SureStar

Clouds

Lightweight UAV LiDAR System

Ultra-light design Perfect for VTOL platforms

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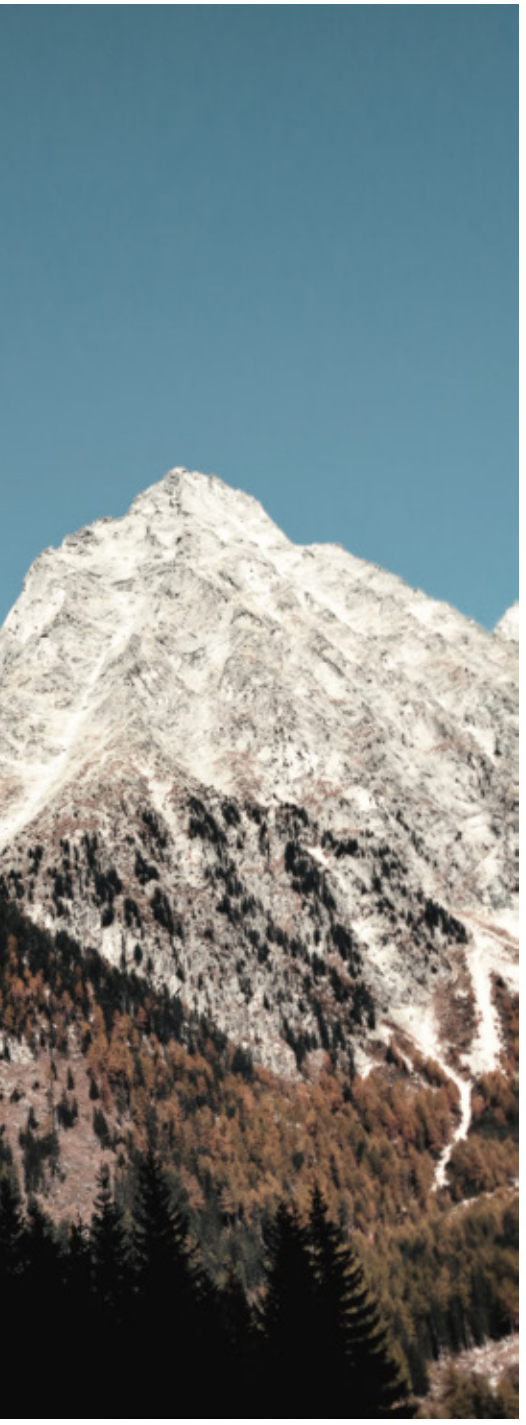
Clouds is a complete LiDAR system comprising our medium-range AP-1000 LiDAR, IMU system, digital camera and power supply. Clouds is small in size and light in weight - at 4.0 kg the lightest in its class – and can be mounted to most flight platforms.

The Clouds system boasts fast data acquisition, high precision, and long acquisition range. It is eminently suited to 3D city modeling, transmission line inspection, island reef survey, forestry census, cadastral survey, geological deformation monitoring, water conservancy survey and disaster assessment.

1 Clouds



Multi-platform capability

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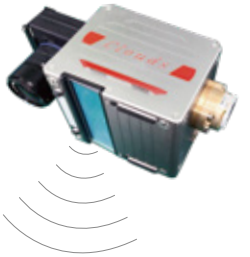
Product Overview



Sensor

Software

Platforms

Scanner
IMU
Photogrammetric camera

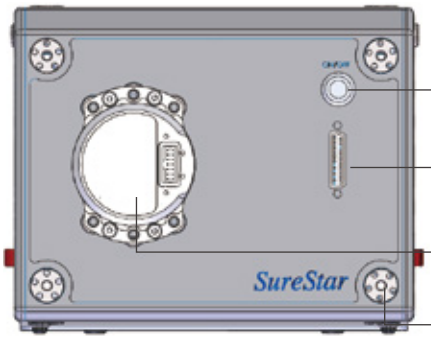
Control & monitoring software
Preprocessing software
Application software

Multi-rotor drone
Hybridwing UAV
Manned platform

Flexible packages

Options	Configuration	Weight	Note
Option I	LiDAR + IMU	4.0kg	Lightest package Without camera External power
Option II	LiDAR + IMU + Camera	4.6kg	External power
Option III	LiDAR + IMU + Battery + Mount	5.2kg	Without camera
Option IV	LiDAR + IMU + Battery + Mount + Camera	5.9kg	Standard package

