

SureStar Launches Mini-LiDAR System with Trimble APX UAV from Applanix



Genius Drone LiDAR system designed to achieve ideal balance of weight, cost, and performance factors.

Lightweight solution aims to overcome prevalent challenges associated with UAV LiDAR systems, including: UAV crashes, flight-time limitations, and poor point cloud quality.

Solution

Genius Drone LiDAR System

A lightweight topographic surveying solution that weighs only 1168 grams, and is comprised of: the SureStar R-Fans laser scanner, the Trimble APX GNSS-Inertial solution from Applanix, and Applanix' POSPac UAV post-processing software.

Industry Challenge

In 2017 it became clear that the airborne mapping and surveying industry was moving towards LiDAR sensors onboard UAVs; these solutions are very cost-effective for highly accurate and fast terrain data gathering. LiDAR has a number of advantages – including the capability to penetrate vegetation cover and provide real-time data – making it the preferred solution for users who regularly perform corridor mapping, and the mapping of hard-to-access areas.

SureStar, a leading LiDAR manufacturer for both mapping and autonomous vehicle LiDAR sensors, began developing a UAV LiDAR project back in 2016 and has now developed a UAV-based LiDAR sensor.

However, there are considerable challenges associated with UAV LiDAR systems, including potential financial losses associated with: UAV crashes, flight-time limitations due to heavy payloads, and poor point cloud quality. Applanix and SureStar began to work together in 2018 on the Genius drone LiDAR system, in order to provide a viable solution. The Genius drone LiDAR system has been designed and built to achieve the perfect balance of weight, cost and performance.

Solution

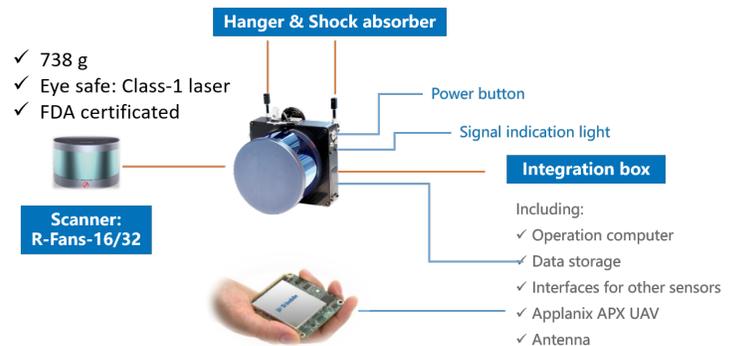
The Trimble APX UAV GNSS-Inertial solution is a complete hardware and software solution suitable for even the smallest of UAVs. It is comprised of a single-board OEM module (6*6.7 cm, 60 grams), which contains a survey-grade multi-frequency GNSS receiver and high-performance MEMS inertial sensors. Also included is Applanix' POSPac UAV software for post-processing the collected data.

SureStar R-Fans laser scanner weighs only 738 g, yet is able to detect objects with 10% reflectivity at 200 m. UI-RF software comes with the R-Fans scanner to enable data fusion of flight trajectory and point cloud output in LAS or xyz format, as well as point cloud visualization.

Together, these integrated products offer a lightweight solution which enables those mapping or surveying with a UAV to produce high-quality deliverables quickly and efficiently.

Combined Strengths of Applanix and SureStar

The Genius drone LiDAR system weighs only 1168 grams, meaning that it can be installed on even very light-weight drones.



Genius is able to:

- ▶ Rapidly collect accurate 3D data, even in remote areas
- ▶ Eliminate the need for Ground Control Points
- ▶ Penetrate vegetation with 2 echoes
- ▶ Support one-button start system operation
- ▶ Monitor working status of the system in real-time
- ▶ Review point clouds in real-time
- ▶ Support continuous data acquisition and processing with an on-board computer
- ▶ Complete data collection and processing with only one engineer

Key Features of Genius

- ▶ Range of 250 m for support flying at 150 m AGL
- ▶ 1168 grams of weight – allows for integration with most drones
- ▶ The total weight of drone + Genius can be less than 7 kg, making it unnecessary to obtain an airspace permit
- ▶ Up to 640 kHz pulse frequency supports high point density
- ▶ Elevation error: better than 10 cm
- ▶ Two echoes to penetrate vegetation
- ▶ Can be integrated with various other sensors, including: visible light, Infrared, multispectral and hyperspectral camera.

