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DRONE LIDAR SYSTEM TDOT3

AMUSE ONESELF Inc.

TDOT3

DRONE LIDAR SYSTEM

No light can replace green light.

FEATURE

Features of Drone Laser Scanner System "TDOT"

TDOT GREEN is a drone-mountable laser scanner system using green light, which is hard to be absorbed by water.
TDOT GREEN delivers 60,000 pulses of laser per second toward the ground.
3D data can be acquired with a simple flight that anyone can do.
3D models of wet ground, riverbeds, and shallow seabed, which were not measured before, can be created.

LASER MODULE

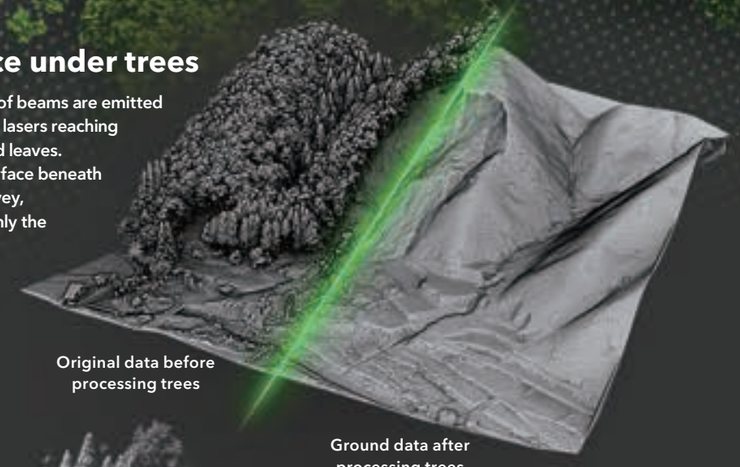
Removing trees and visualizing the ground surface

Lasers reach the ground surface through gaps in trees

TDOT3 -GREEN- TDOT3 -NIR-

Scanning the ground surface under trees

Even in areas covered with trees, tens of thousands of beams are emitted per second from low altitudes, increasing the rate of lasers reaching the ground surface through gaps in the branches and leaves.
By using only the data reflected from the ground surface beneath the trees, it can be used in various fields such as survey, construction, and research because it can express only the ground surface as if the trees had been cut down.



Original data before processing trees

Ground data after processing trees

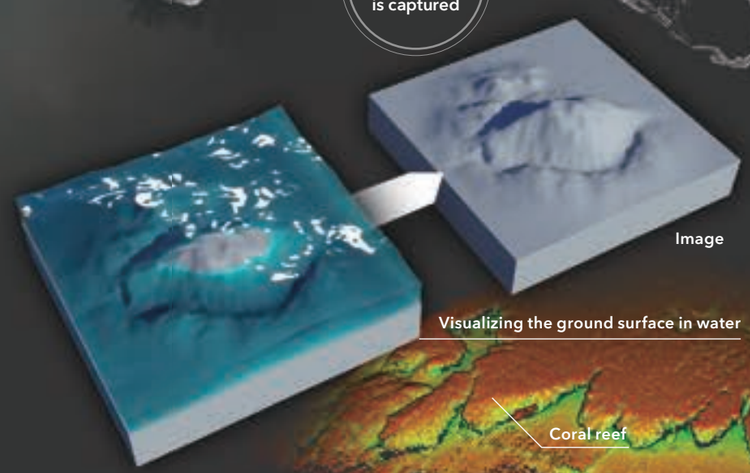
Cross-sectional view of acquired data

TDOT3 -GREEN- TDOT3 -NIR-

Green laser not easily absorbed by water

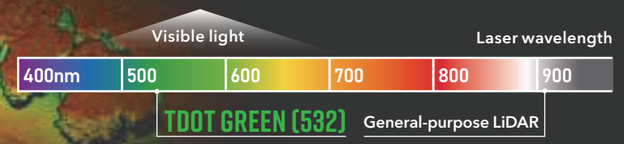
A typical laser scanner uses a near-infrared laser module with a wavelength of 905nm. Near-infrared light is easily absorbed by water, and data cannot be obtained by scanning wet objects. Also, even if you scan a black surface such as asphalt pavement, it is not possible to make measurements because the light reflection is weakened.

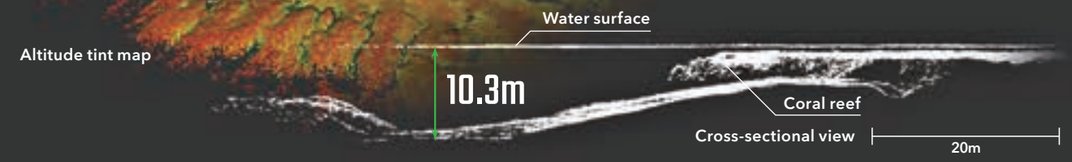
TDOT GREEN is equipped with a green laser module with a wavelength of 532nm, which is not easily absorbed by water. This makes it possible to scan and obtain high-density 3D data on wet, black, and even underwater terrain, which is difficult to do with near-infrared light.



Visualizing the ground surface in water

Altitude tint map





ACCURACY

TDOT3 -GREEN- TDOT3 -NIR-

To higher performance
Built-in high-performance INS
with further improved measurement accuracy and resolution

INS (inertial navigation system), which determines the accuracy, is further upgraded.
GNSS can receive the position data from satellites only a few to dozens of times per second.
Therefore, even with a high performance GNSS receiver, a high performance INS that calculates gyro and acceleration is essential to obtain a detailed and accurate flight trajectory.

Please be sure to feel the performance of TDOT 3 that fully integrates the latest high-performance devices.

Specifications of the new IMU

Position accuracy	5mm
Heading	0.03°
Pitch/Roll	0.006°
Speed	0.01m/sec

TDOT3 -GREEN- TDOT3 -NIR-

Range of 45° right and left from directly below the drone where the accuracy of altitude is stabilized

TDOT is designed specifically for surveying.
The concept of TDOT is to acquire the required data efficiently and with high accuracy.
TDOT is designed to intensively scan the ±45° area from directly below the drone.
In the range, the accuracy of the altitude value is stable because it is less affected by the drone's posture.

On the other hand, the further away from this range, the more unstable the elevation becomes due to the drone's attitude.
For surveying with drones, we believe that this is the best choice as the scanning range can be limited to ±45° from directly below, which simplifies the mechanism and reduces the weight of the scanner.

TDOT3 -GREEN- TDOT3 -NIR-

Beam diameter of 1.0mrad suitable for laser surveying

Many inexpensive systems are converted from laser scanners developed to be installed in cars.
However, since the purpose of them is to ensure the detection of nearby obstacles, the beam diameter is wide and the accuracy for the irradiation distance is not important in their design.

If the beam diameter is too wide, the areas where the laser beam is irradiating will be vague and the accuracy of the data will be impaired.
TDOT is a scanner system designed for surveying with drones from scratch.
With a beam diameter of 1.0mrad (10cm spread angle at 100m ahead), the scanner system is suitable for laser surveying that accurately captures the survey target and can pass through gaps in trees easily.