Equipment diagram

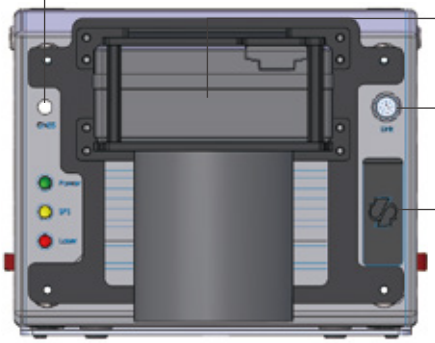


1 System switch

2 Power / data interface

3 uIMU

4 Mounting holes

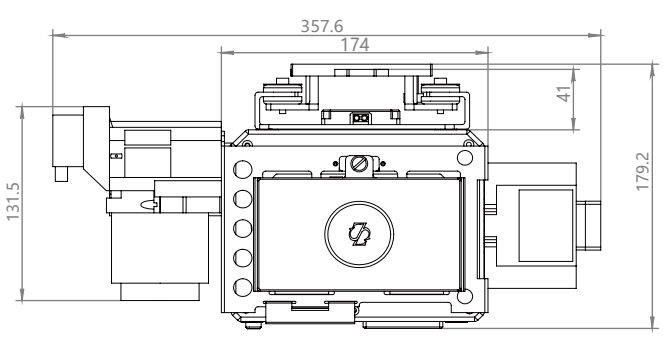


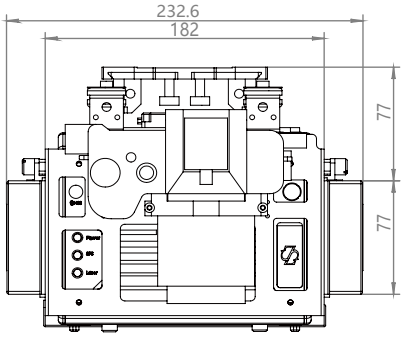
5 GNSS antenna

6 Camera

7 Network interface

8 USB network port and SD card





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Characteristics

01 **Large FOV, long acquisition range**

FOV 75°
Maximum range is 1000 m
Swath is greater than 460 m @ 300 m range

02 **High frequency, high precision**

Pulse frequency: 500 KHz
Scanning frequency: 150 Hz
Range accuracy: 10 mm @ 100 m

03 **Parallel line scanning**

Perfect parallel scan lines
Point cloud is evenly distributed.

04 **Modular design**

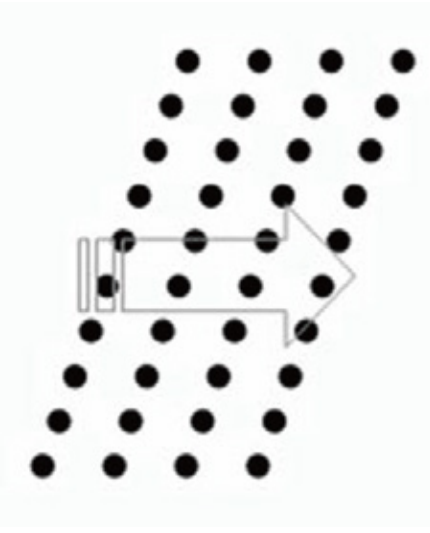
Built-in GNSS receiver configurable with one or two antenna
IMU interface module enables flexible configuration
USB memory provides synchronized acquisition of images and data.

05 **Small size, light weight**

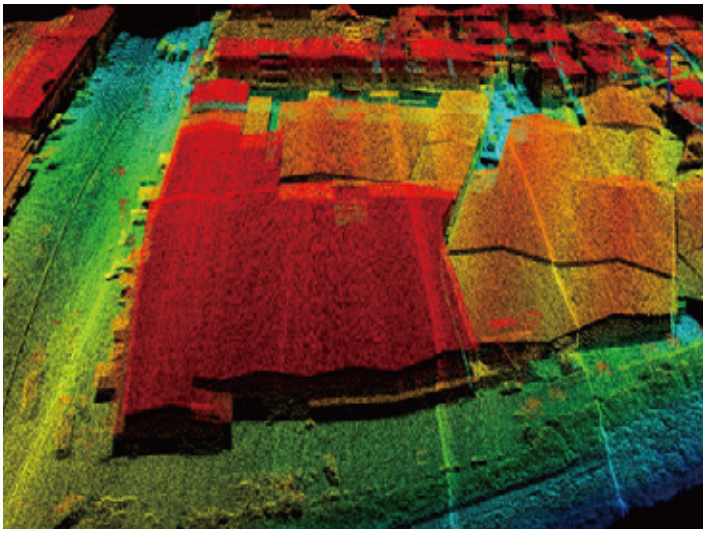
Suitable for multiple flight platforms including traditional fixed-wing, multi-rotor drone, and VTOL fixed-wing UAV.

06 **Open software interface**

The software kit allows users to further develop the system to meet their specific needs.
A high level of component integration makes for easy system operation.



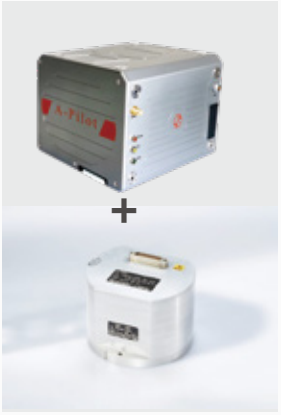
Parallel scan lines



Evenly distributed and detailed point clouds

Highly efficient operation

Suitable for a variety of flight platforms.
Efficient operation over varied topography
for many applications.