Applications

- ▶ Topographic Surveying



CASE USES

Time: April 2019
 Place: Guangzhou, China
 Equipment: Genius LiDAR + DJI drone M600

Requirement: DEM, 1:1000 scale map
 Challenges: mountainous terrain, uninhabited area with dense vegetation, limited time to deliver results

Diaries of Surveying

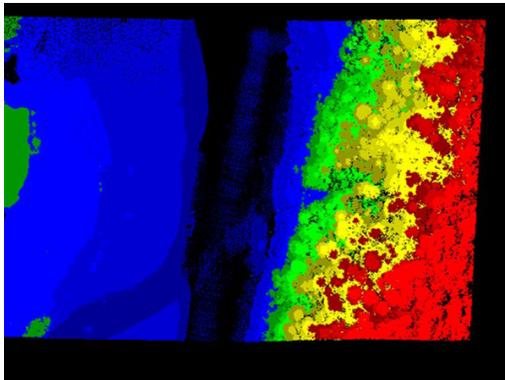
Tasks	Task Description and Achievement	Time Spent
Field Expeditions	Identify the zone for drone to take off from and land on	30min
Route Planning	Decide flying altitude and speed according to requirements on accuracy and point density	5min
Equipment Preparation	Install Genius LiDAR to the drone, power on the system and wait for GNSS signal ready	10min
Flying and Data Collection	Drone flying and system collect data	20min
Data Loading	Transfer the raw data of POS and LiDAR to the computer from removable disks	10min
Pre-processing	Solve trajectory, point cloud and produce orthophotos	60min
Data Processing	DEM, topographic map	120min



Project environment



Genius flying with DJI M600



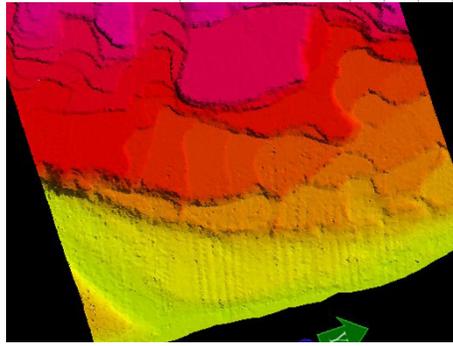
Point cloud

Use	Number	Easting	Northing	Known Z	Laser Z	Dz
<input checked="" type="checkbox"/>	52	513121.18	3834766.65	42.460	42.520	+0.060
<input checked="" type="checkbox"/>	64	514394.99	3831756.26	36.004	36.060	+0.056
<input checked="" type="checkbox"/>	51	512878.11	3835271.75	44.955	45.010	+0.055
<input checked="" type="checkbox"/>	57	513889.59	3832906.73	38.269	38.320	+0.051
<input checked="" type="checkbox"/>	89	515334.75	3826062.69	34.473	34.520	-0.047
<input checked="" type="checkbox"/>	58	513935.37	3832906.39	38.259	38.300	+0.041
<input checked="" type="checkbox"/>	79	515098.13	3828714.71	34.045	34.080	-0.035
<input checked="" type="checkbox"/>	82	515110.82	3828226.61	38.207	38.240	-0.033
<input checked="" type="checkbox"/>	60	514032.87	3832659.98	36.587	36.620	-0.033
Average magnitude		0.0398		Average dz		+0.0178
Std deviation		0.0479		Minimum dz		-0.1100
Root mean square		0.0507		Maximum dz		+0.1080

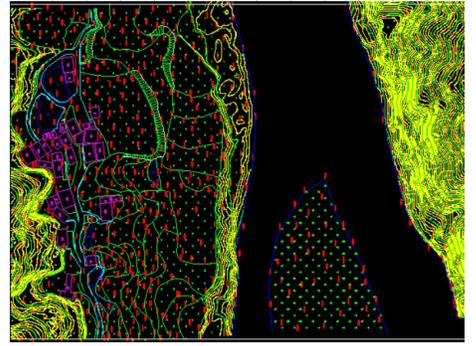
Point cloud elevation accuracy verification