LIGHT WEIGHT

TDOT3 -GREEN- TDOT3 -NIR-

Achieved lighter weight directly related to flight time, safety, and convenience

TDOT3 GREEN	TDOT3 NIR
2.7KG	1.8KG

Drones have a weight limit.
As equipment becomes heavier, the drone to carry it becomes larger and the flight time becomes even shorter, making it more difficult to operate the system.
If the equipment is light and compact, it can be mounted on a small drone and the flight time will be longer, increasing the efficiency of surveying by flying over a wider area and also greatly reducing the risks associated with flying.

TDOT is a green laser scanner that was considered difficult to reduce in weight, but by applying the best of technology, we have achieved an unparalleled weight reduction.
It weighs only 2.7kg.
Reduced weight to the utmost limit while maintaining strength will improve footwork in operations.

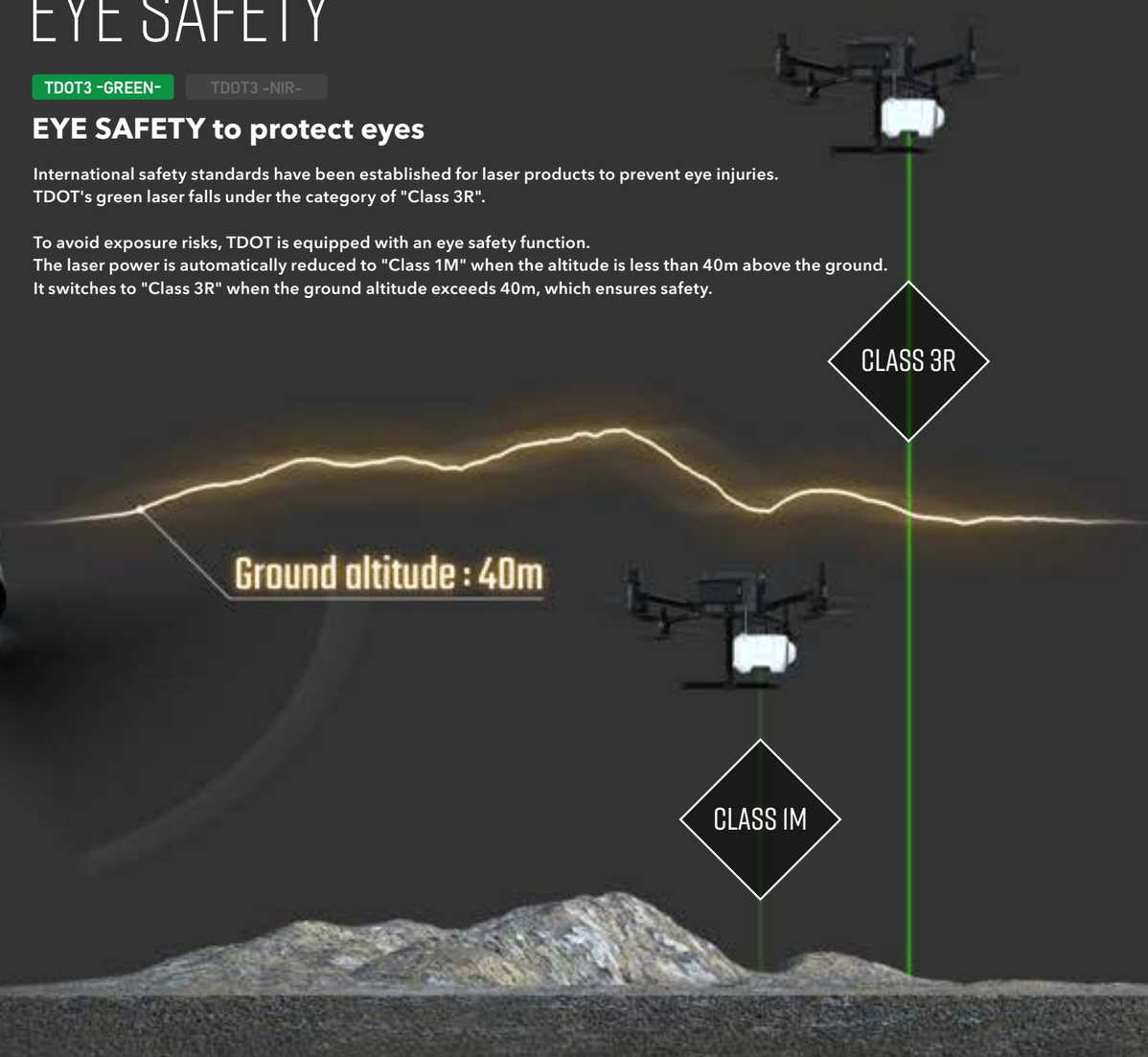
EYE SAFETY

TDOT3 -GREEN- TDOT3 -NIR-

EYE SAFETY to protect eyes

International safety standards have been established for laser products to prevent eye injuries.
TDOT's green laser falls under the category of "Class 3R".

To avoid exposure risks, TDOT is equipped with an eye safety function.
The laser power is automatically reduced to "Class 1M" when the altitude is less than 40m above the ground.
It switches to "Class 3R" when the ground altitude exceeds 40m, which ensures safety.



JIS C 6802 Laser Product Safety Standard
("JIS C 6802" is a translation of the international standard by the Japanese Industrial Standards).

Class 1	Essentially safe.
Class 1M	Safe even for long hours of direct observation in the beam with the naked eye. Observation with optical instruments may be hazardous.
Class 2	Low power with visible light (wavelength from 400 to 700nm). Safe in case of instantaneous exposure, but dangerous when intentionally looking into the beam.
Class 2M	Low power with visible light (wavelength from 400 to 700nm). Lasers that are safe for short exposures to the naked eye only. Observation with optical instruments may cause eye damage due to exposure.
Class 3R	Laser with a relatively low risk of eye injury when viewing in the beam with naked eye. The risk of eye damage increased with exposure time. Intentional exposure to the eye is dangerous.
Class 3B	Even short exposures are dangerous if in-beam exposure to the eye occurs.
Class 4	Observations and exposure to skin are dangerous. Laser that can also be dangerous to observe diffuse reflections. There is a risk of fire.

* Class 3R laser equipment can be operated by installing an auto power reduction mechanism to save power in the danger zone.
* For the use of Class 3B and Class 4 laser equipment, a jurisdictional area with no human intrusion is required.

Real-time display of cross-section data and TDOT status

REAL TIME DISPLAY

TDOT3 -GREEN- TDOT3 -NIR-

Scan data is displayed in real time

It is now possible to view surveying data during scanning in real time. Also, the status of scanning under vegetation in areas with many trees, and in water areas, the status of reaching the bottom of the water can be checked during flight.