High precision

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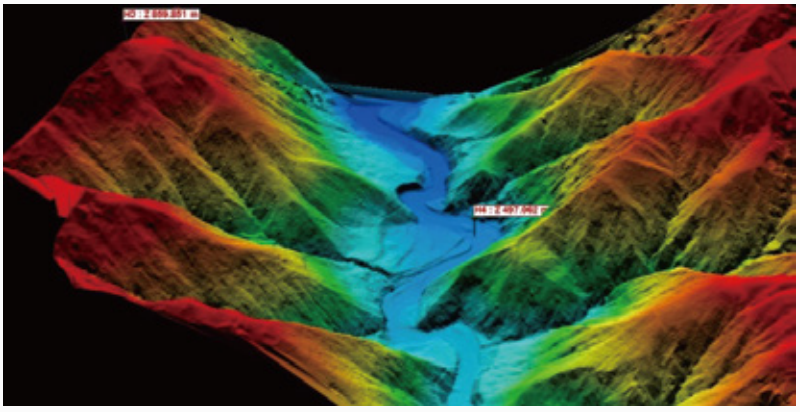

High relief terrain capable

Efficient operation on various flight platforms

Flight platforms	Altitude	Speed	Endurance	Flight range	Area	Point density
Multi-rotor battery-powered UAV	200 m	8 m/s	50 min	24 km	1.8 km²	79 pts/m²
Multi-rotor battery-powered UAV	300 m	8 m/s	45 min	24 km	2.5 km²	35 pts/m²
VTOL fixed-wing UAV	300 m	30 m/s	360 min	270 km	21 km²	9 pts/m²
VTOL fixed-wing UAV	500 m	30 m/s	360 min	270 km	25 km²	4 pts/m²

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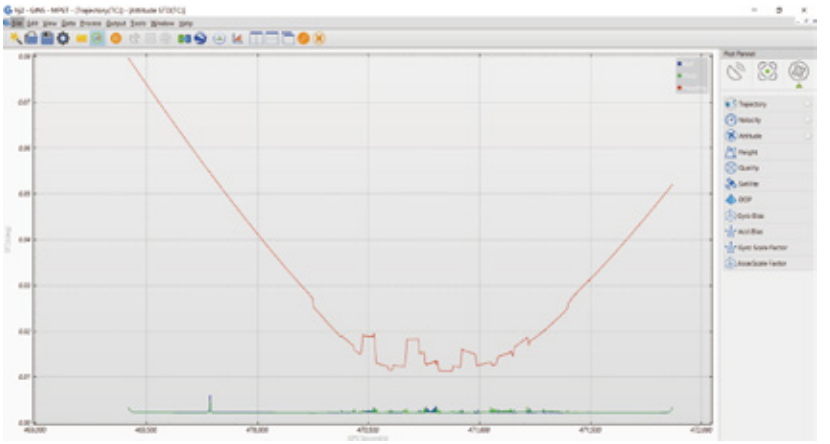
Software

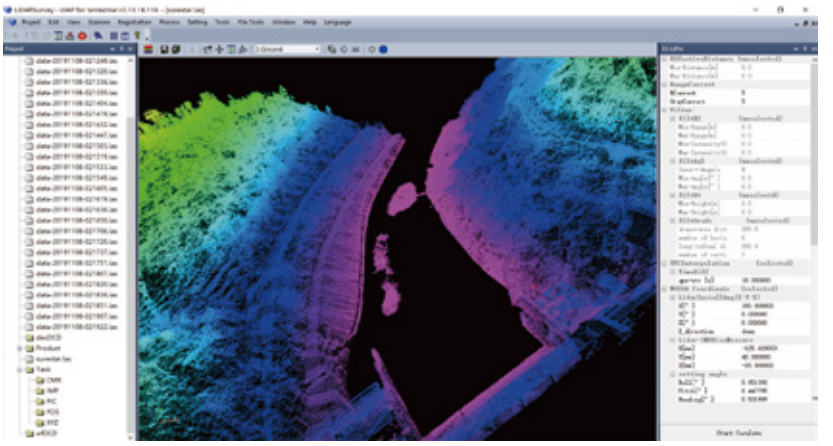
Pre-processing software

SS-GINS software
SS-GINS trajectory calculation software



- The software provides both looselyand tightly coupled trajectory solutions
- Precise Point Positioning(PPP)
- Post-Processed Kinematic (PPK)

SS-LiPre software
SS-LiPre point cloud pre-processing software



- Flight trajectory file + Laser RAW data fusion
- Point cloud visualization: data checking, grey scale projection, coordinate transformation and calculation
- Data output: Las, xyzi format