DOM



DEM

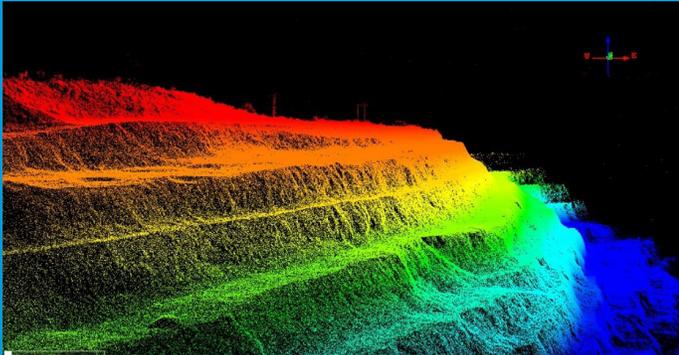


1:1000 scale topographic map

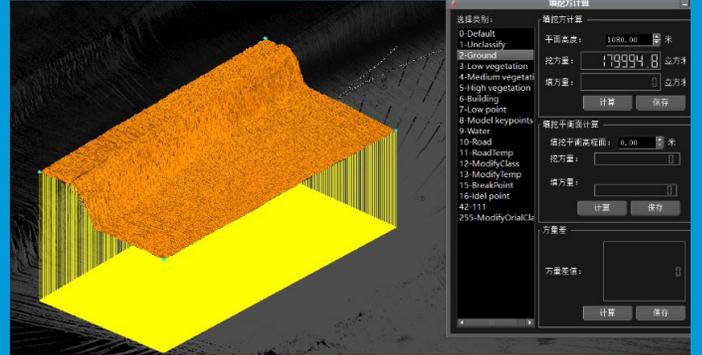
Mining Survey



Open pit mine



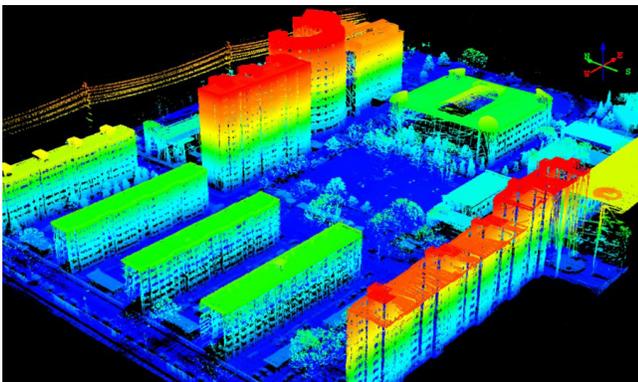
Point cloud collected by Genius



Completed hardware and software package allow for quick volume calculation of open pit mines

3D Modeling

Point cloud and image can be effectively combined to restore real scenes.



Point cloud collected by Genius



3D model

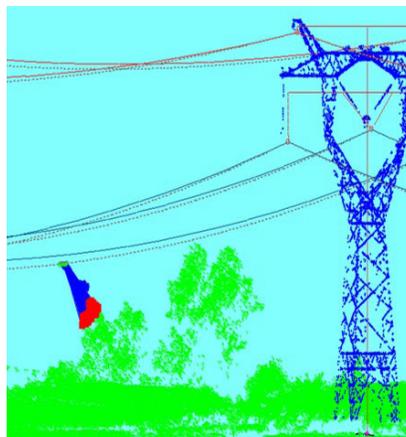


Transmission Line Inspection

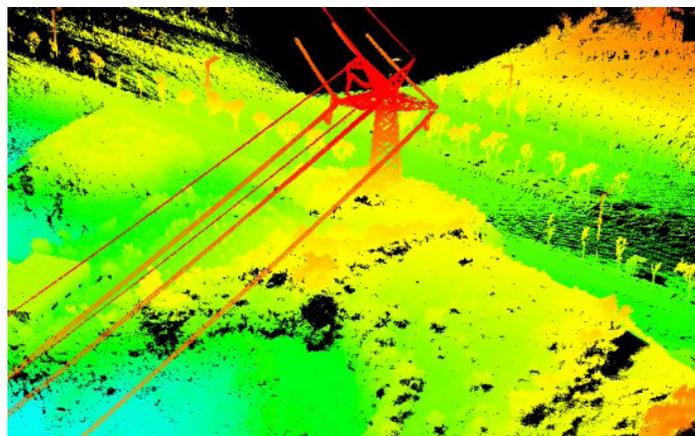
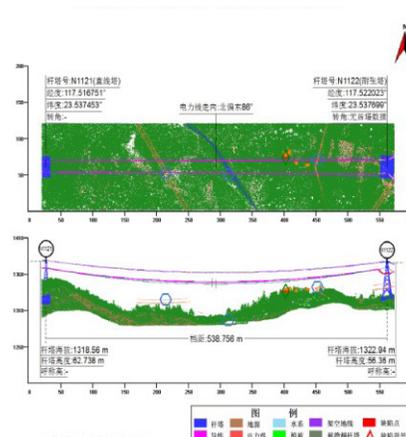
Threats analysis along with 3D demonstration of power line, tower, and facilities.