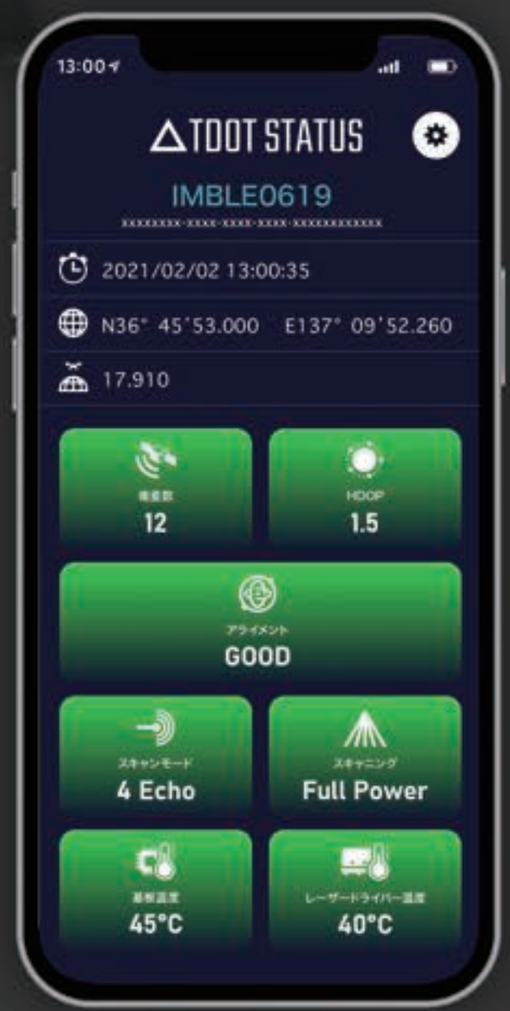
※ For cross-sectional output, an image transmission device and DJI SkyPort that can be connected to HDMI are required on the drone side.

TDOT3 -GREEN- TDOT3 -NIR-

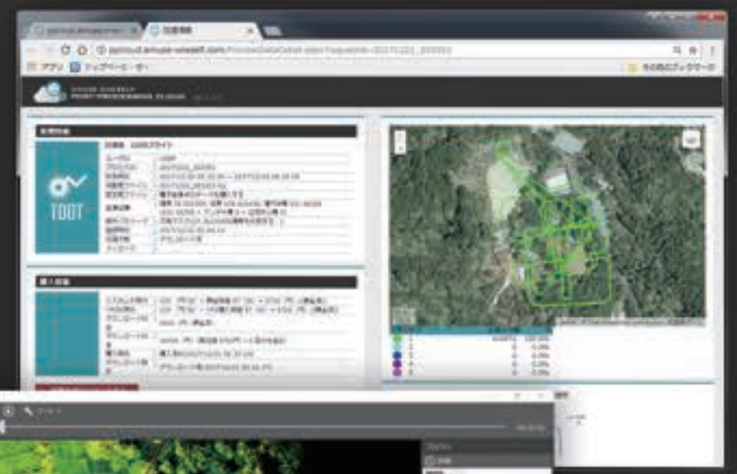
TDOT status is shown on the display

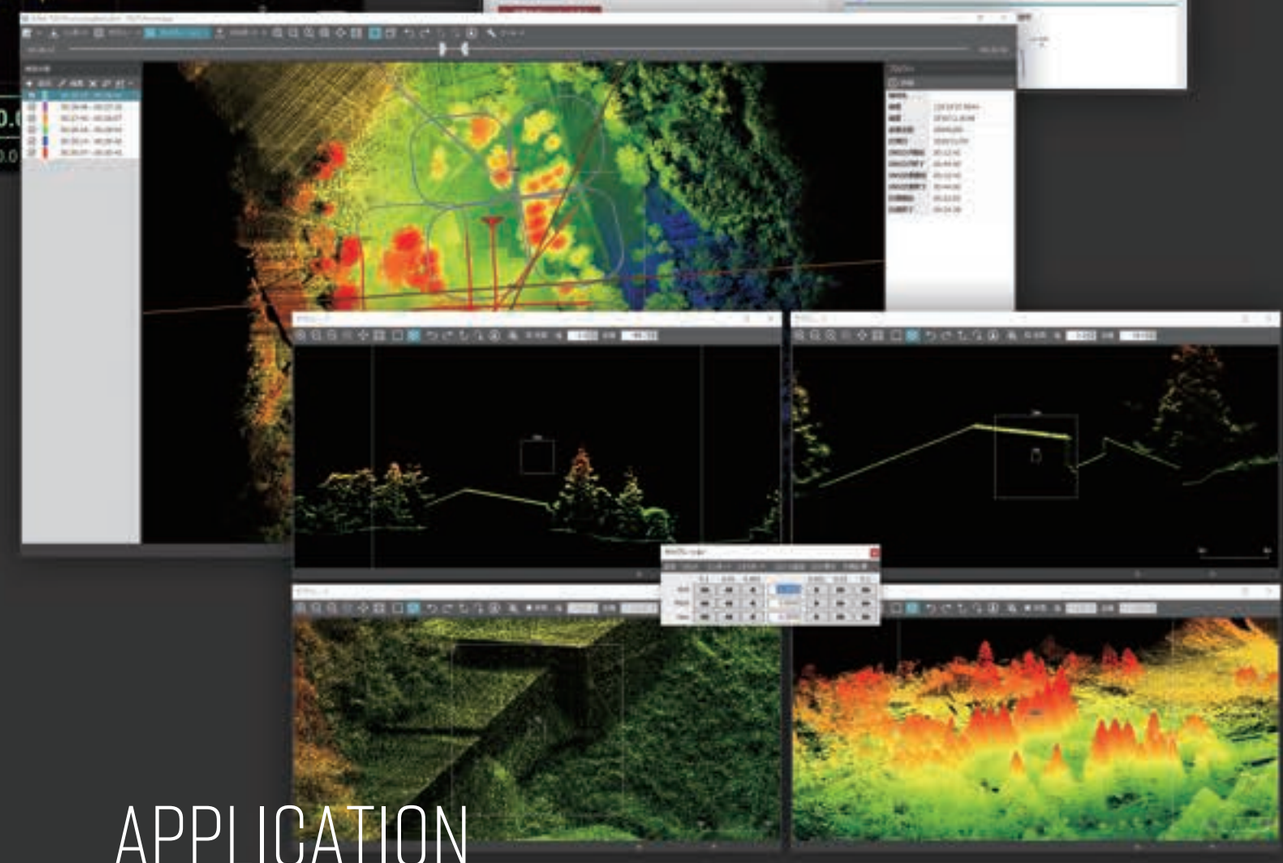
- Number of received satellites
- Satellite quality
- Alignment status
- Scan mode
- Scanning status
- Substrate temperature
- Driver temperature

The status of the above seven items can now be viewed in real time.
The smartphone app was also released.



