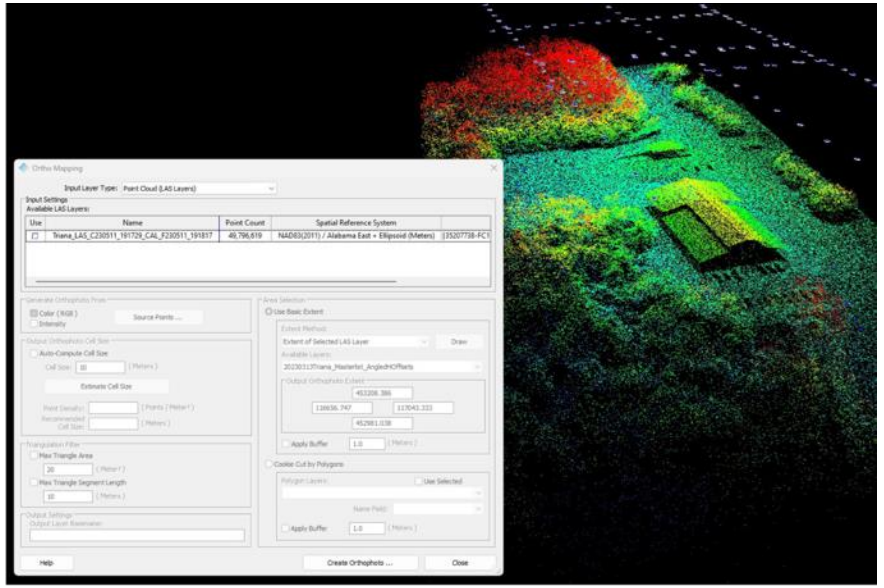
Seamless Trajectory Processing

- Trajectory processing is integrated directly into LP360 for seamless workflow.
- Simplified interface for ease-of-use for new users.
- Includes full reporting on quality of solution.



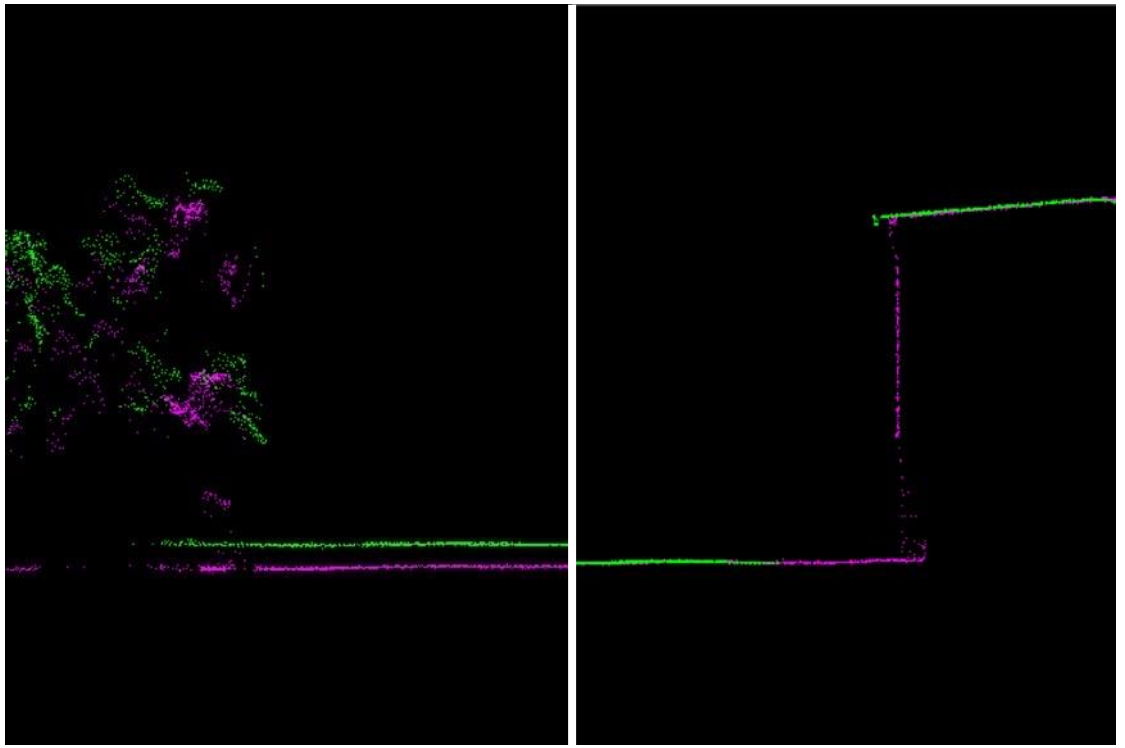
LP360 Photo Add-On

- Ultra-fast ortho mapping from a point cloud
- Create your orthophoto backdrop in a completely integrated workflow
- Efficient fast processing
- Export photo package to your 3rd party Photogrammetry software
- Support most common 3rd party sensors (DJI Mavic 3E, DJI Phantom 4 RTK and DJI Zenmuse P1)



LP360 StripAlign

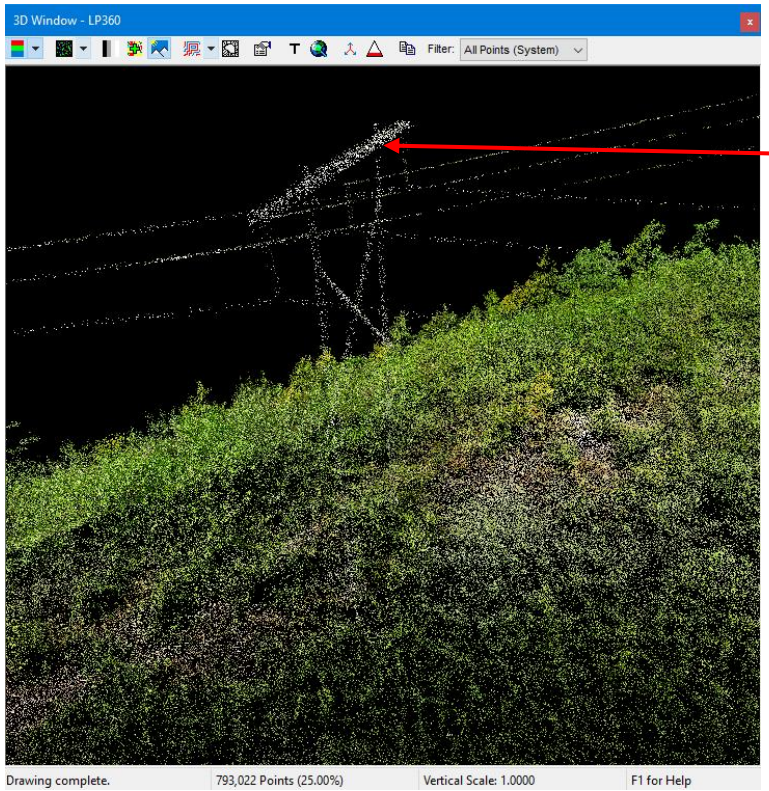
Data can exhibit small geometric inconsistence, especially when combining data from multiple flights. Strip Align for LP360 Drone detects and corrects these errors via an application of sensor-specific mathematical modeling. Strip Align is a fully automated process with no need for users to set project-specific “tuning” parameters or to move in and out of the LP360 Drone processing environment – press a button and it works!