Specifications

System specifications	
System components	AP-1000, GNSS card, INS, digital camera
Typical range	100 –600 m
FOV	75°
Elevation accuracy	< 0.05 m
Time synchronization accuracy	< 1 mSec, including GPS, LiDAR, camera and IMU
No control mapping scales	1:500, 1:1000, 1:2000
Data storage	SD card for LiDAR and IMU
System weight	4.0 kg / 4.6 kg / 5.2 kg / 5.9 kg
Operating temperature range	-20℃ ~ 55℃
Scanner	
Scanner model	AP-1000
Minimum acquisition range	3 m
Maximum acquisition range	1000 m（ρ=60%）
Pulse frequency range	50 – 500 kHz
Laser safety class	Class I
Wave length	1550 nm
Echo mode	Multiple echoes
Beam divergence	~0.35 mRad
Strip width	> 460 m@300 m
Scanning frequency	30-150 Hz
Range accuracy	10 mm@100 m
Angular resolution	> 0.005°
Intensity resolution	12 bits
Scanner weight	3.3 kg
Power supply range	24 ~ 28 V DC
Average power consumption	48 W
GNSS/INS Unit	
IMU type	SS-μIMU-IC
IMU refresh rate	200-1000 Hz
GNSS antenna connections	1~ 2
Satellite systems	GPS L1/L2 、GLONASS L1/L2、BDS B1/B2
Position accuracy (post-processed)	Horizontal：0.01m (locked)；0.3m（GNSS signal loss of lock for 60 seconds)
Heading accuracy (post-processed)	Vertical：0.02m (locked)；0.1m（GNSS signal loss of lock for 60 seconds)
	0.009° (locked)；0.03° (GNSS signal loss of lock for 60 seconds)
Pitch/Roll accuracy (post-processed)	0.005° (locked)；0.02° (GNSS signal loss of lock for 60 seconds)
Camera	
Models	AFD C42 / Sony α7R2 / Canon 5D（optional）
software	
SS-GINS	Trajectory calculation software
SS-LiPre	Point cloud pre-processing software

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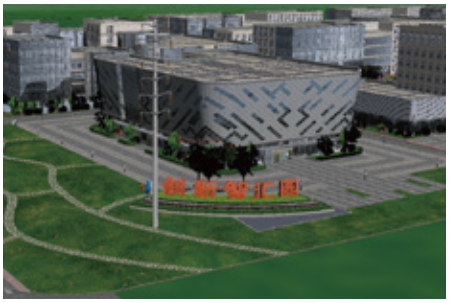
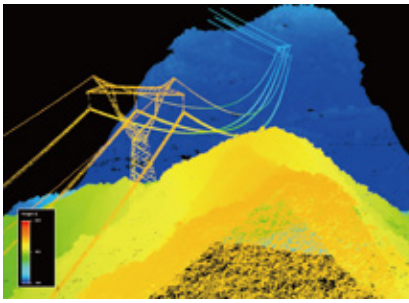
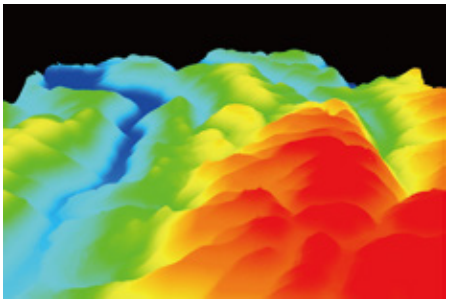
Applications

Digital city



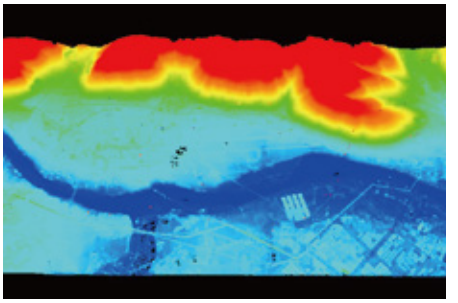
Transmission line inspect

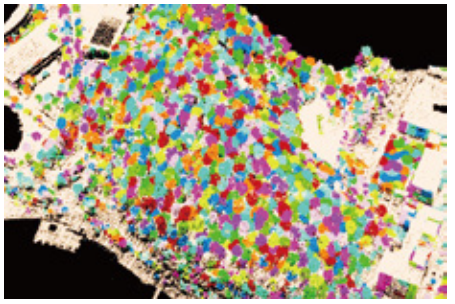


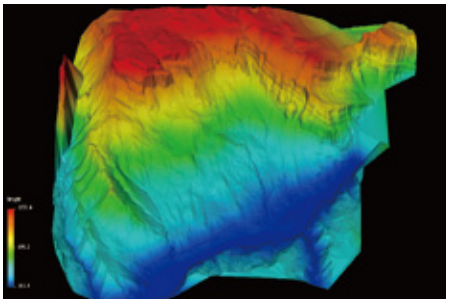


Topographic

Water conservation







Agricultural and forestry investigation

Geological disaster warning and assessment

Large-scale topographic mapping

Project Background

Project Location	Sichuan
Main mission	Terrain scanning of a 3kmcorridor, transmission tower site selection, and 3km-long strip-shaped area
Customer attention	Vegetation penetration Elevation accuracy Operational efficiency
Requirement	Verification points are evenly arranged in the survey area, and the elevation accuracy is better than 10cm High point density to meet 1: 1000 terrain needs Classify point cloud, DEM, and provide orthophoto data at the same time
Challenge	Mountainous terrain and dense vegetation


Project site


Flight Platform

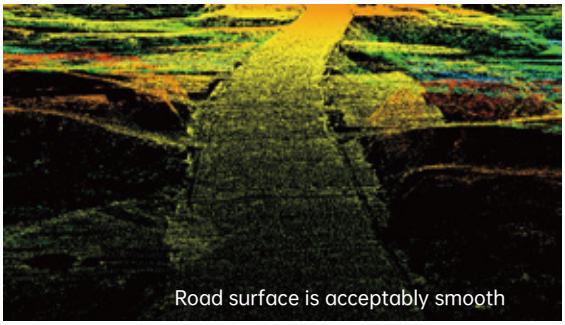
Clouds and the flight platform can be directly mounted for flight without any modification, and it has excellent stability and efficiency.