POST PROCESSING CLOUD (pay-as-you-go)





TDOT PROCESSING PRO

APPLICATION

Rich set of applications

TDOT3 -GREEN- TDOT3 -NIR-

Automation of analysis processing without requiring expertise

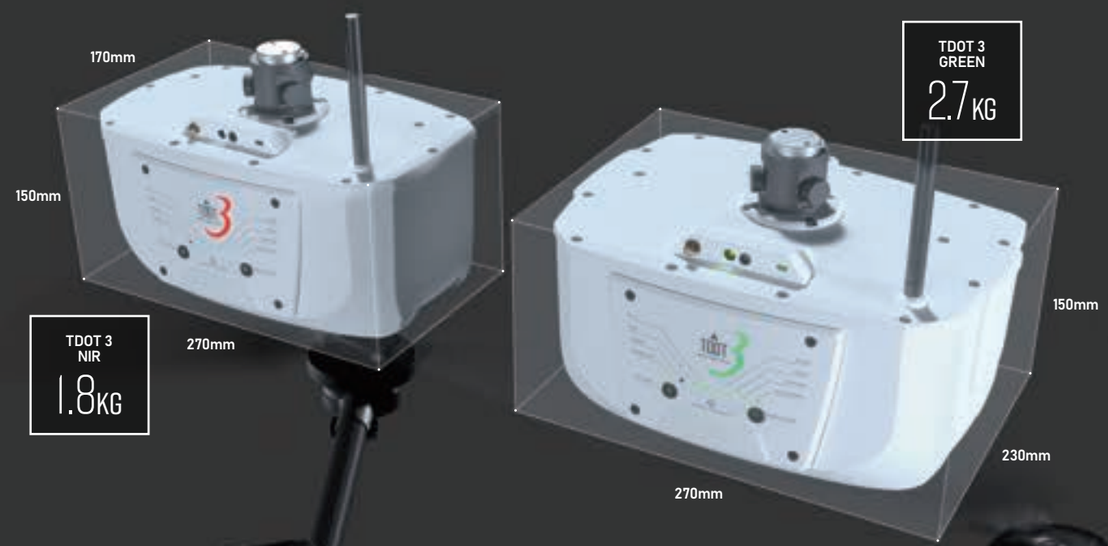
Kinematic analysis process, which used to require expertise, is automated on the cloud.
"POST PROCESSING CLOUD (pay-as-you-go)" that automatically performs optimal trajectory analysis using data from electronic reference points and fixed stations.
"TDOT PROCESSING" for outputting high-precision point group data from data output by optimal trajectory analysis and measurement data.
TDOT, a system that everyone can use.
There is no compromise in the application as well.

COMPATIBLE DRONES

TDOT3 -GREEN- TDOT3 -NIR-

It can be mounted on drones with a payload of 3 kg or more

TDOT can be directly mounted on "GLOW" series of purely Japanese-made drones developed by our company and DJI MATRICE 300 RTK.
Compact and lightweight TDOT can be operated with various drones.



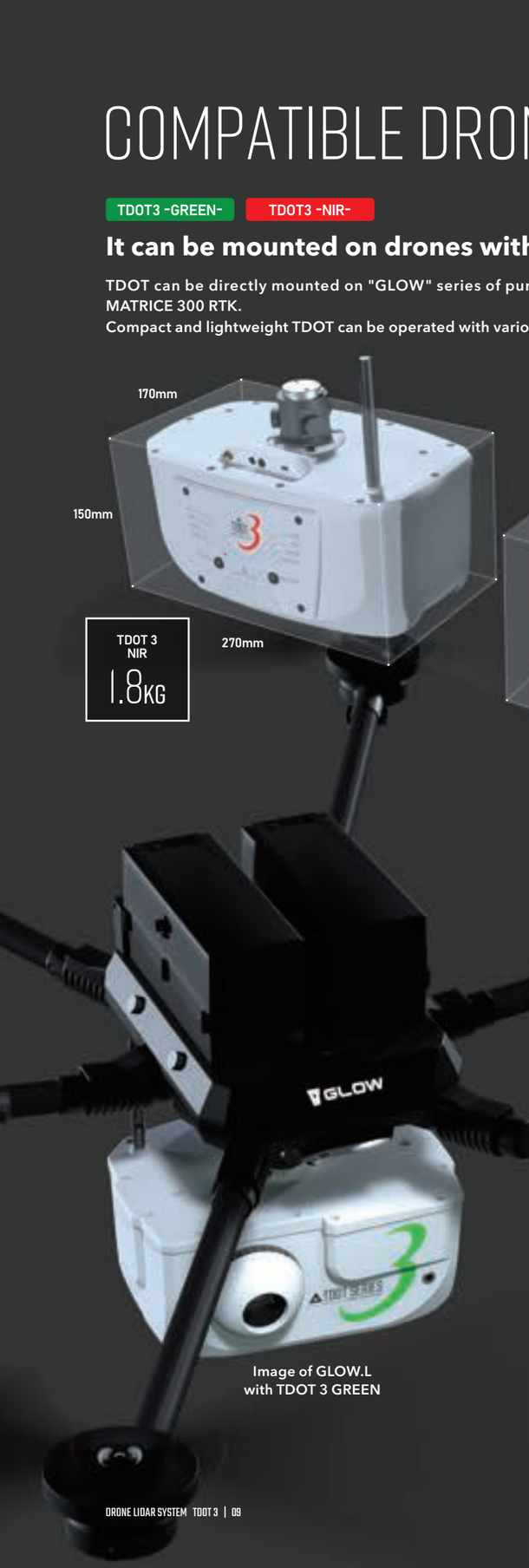


Image of GLOW.L
with TDOT 3 GREEN

"GLOW" series, a purely Japanese-made drones developed to carry the TDOT3 series

PROMOTION

GLOW.L
LIPO BATTERY DRONE

Lipo battery-powered drone with reduced waste and improved energy efficiency. It maximizes battery-powered flight time.

Lipo Drone (excluding Antenna/Battery) 6 Rotor

In flight form	Rotor shaft diameter Φ1450 mm
In storage form	300 x 350 x height 850mm
Flight duration*	When TDOT3GREEN is mounted: 33 mins
	When carrying 5kg of load: 29.5 mins (both batteries 30% remaining)

* This is the calculated flight duration at the time of design.
* It depends on the control of the flight controller.
This is for promotional purposes only, and specifications, designs, colors, etc. are subject to change without notice.

Image of GLOW.H
with TDOT 3 GREEN

PROMOTION

GLOW.H
HYBRID DRONE

Hybrid drone equipped with the range extender.
Flight time more than 6 hours for drone alone, and more than 2 hours with TDOT 3 GREEN mounted, which is impossible by pure battery-powered drone, has been achieved.

Hybrid drone 4 Rotor

In flight form	Distance between rotors 900 x 900 mm
In storage form	650 x 650 x height 250mm
Flight duration*	Non-installed: more than 6 hours
	TDOT3GREEN installed: 2 hours

FLIGHT TIME
6 non-installed hours+

Image of DJI MATRICE 300 RTK
with TDOT 3 GREEN

DJI MATRICE 300 RTK
DJI MATRICE 600 PRO

Industrial drones made by DJI
It can be mounted on MATRICE 300 RTK and MATRICE 600 PRO.
Dedicated mounting attachments must be fitted for mounting on MATRICE 600 PRO (No modifications to the body are required for both).