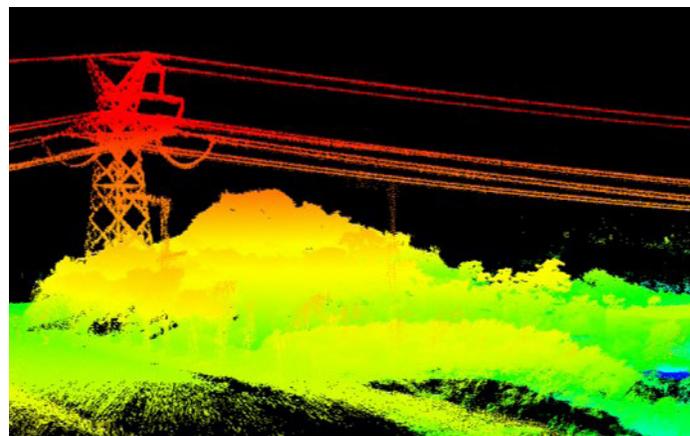
Point cloud collected by Genius



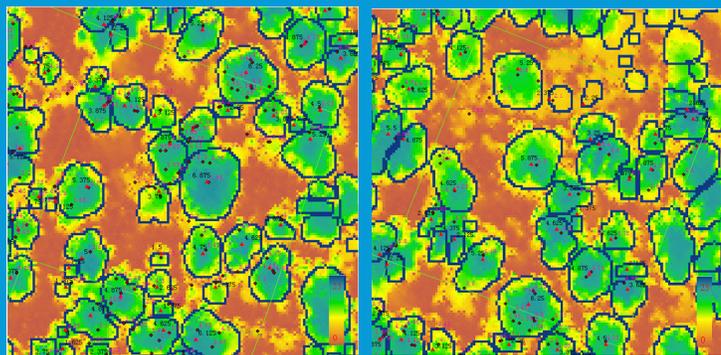
Single wood evaluation



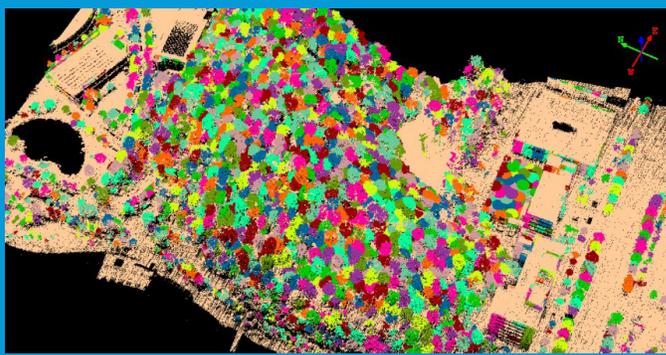
Point cloud collected by Genius



Forestry Survey



Single wood evaluation



Point cloud clustering



High Resolution Map

Genius is not limited to use only with UAVs. It can be installed on many types of vehicles for high resolution mapping.



High resolution map



ABOUT SURESTAR

SureStar was established in 2005 in China to offer LiDAR mapping solutions. SureStar is the one of earliest LiDAR manufacturers to be involved in integrated-circuit design specifically for LiDAR signal processing (LSP). The high-performance LSP chips, modular design, and unique semiconductor assembly process make SureStar stand out in product performance, low weight, and low power consumption, as well as high production efficiency. In as early as 2014, anticipating an increasing demand for autonomous vehicle and UAV applications, the SureStar team decided to put more effort into the development of automotive LiDAR and lightweight UAV LiDAR.

SureStar embraces complete and comprehensive LiDAR core technologies and has reported over 100 intellectual property rights (patents, software copyrights, and trademarks). Quick roll-out of new products comes from a talented and fast-growing R&D team. The SureStar headquarters and R&D center are located in Beijing, while its production facilities are located in Suzhou, and software team in Hefei. In 2018, SureStar set up a representative office in Wixom City, near Detroit, to provide timely technical support to North American clients. SureStar currently has more than 200 employees, of which more than 50% are involved in R&D and technical support.

ABOUT APPLANIX

Applanix, a Trimble Company (NASDAQ:TRMB), develops, manufactures, sells, and supports products and solutions for mobile mapping and positioning. Applanix' products and solutions are used in a variety of applications, including: road profiling, GIS data acquisition, aerial surveying and mapping, railroad track maintenance, and seafloor mapping. Established in 1991, Applanix supports its growing global customer base with exceptional service.

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