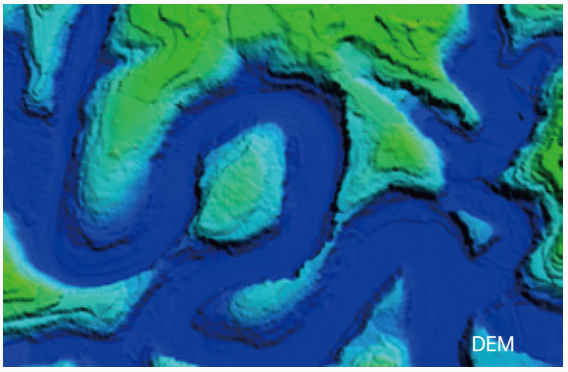

Flight plan

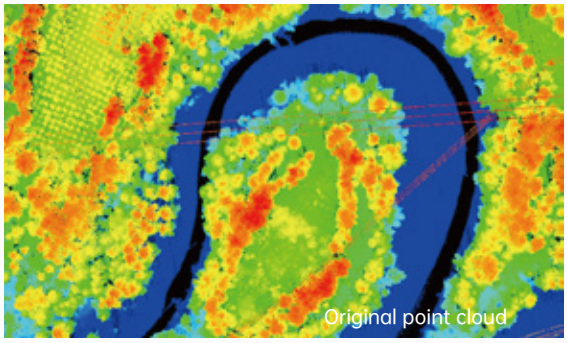
Configuration

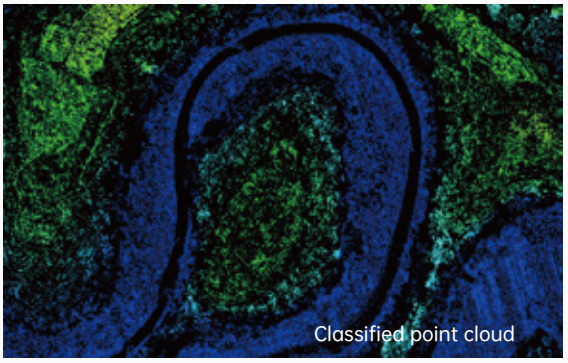
Flight platform	Yunux-Long120
Flight parameters	Altitude: 300 m, Speed: 6 m / s
LiDAR	point frequency: 200 KHz, Scan speed: 3,000 rpm
Base station	Acquisition mode: static Sampling frequency: 1s Elevation cut-off angle: 15°
Image geometry	Sidelap: 45%, Endlap: 70%

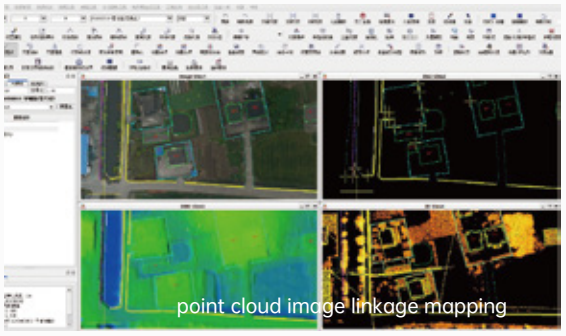

Check point distribution











Acquired LiDAR and image data
Processed data and deliverables

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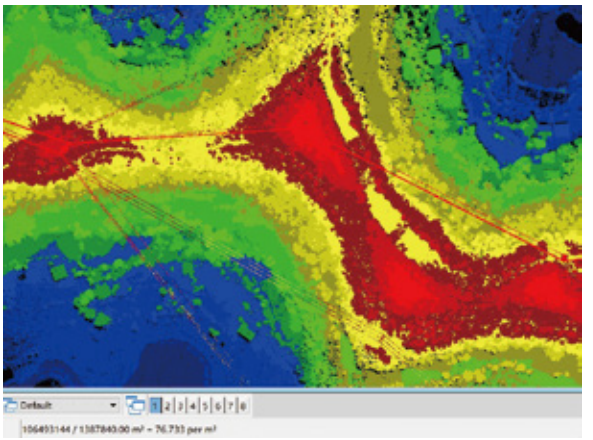
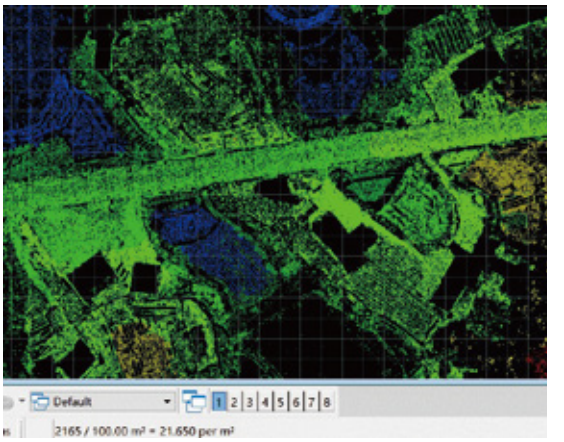
Large-scale topographic mapping