WORK FLOW

TDOT is a laser scanner system specialized for surveying operations.
It can be mounted to a drone with a single touch for quick measurement and quick removal.
It makes the operations as simple as possible.
In the processing phase, it is automated so as to eliminate the need for expertise as much as possible.

High precision data is output in a short time.

SCANNING PHASE

Preparation for flight

By mounting TDOT to the drone with a single touch, you can start the flight immediately.

Alignment flight

Send a pre-prepared flight plan and conduct an INS alignment flight.
It will complete automatically in minutes.

Measurement flight

Send a pre-prepared flight plan.
If the survey range is wide, repeat the battery replacement and perform multiple flights.

Preview

After the surveying is completed, the data is pre-analyzed and checked on the spot.
Field work is completed in these series of processes.

Withdrawing

Acquisition

Analysis

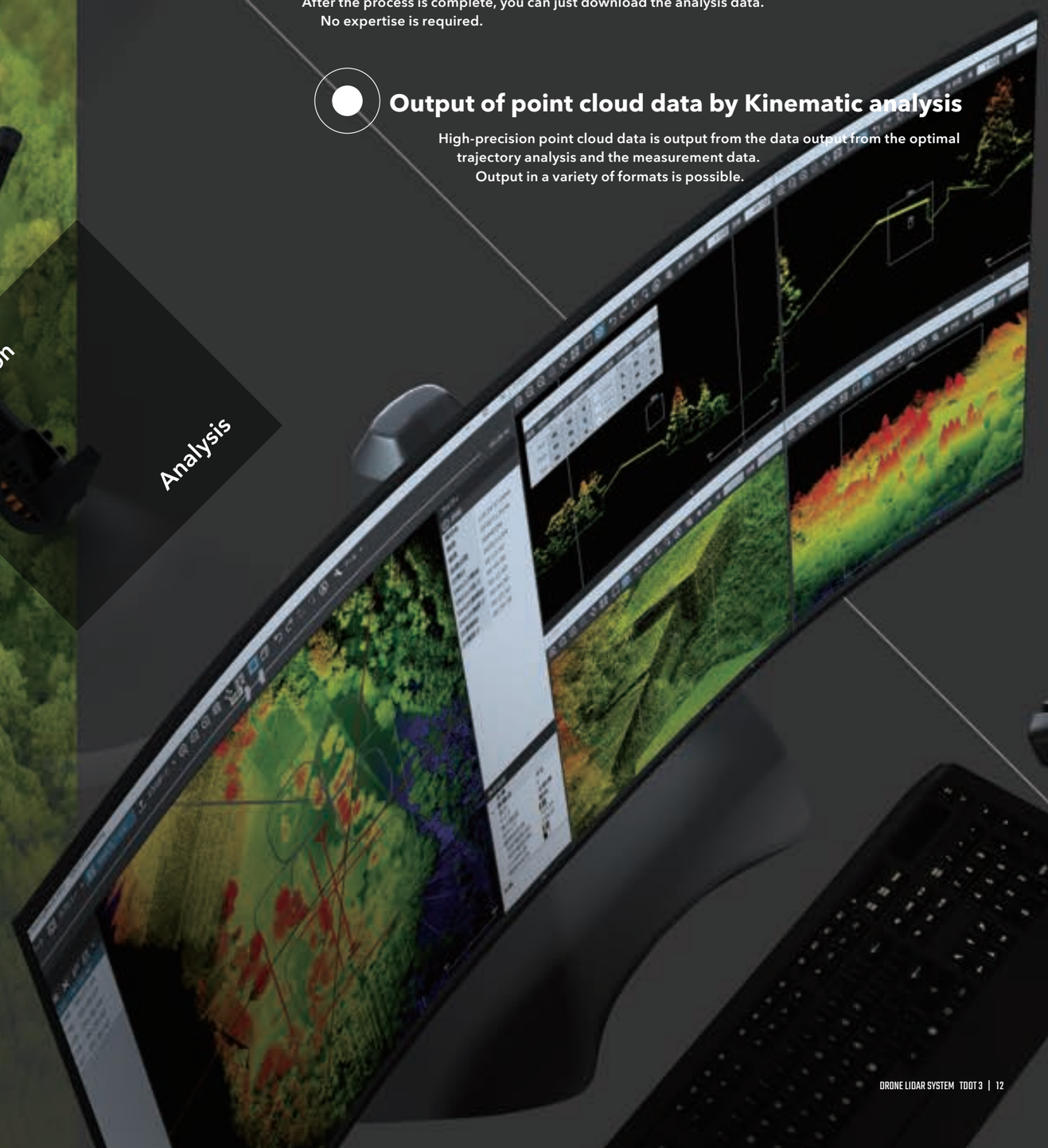
PROCESSING PHASE

Optimal Trajectory Analysis with cloud services

Simply uploading the acquired data to the cloud service automatically begins the optimal trajectory analysis.
After the process is complete, you can just download the analysis data.
No expertise is required.

Output of point cloud data by Kinematic analysis

High-precision point cloud data is output from the data output from the optimal trajectory analysis and the measurement data.
Output in a variety of formats is possible.