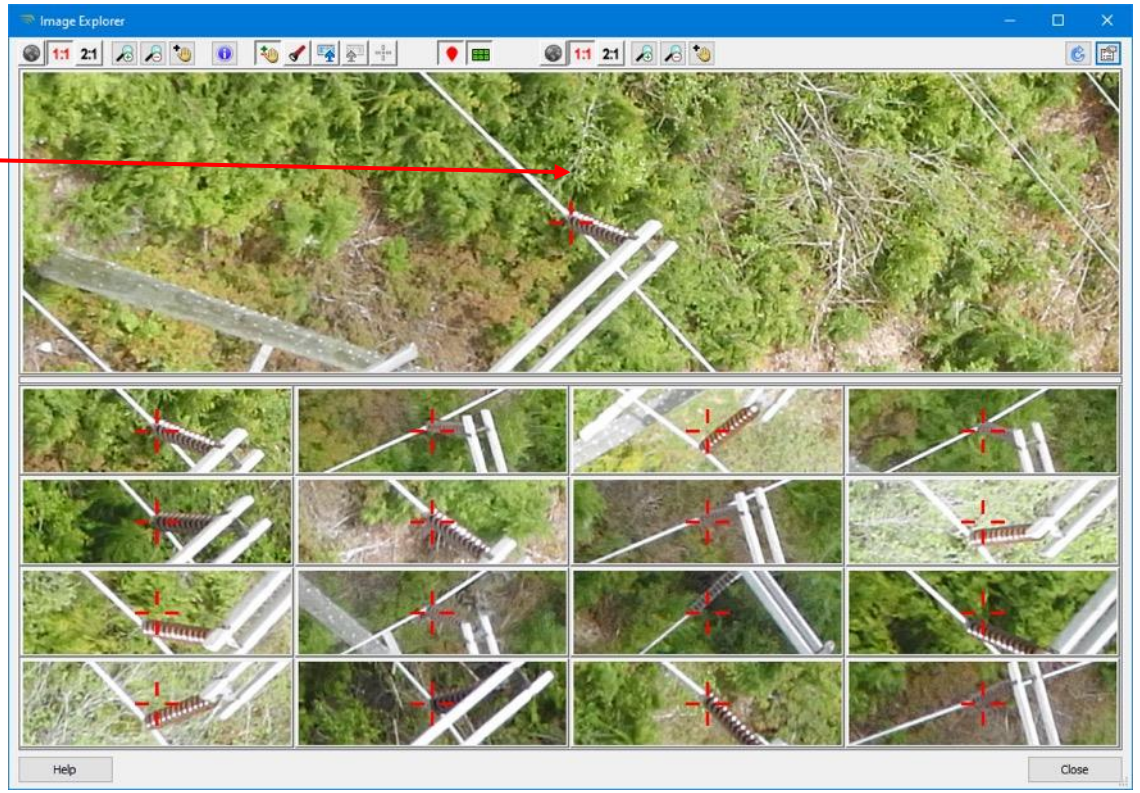
BEFORE AFTER

LP360 Explorer – Free Viewer & Data Sharing

LP360 Drone contains a tool that allows you to export an Explorer Package



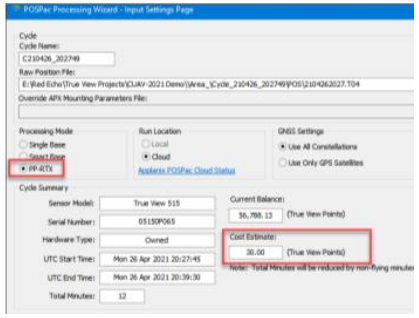
Plan, profile, 3D viewing of point cloud data



Click anywhere in the point cloud data to view all images that “see” a point (you can even do 3D point measurements). Excellent inspection tool!

LP360 For Photogrammetry Workflows

- LP360 Drone also supports photogrammetric workflows for DJI guest sensors:
  - PPK processing for the P4 RTK
  - PPK processing for the M300 RTK with P1 camera
- Allows use of your existing base station.
- Includes dynamic antenna lever arm corrections (both platforms).
- Formats images for direct use in Pix4D, ContextCapture, …
- Queued, batch processing in Metashape.
- Allows on-demand (“metered”) purchase and processing using Trimble PP-RTX service.
- We calibrate the camera if you purchase the system from us.