Point density check

The original point density is greater than 76pts / m²



Ground point density is greater than 21pts / m²



Elevation accuracy report

File Sort

Use	Number	Easting	Northing	Known Z	Laser Z	Dz
☒	3	)63.60	2460.54	425.210	425.230	+0.020
☒	4	)29.53	2384.57	420.820	420.790	-0.030
☒	8	)57.03	2510.55	418.160	418.060	-0.100
☒	9	)43.02	2539.74	420.160	420.110	-0.050
☒	10	)60.05	2542.67	420.380	420.260	-0.120
☒	11	)88.39	2565.14	420.010	419.960	-0.050
☒	12	)41.95	2632.39	422.010	422.100	+0.090
☒	14	)55.12	2646.75	421.780	421.720	-0.060
☐	15	137.13	2969.98	413.360	-	outside
☐	16	116.98	2970.11	413.300	-	outside

Average magnitude	0.0650	Average dz	-0.0375
Std deviation	0.0667	Minimum dz	-0.1200
Root mean square	0.0728	Maximum dz	+0.0900

Show location Identify

Deliverables

Type	Data format	Description
Original point cloud	LAS\LAZ...	Raw point cloud
Classified point cloud	LAS\LAZ...	The point cloud classified into buildings, vegetation, rivers, ground, and power lines.
Colored point	LAS\LAZ...	True color texture mapped point cloud provides accurate interpretation and identification.
DOM	Tiff	Full area coverage with GSD better than 5cm.
DEM	Tiff、XYZ....	High precision DEM.
DLG	DWG、DGN...	Large-scale line drawing compatible with previous records and required accuracy.

Project summary

Task	Work done	Time required
Site survey	Familiarization with the work site. Determination of landing location.	10 min
Flight planning	Independent route	5 min
Flight preparation	Install and program LiDAR as per designed specifications.	15 min
Flight operations	Perform mission according to flight plan	45 min
Verification of data collection	Elevation verification point collection	1 h
Data pre-processing	Solve trajectories, generate point clouds and make orthophotos.	1 h
In-house post-processing	Generate DOM, DEM and topographic map	One day

Advantages of Clouds LiDAR

More: Dense and accurate 3D data, wide range of deliverables, multiple applications beyond the project.

Efficient: Total time spent on data acquisition + in-house processing is less than two days, compared with a traditional survey of N days

Accurate: Point cloud, DEM, DOM, topographic maps and orthophotos meet high accuracy requirements with reduced time and resources

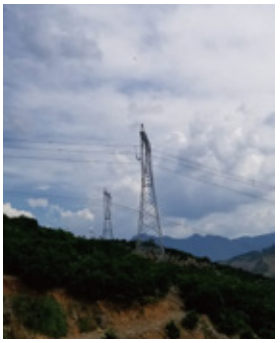
Cost effective: Two-person team means significant cost savings. Multiple data sources and deliverables allow exploitation for other purposes.

Transmission line inspection

Project background

Project Location	Sichuan Transmission Line Inspection
Main mission	Power corridor inspection, point cloud classification, condition analysis, cross-span analysis, vegetation incursion analysis
Customer attention	Vegetation penetration Tower and transmission line scanning performance
Requirements	Coverage of 150m each side of the transmission line Complete coverage of 400km corridor Point cloud classification Accurate and complete line condition and vegetation incursion reports
Challenges	Undulating terrain with tower-to-tower drops up to 200m Point density greater than 50pts/m² The result is to be submitted within one week.