GALLERY

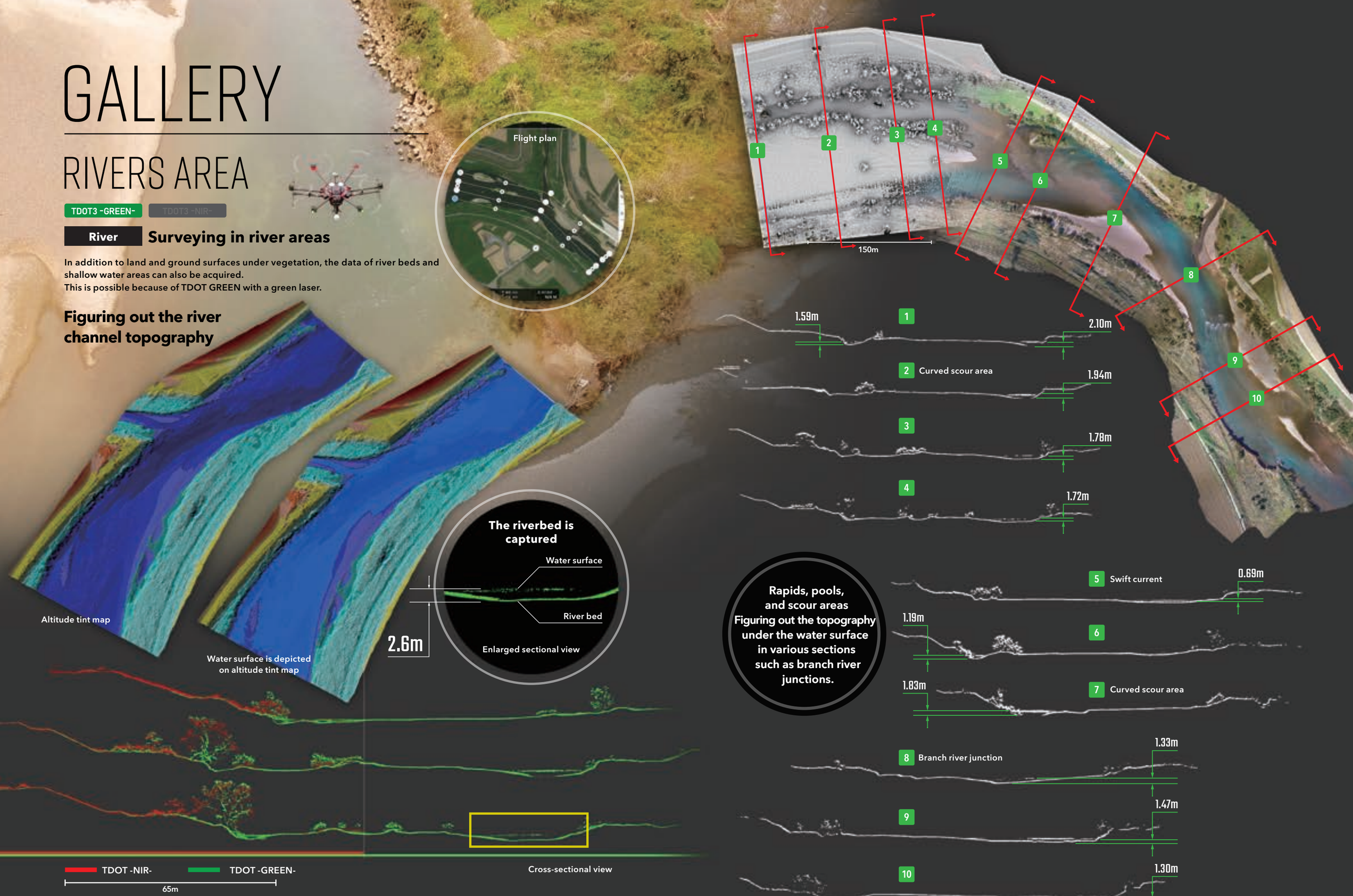
RIVERS AREA

TDOT3 -GREEN- TDOT3 -NIR-

River **Surveying in river areas**

In addition to land and ground surfaces under vegetation, the data of river beds and shallow water areas can also be acquired.
This is possible because of TDOT GREEN with a green laser.