Data Processing Software

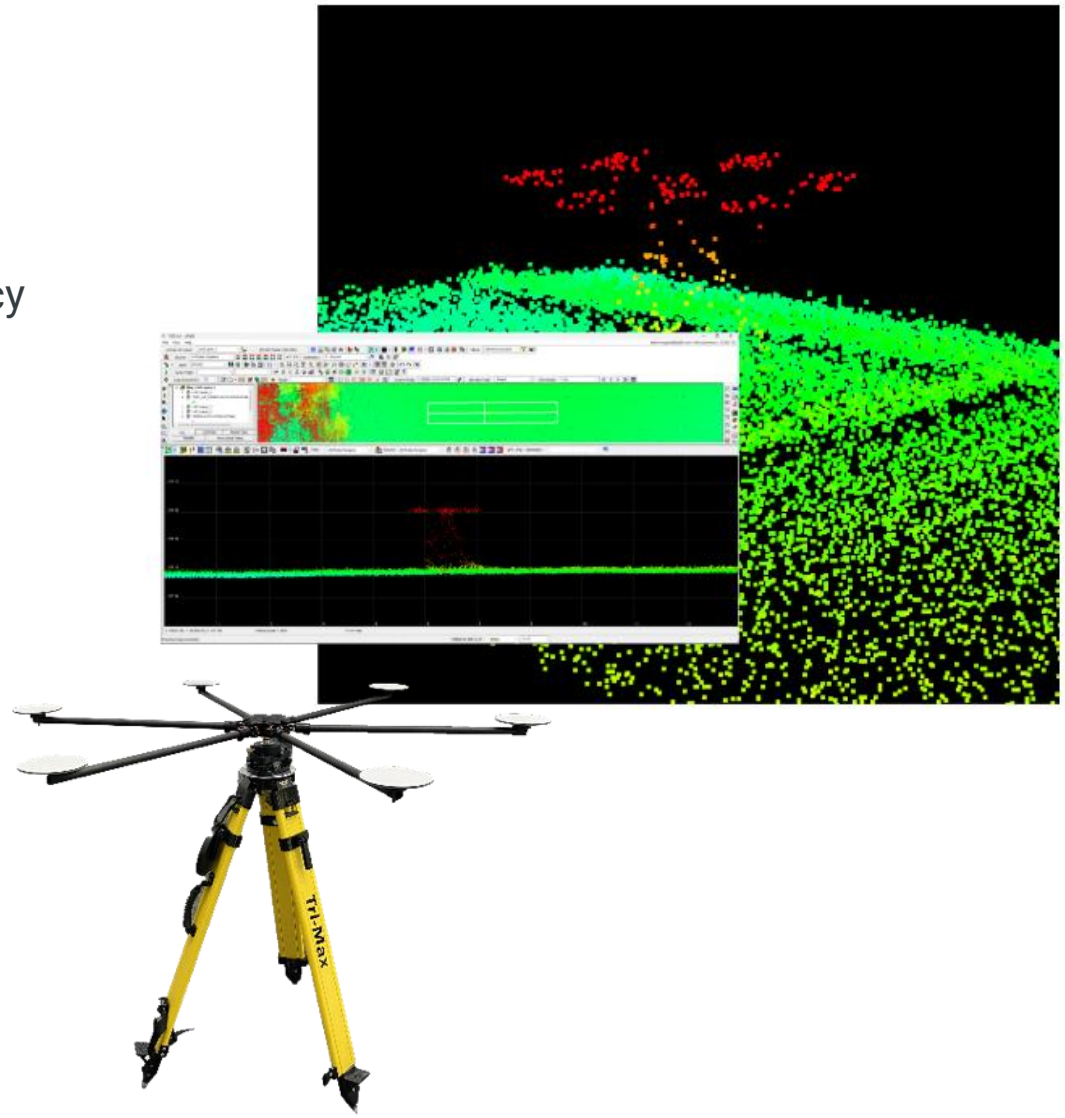
3D Accuracy

3D Accuracy in LP360: Accuracy Star

Accuracy Star is a target specially designed for drone LiDAR projects to be installed on your tripod. When used with 3D Accuracy Add-on in LP360, you can achieve automated vertical and horizontal accuracy checks and improvements.

- Install one or multiple Accuracy Star units as a target on the flight area.
- Set-up over known survey nail locations or can act as a base station (when GNSS is added on top of the Accuracy Star)
- Easy Workflow in LP360

Use with Your Own Tripod/Base Station (not included)



Reminder: what the software does

3D accuracy module allows:

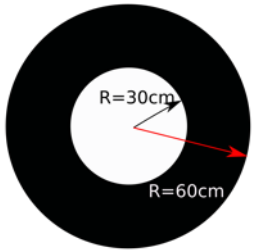
1. To measure the absolute position error of a point cloud versus controls in 3D
2. To calculate and apply a 3D correction to the point cloud to better fit those controls

3D accuracy allows the user to verify the absolute location of the data in the world, in comparison to known points in their coordinate system

What is new: additional hardware supported, easier to use and setup

After the launch of 3D accuracy, we added support for 2 additional types of targets:

- Checkboard – commonly used in Photogrammetry
- Concentric targets – Innovative solution developed internally and more adapted to LiDAR



Performance and recommendation

Accuracy Stars are the most accurate but are harder to install. Use one per survey, on a tripod next to the pilot, under the base station

Concentric targets are very accurate, super easy to install. Use a min of 2 to complete your 3D. But in reality, use as many as you want. You simply need to put it on the ground, survey the center, and you are done! My personal rule would be 1 target per 5 ha of survey (which is 1 target per 12 acres roughly)

Checkboard are truly more adapted to photogrammetry. They will work with sufficient density but are not ideal for LiDAR. Use them if you have them for photogrammetry on your job, but prefer concentric target if possible.

The Revolution in Viewing Pointclouds

What is an LPLAS File?

A LPLAS file is a LAS file:

- Extension is *.LAS
- Is it compatible with any software that will read LAS file
- It follows the ASPRS standard for the most up to date specification for LAS file

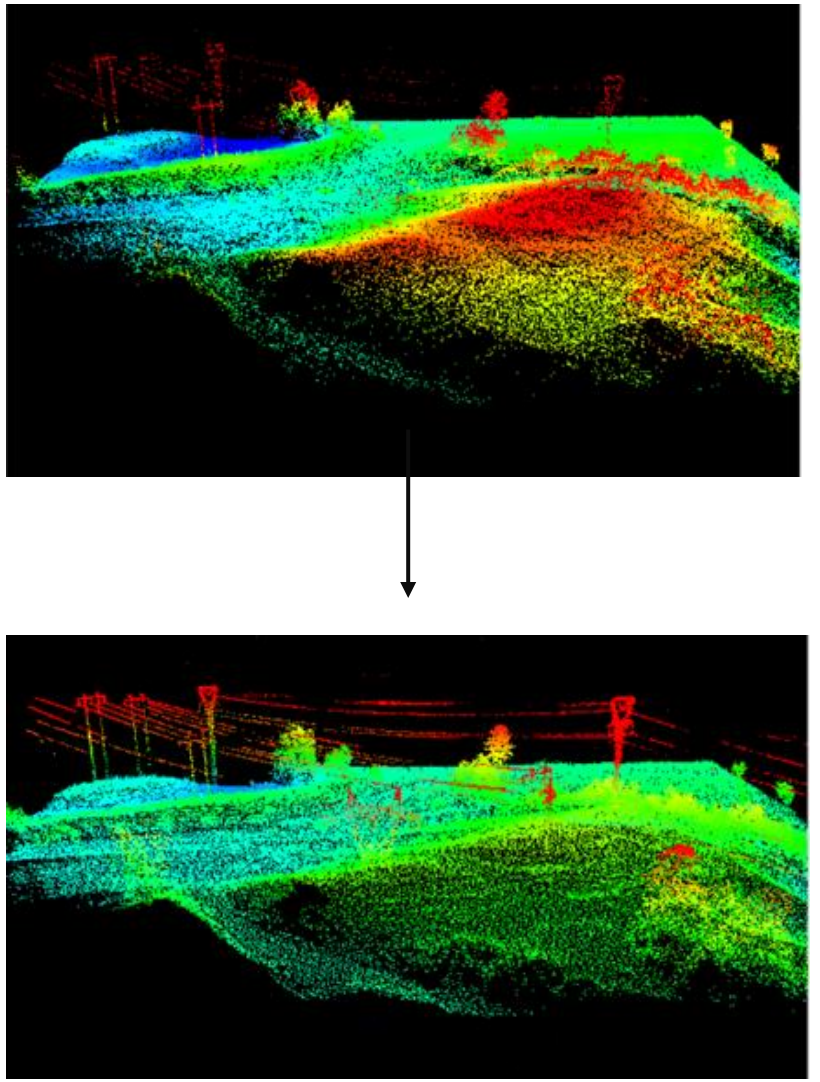
We can make any LAS file a LPLAS file:

- We run the LAS file thru LP360 that studies the LAS, re-organizes for better capabilities and saves it
- The created LPLAS keeps all the information of the original (classes, color, etc). This is just a re-organization of the file

LPLAS File Format

Improve the viewing experience to see all the details that you need

Intelligently manage the level of detail displayed in your project. Smart technology ensures that you always have the best view of your geospatial subject possible, within LP360. Best of all, LPLAS is still backwards compatible and can be opened up in any application that opens LAS files.