Work site

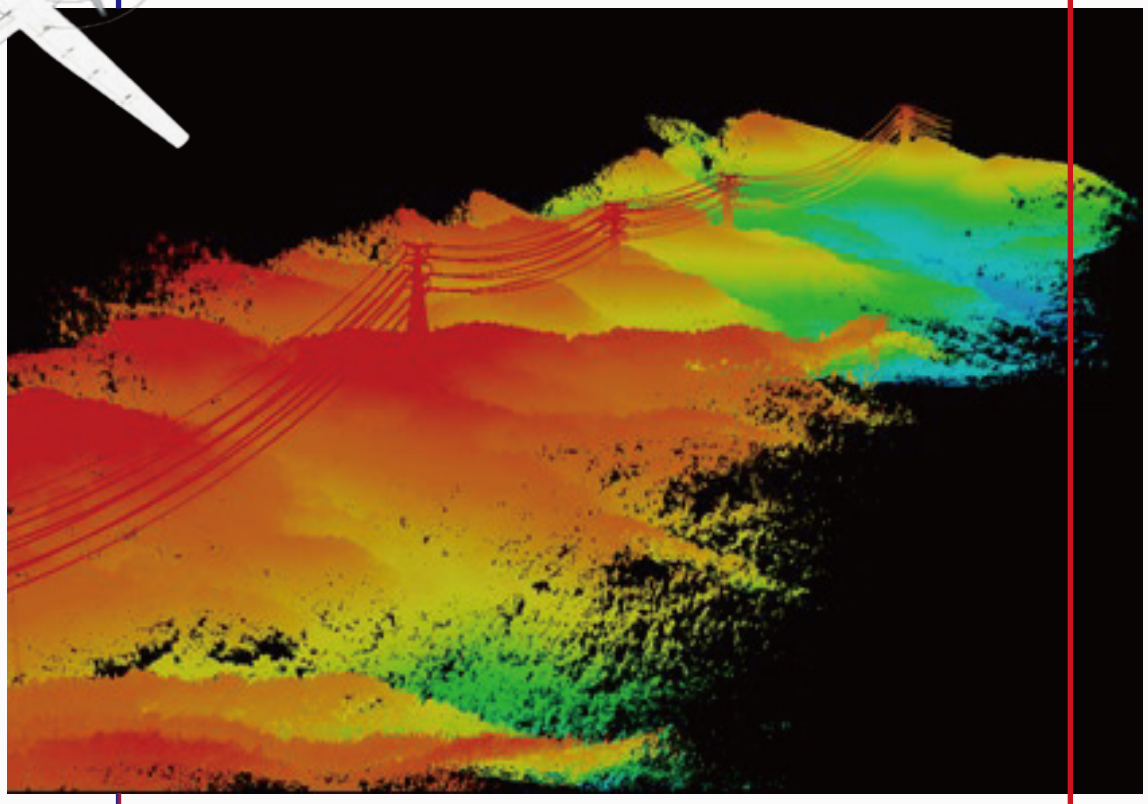


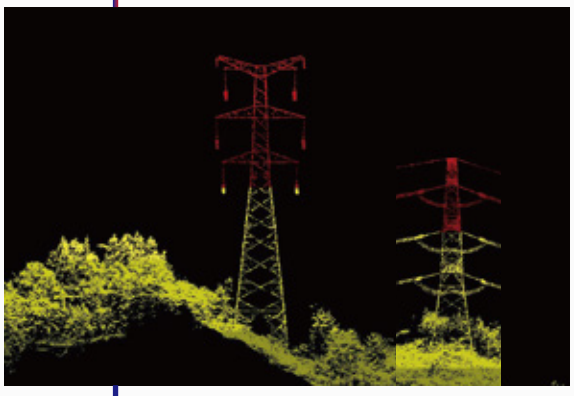
Clouds can be directly mounted onto platforms without modification and has excellent reliability, stability and efficiency.

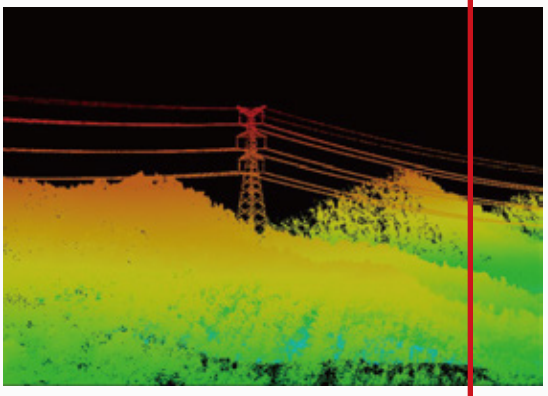

Flight platform

Configuration

Flight platform	Hanfei Eagle VOTL fixed wing
Flight parameters	Altitude: 200m above power line, Speed: 32 m/s
LiDAR	point frequency: 250 KHz, Scan speed: 3,000 rpm