Figuring out the river channel topography

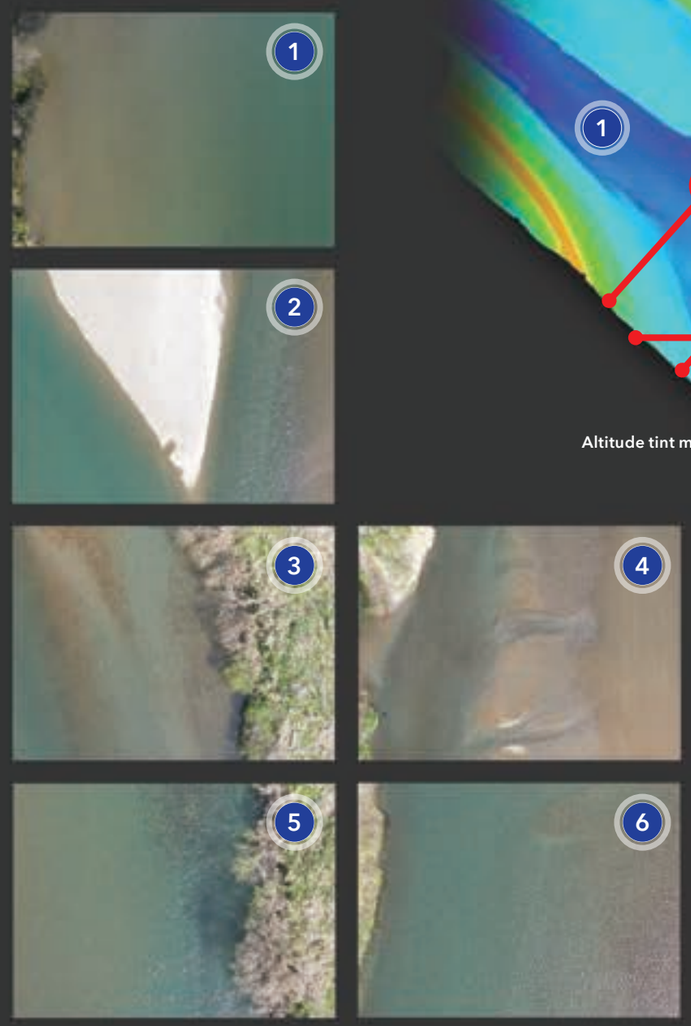


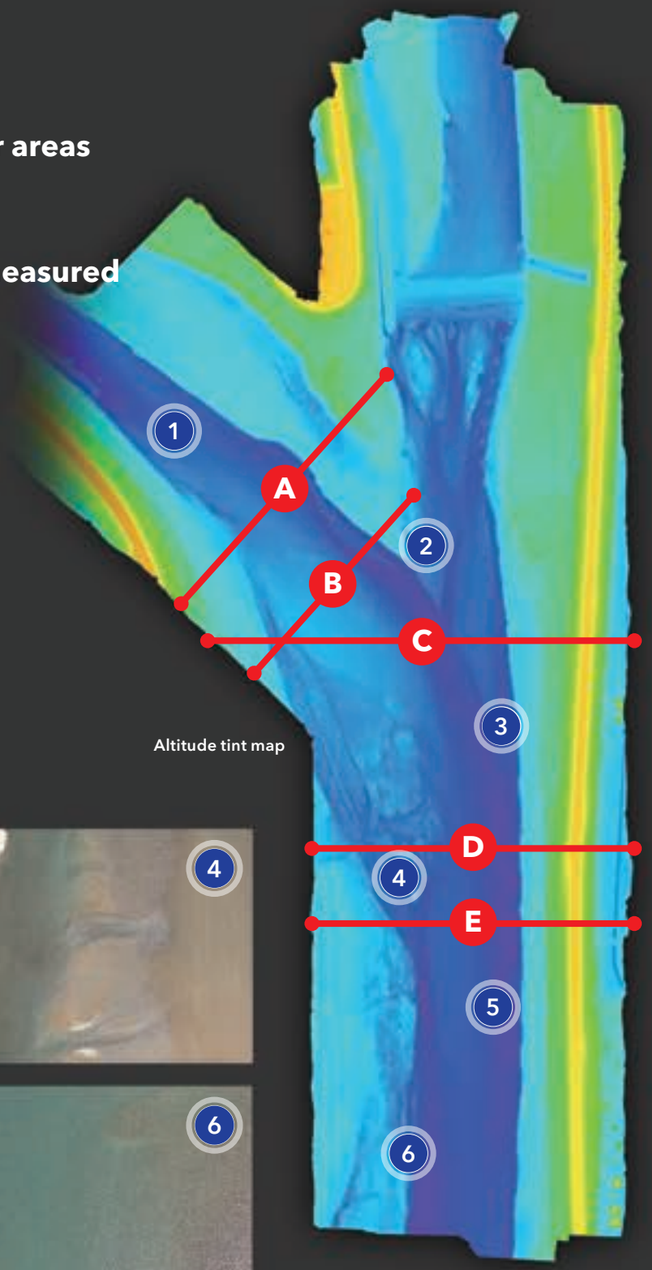
TDOT3 -GREEN- TDOT3 -NIR-

River

Surveying in river areas

Photos of the status when measured

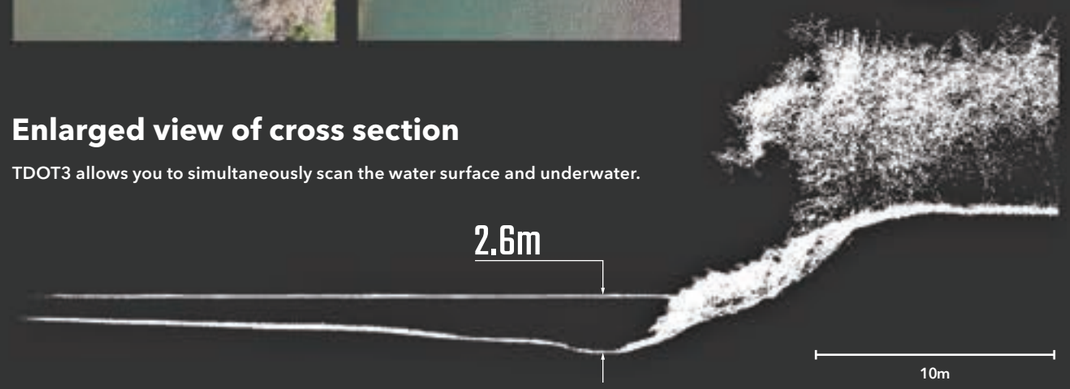




Altitude tint map

Enlarged view of cross section

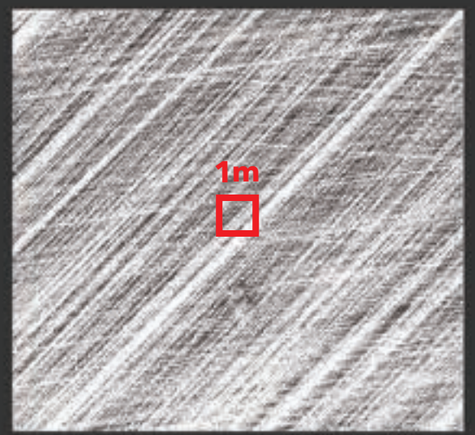
TDOT3 allows you to simultaneously scan the water surface and underwater.



Bank forests and riverbeds are captured as images.

Bird's-eye view

Example of measuring a range of 2km extended over 2 hours.

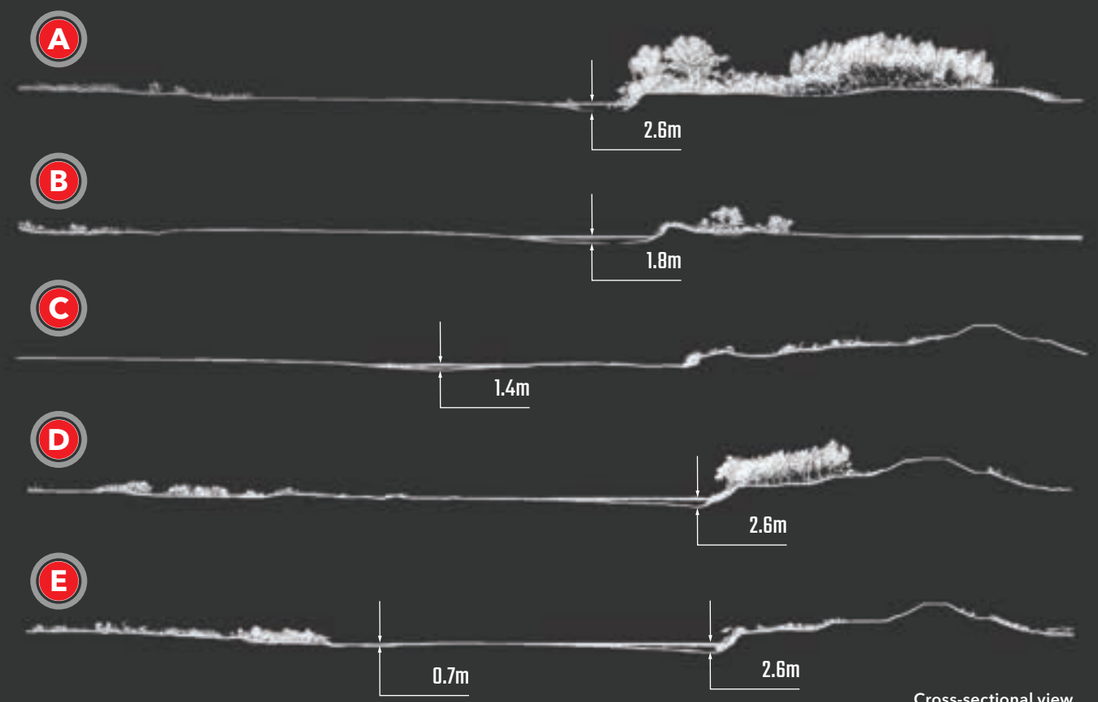


Point group density

1903 points/m²

(475,647 points/250m²)