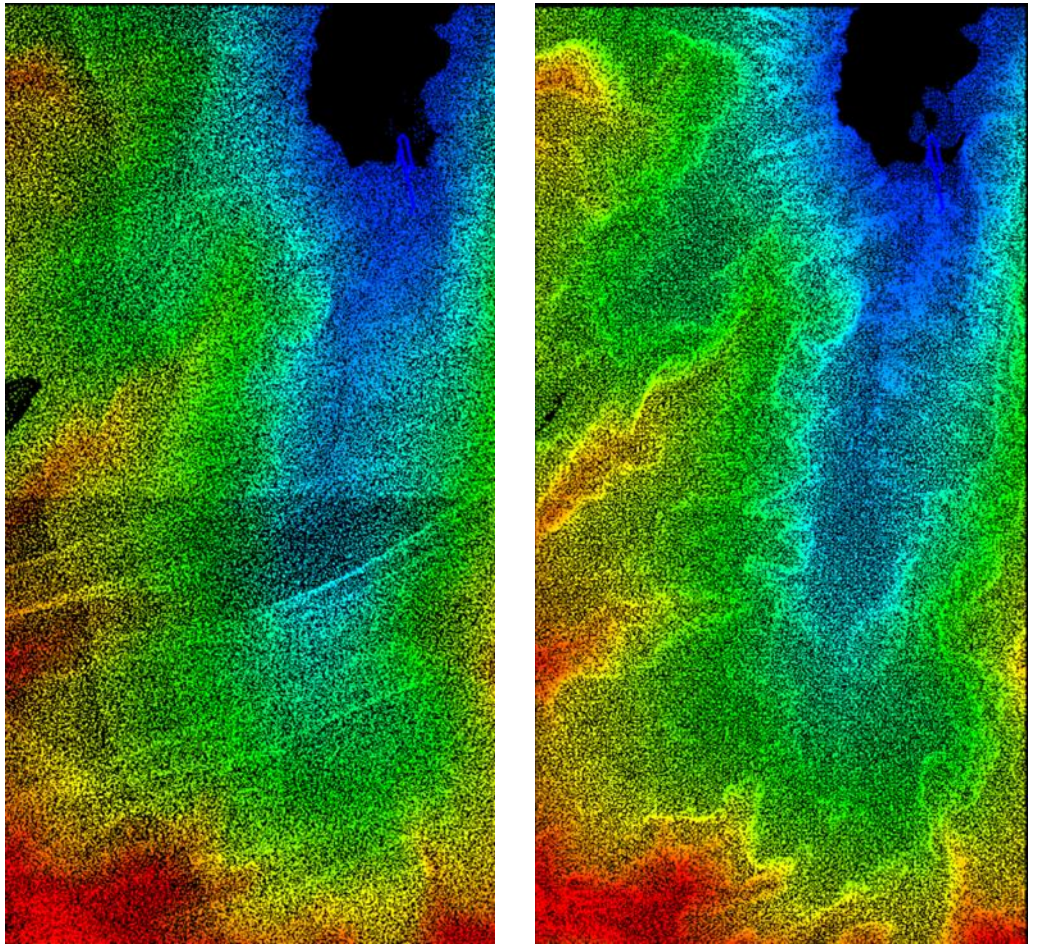
IMPORTANT NOTE: An LPLAS file is a LAS file: Extension is *.LAS It is compatible with any software that will read an LAS file. It follows the ASPRS standard for the most up to date specification for LAS file.

So…where is the revolution?

LPLAS will give LP360:

- state of the art viewing capabilities
- Almost limitless size of file support
- Smooth, optimized viewing

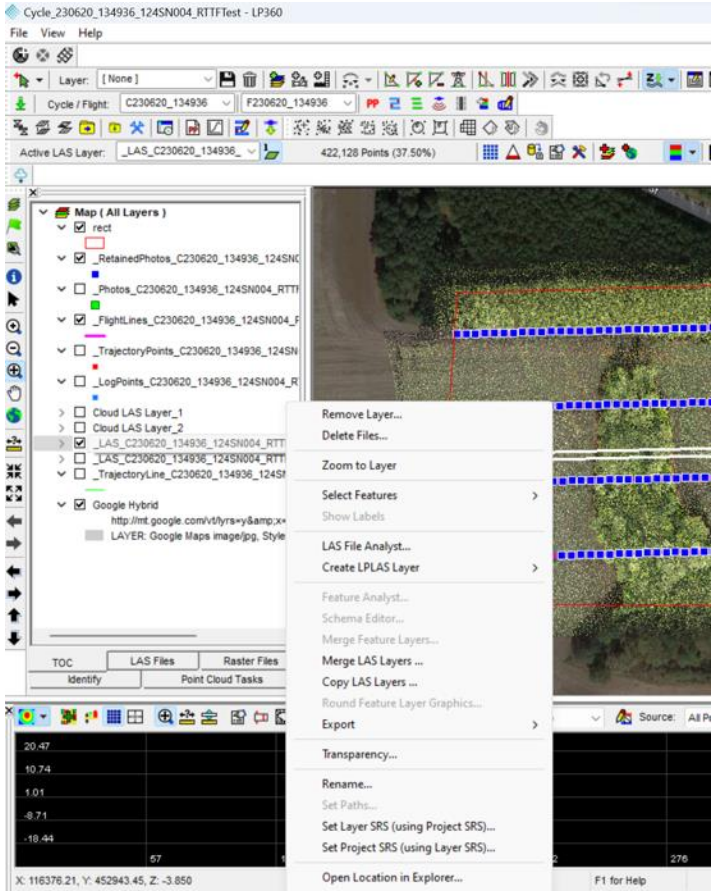
See the details you need, when you need them



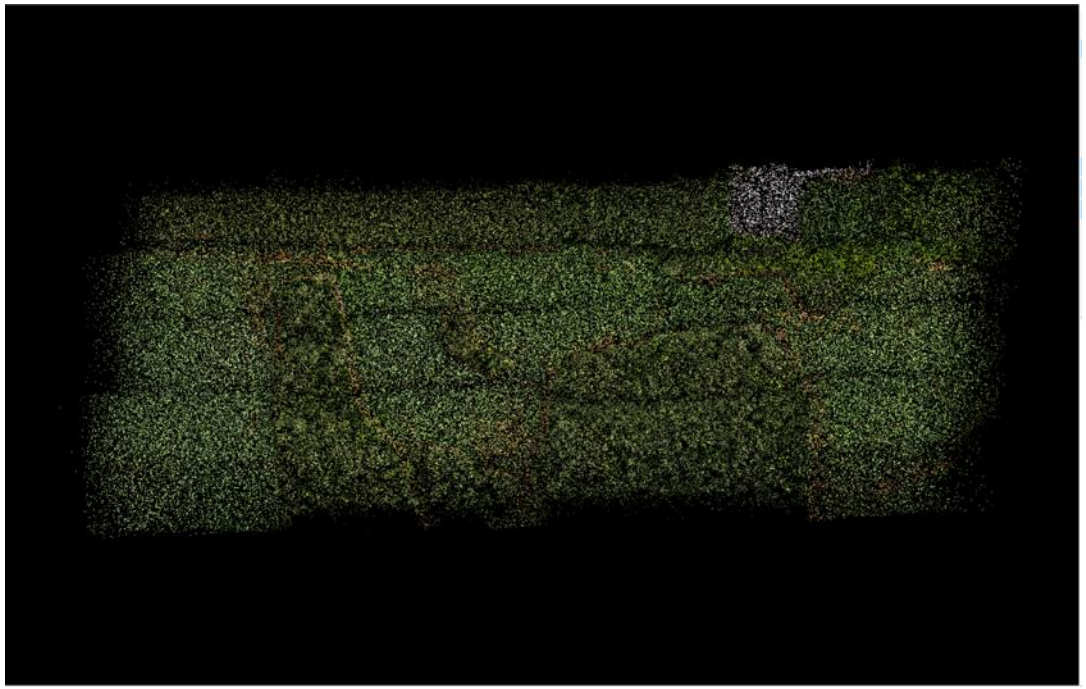
So… How do I get an LPLAS and the improved viewing?