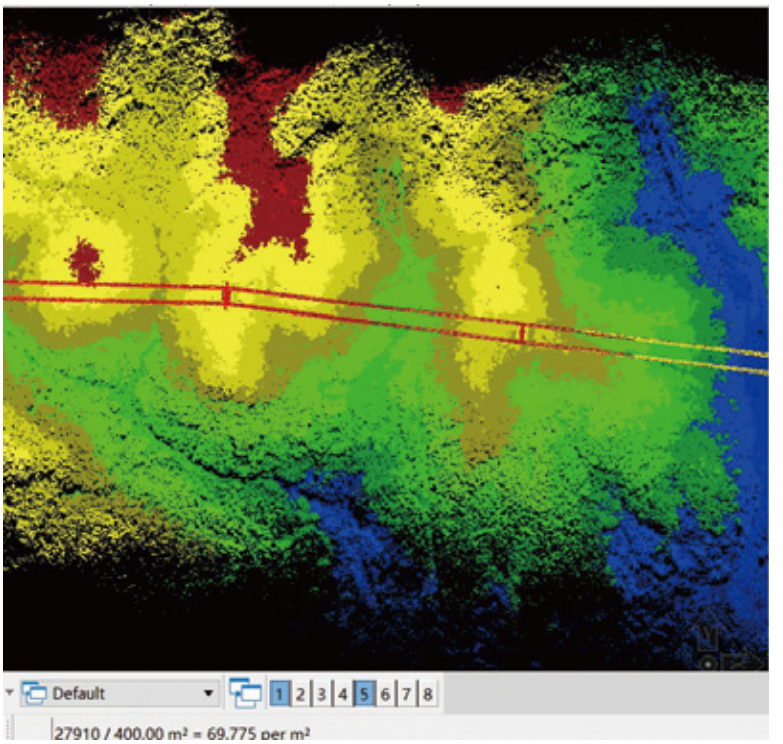




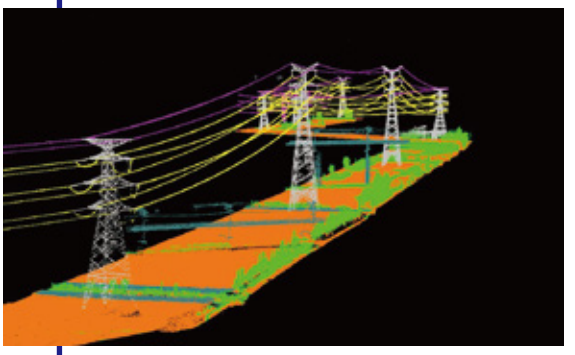


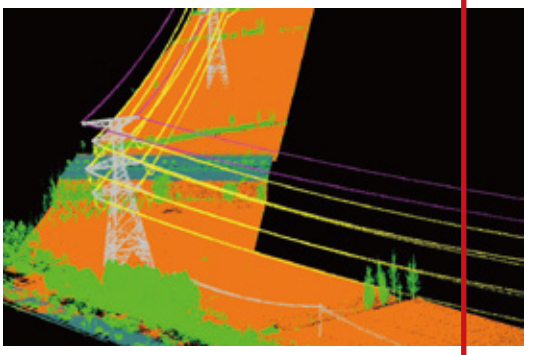
Raw point cloud and details

Transmission line inspection



Point density greater than 69pts/m²



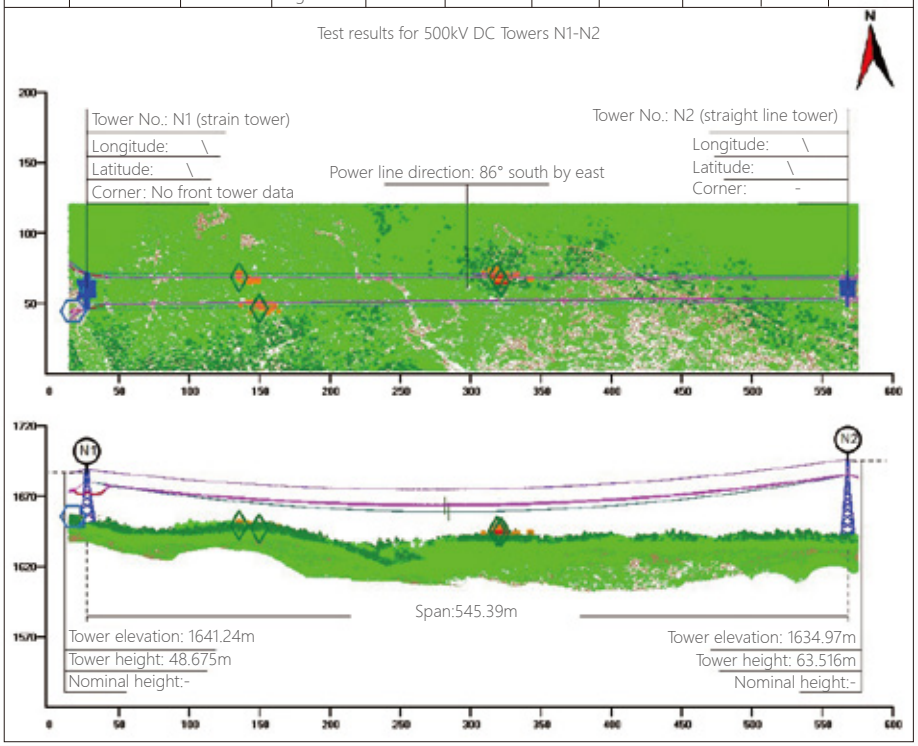


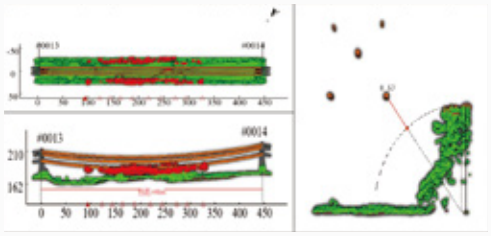
Classified point cloud and details

Inspection report (threats analysis)

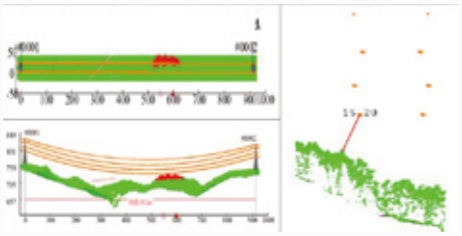
Distance Defect Report for 500kV DC Transmission Line.

Tower interval	Distance from first tower	Coordinate point	Defect type	Radius to defect	Measured distance			Safe distance		
					Horizontal	Vertical	Clearance	Horizontal	Vertical	Clearance
N1-N2	294.10	\	High vegetation	2.88m	3.80m	15.02m	15.49m	-	-	16.00m

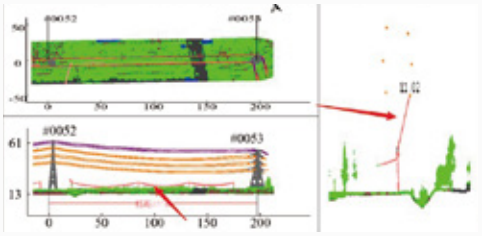




Tree lodging analysis report



Tree incursion analysis report



Transmission line cross-span analysis report

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