Today, we are releasing “on demand”. A simple “right click” – Create LPLAS. We want the user to start seeing the benefits

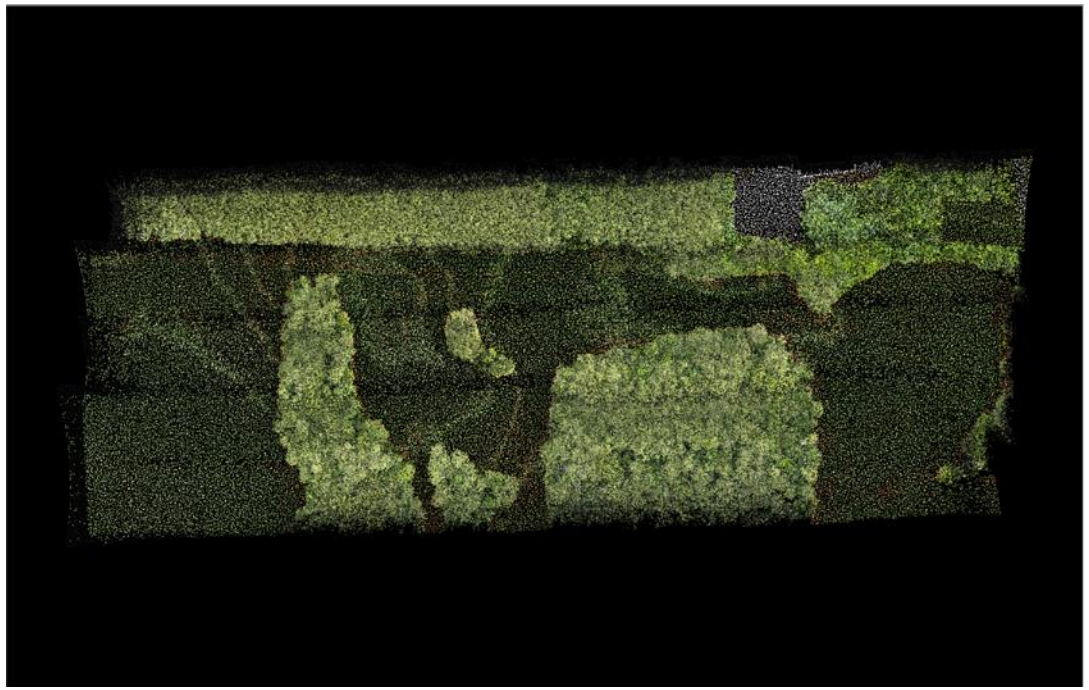
In September, **we will make it the default option when opening any LAS file**



Next to the office – EasyOne UHR example

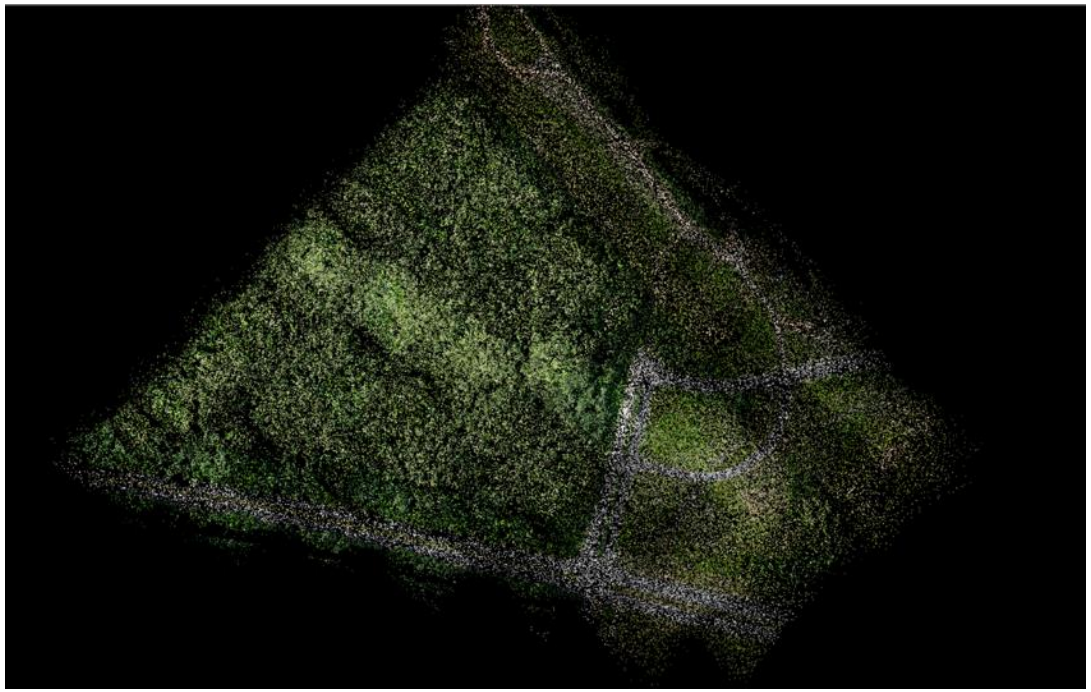


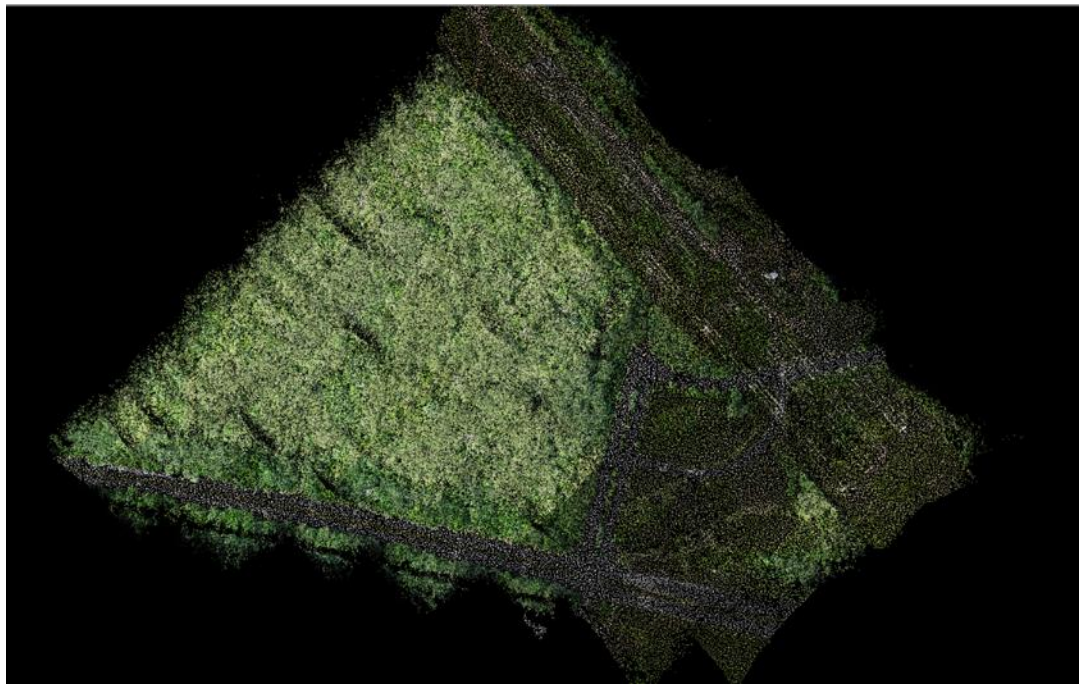
Traditional



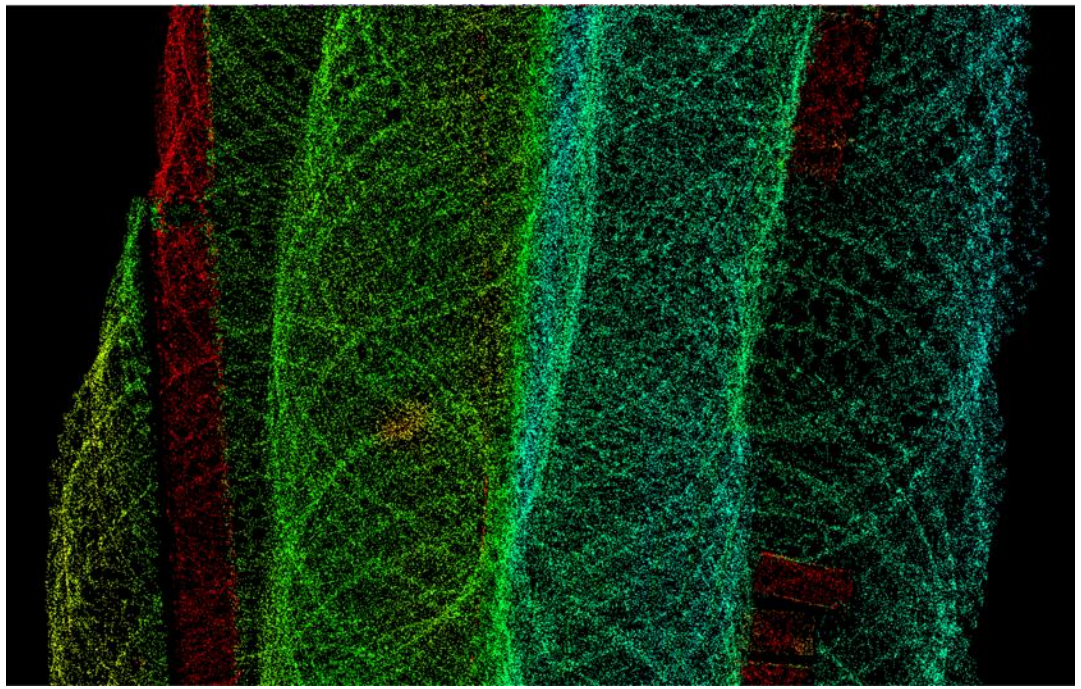
LPLAS

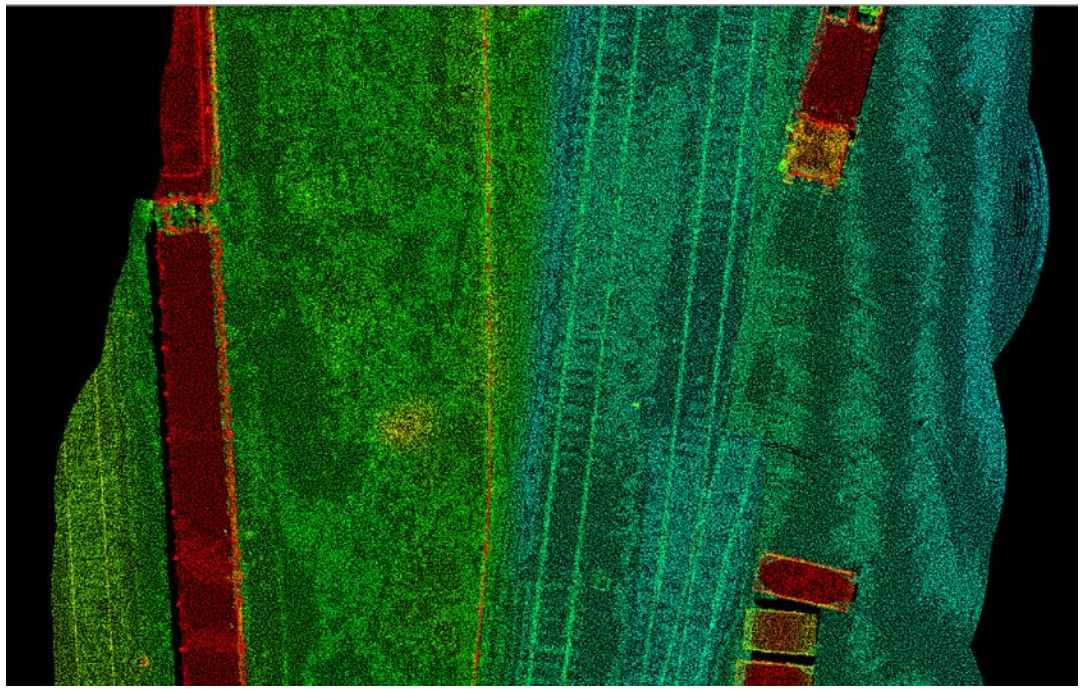
LEEDS example

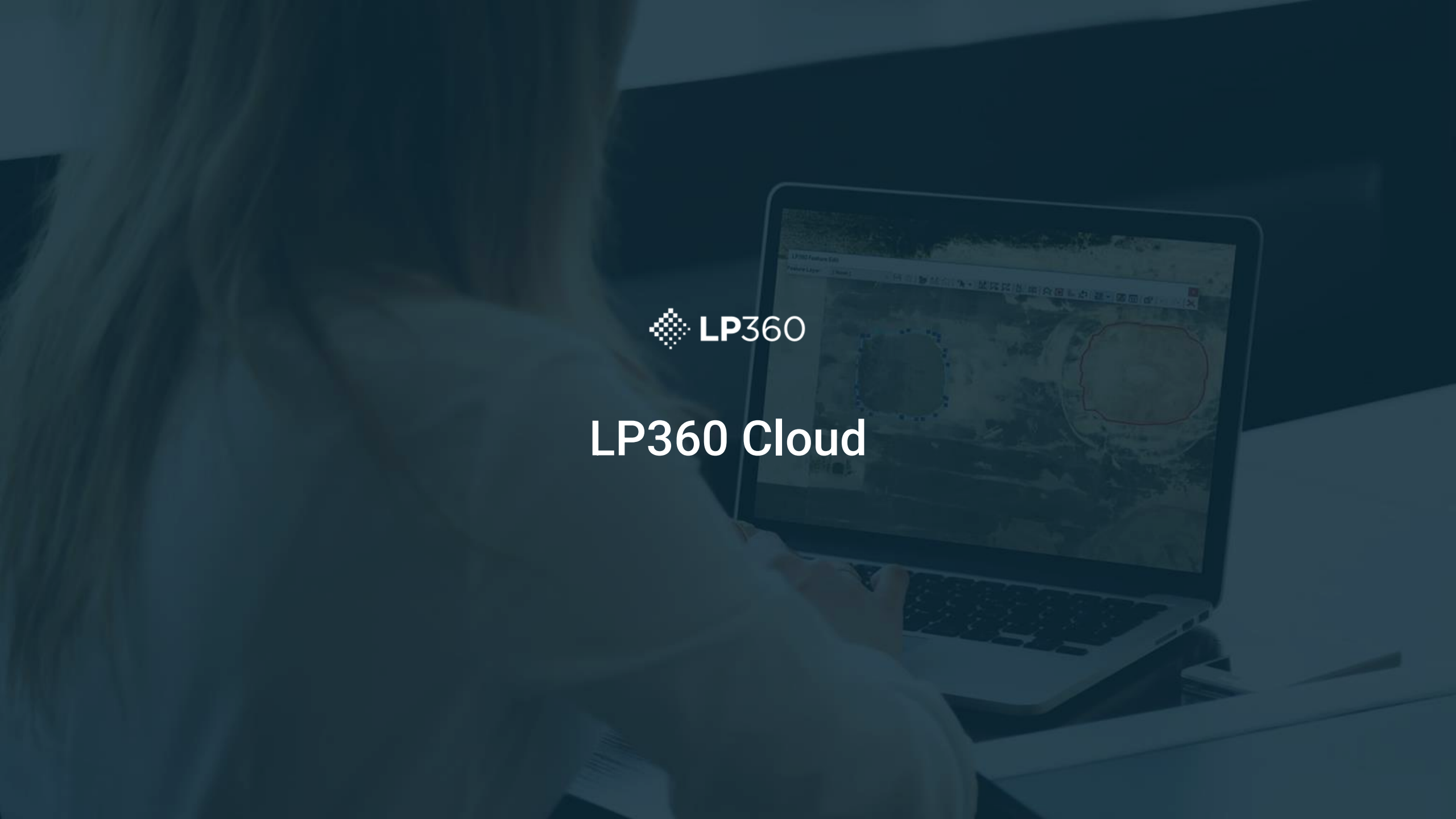




Rail Example





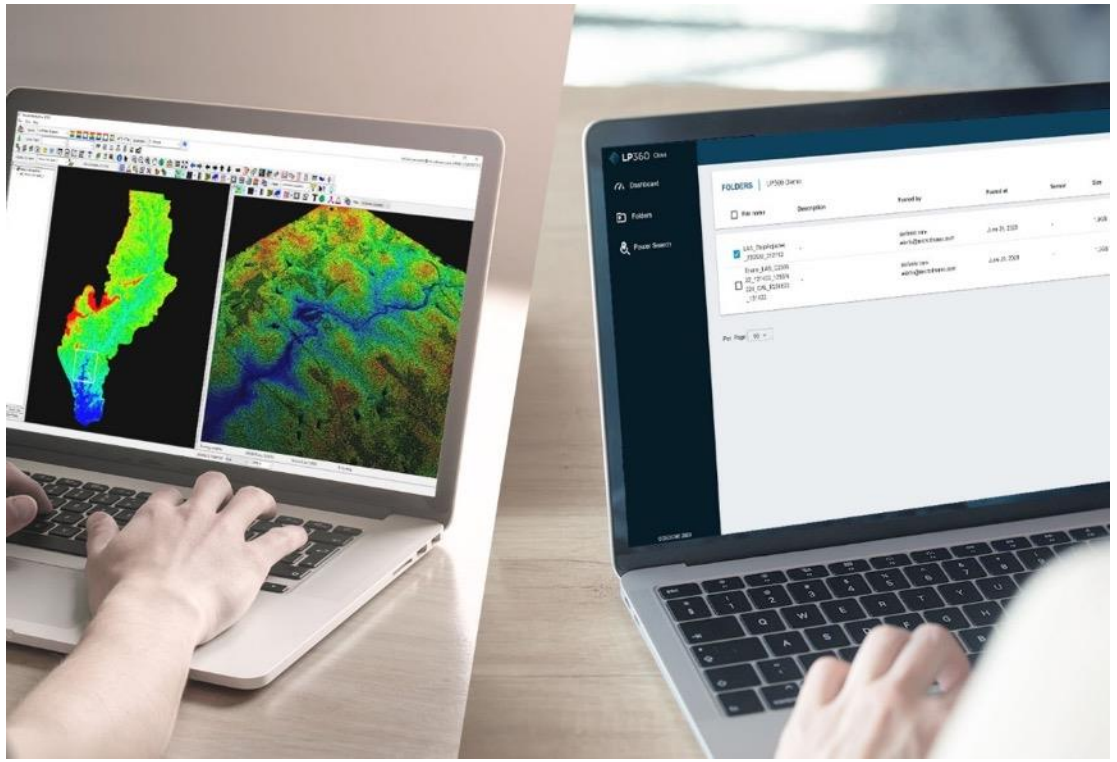


LP360 Cloud

LP360 Cloud

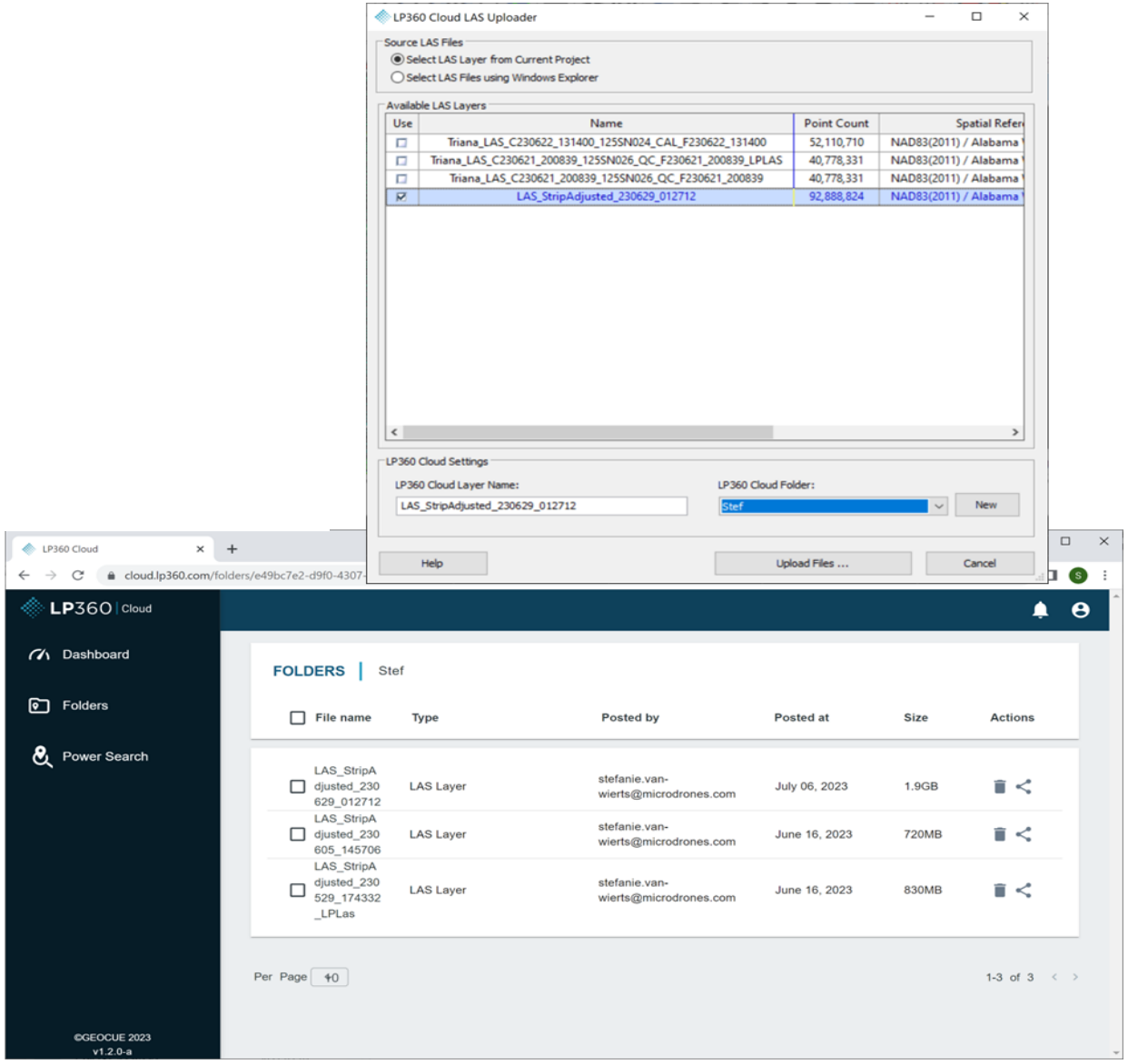
Get LP360 Cloud to make your geospatial work easier

LP360 Cloud is an ever-growing collection of cloud-based tools and resources that will make it easy for you to manage, archive, share and collaborate on geospatial projects. As is true with all LP360 software, we are always building it around you; see below for the latest that LP360 Cloud has to offer.



LP360 Cloud Access

- Login to cloud
- Capability to create folders
- Upload and store data in the cloud through LP360
- Need at Least 1 per company
- 200GB of data storage (share within the organization)
- Price: $25 per month invoiced yearly so $300/year/license
- 1 user/login included the first year each TV payload. After to be added in the maintence fees.



Support and Training

Training

- Training is key to establishing a successful field crew and data processing team.
- Live in-person and remote web training available every month.
- Training at your location can be arranged for a nominal fee.
- Training on advanced topics and workflows also available on request.

Training Curriculum

Day 1 - Field and Office

8:00-10:00am

- Introduction to True View sensor and hardware components.
- Flight Planning Considerations.

10:15-12:00pm

- Field operations
- Training Flight

Lunch

1:00-4:00pm

- Point cloud generation and colorization in LP360 Drone.
- Data QC and Analysis.
- Introduction to LP360 Drone

Day 2 – Office Only

8:00-11:00am

- Live View Filter
- Point cloud task
- Automatic Ground Classification

Lunch

12:00-4:00pm

- Ground Cleanup
- Manual Classification
- Data thinning
- Product Generation

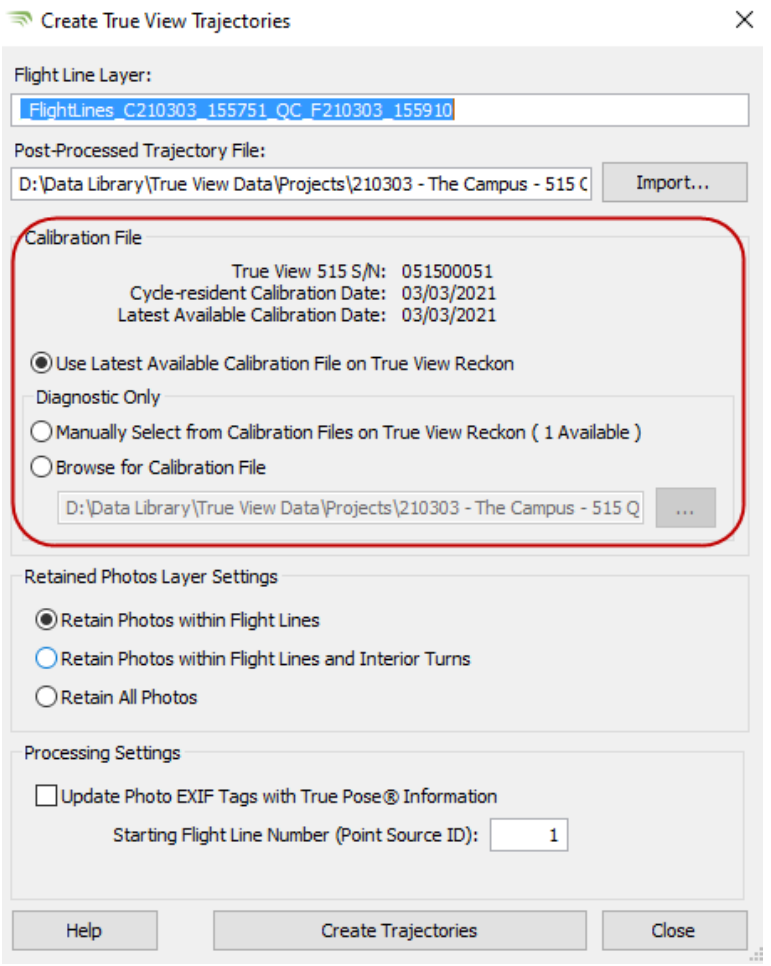
For those who can't travel, there are two virtual training days available monthly.

Support

- Sales is about winning your business today; Support is about winning your business tomorrow.
- Live support available Monday-Friday 7:00 am - 6:00 pm Central Time.
- One-on-one training.
- Virtual web support.
- Hardware trouble-shooting.
- Remote calibration support.
- All sensors are US-manufactured, assembled and tested in Huntsville, AL.
- Support Desk staffed by experienced operators and data processors; we use the systems we support.

Remote Calibration Services

- Sensor calibration files maintained in LP360 Cloud.
- Directly accessible during data processing to guarantee the latest calibration parameters are being applied for your specific sensor.
- Remote calibration service available for field calibrations if required.



LP360

Software Demonstration

LP360 Drone