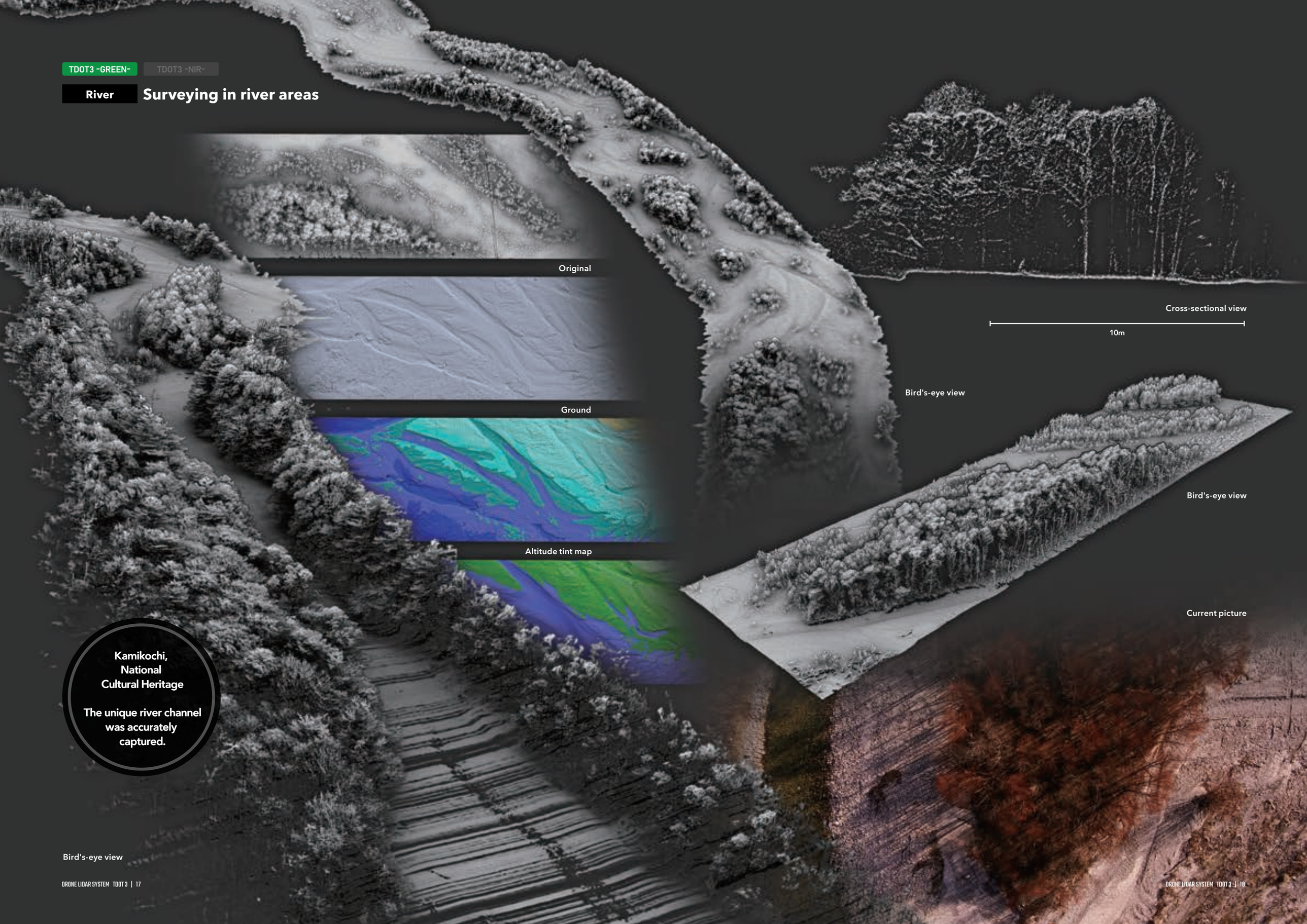
Drones can measure at a higher density than aircrafts.



Cross-sectional view

TDOT3 -GREEN- TDOT3 -NIR-

River Surveying in river areas



Kamikochi, National Cultural Heritage

The unique river channel was accurately captured.

SEASIDE AREA

TDOT3 -GREEN- TDOT3 -NIR-

Shallow sea Surveying in shallow sea area

Measurement is possible even on the seashore where waves stand.
3D mapping of the seafloor topography can be performed even in coastal areas where it is difficult for ships to penetrate.

* In the case of optical measurement using laser beam, it is difficult to measure underwater when water is turbid due to algae, mud, etc. Transparency above the standard is a condition.

Flight plan

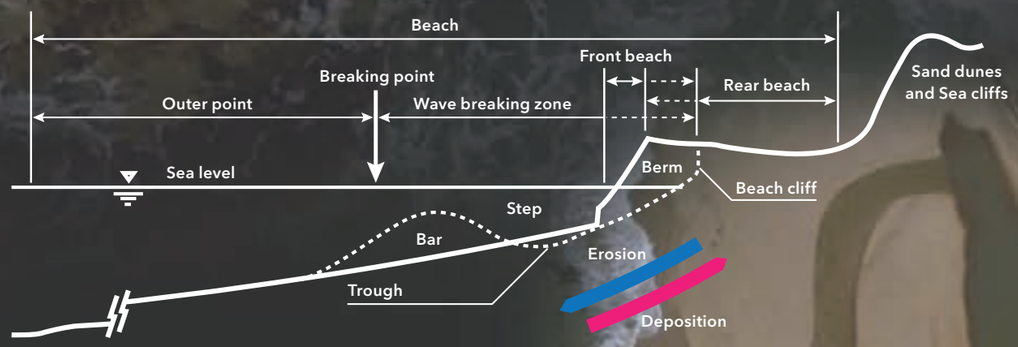
Images of the water bottom can be obtained, which was previously impossible.

Measurement of seafloor topography at 400m offshore

- Obtain data on both water surface and bottom
- 400m offshore, about 9m deepest

Cross-sectional view

To date, various efforts have been made to visualize shallow seabed shapes.
TDOT GREEN has realized detailed visualization of shallow sea areas.
It is expected to contribute to port development and coastal preservation.



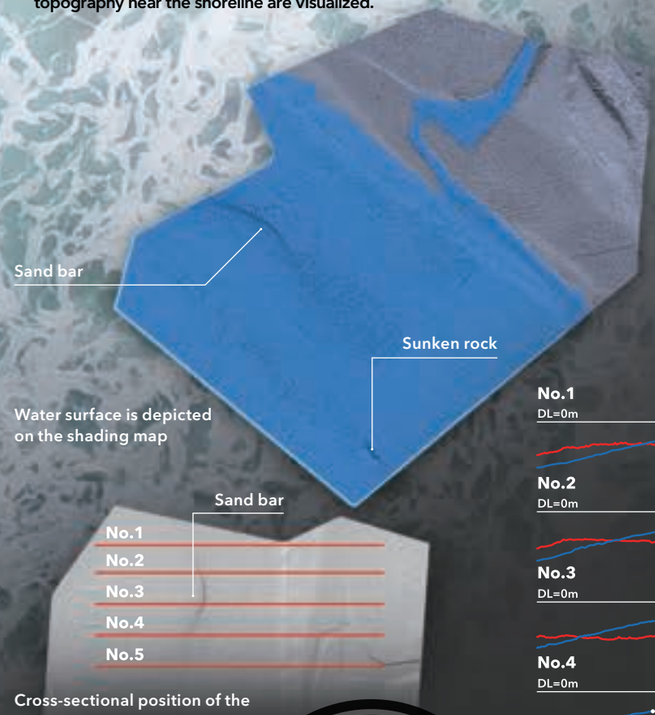
General seaside profiles, the classification and typical topography (Prof. Sunamura in 1999)

Topography of inflowing rivers, river beds, and near shorelines

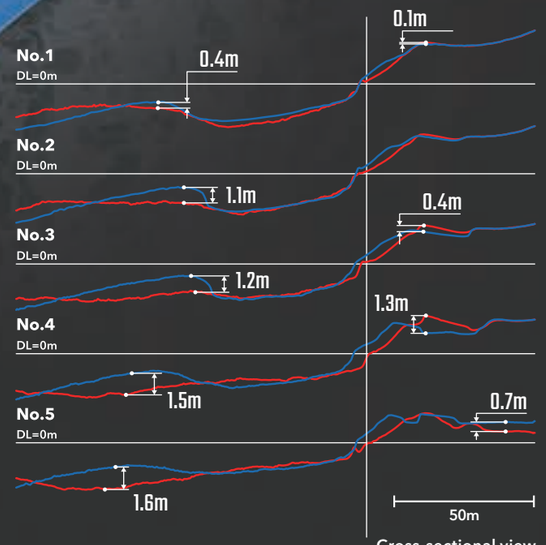
Surface scans of shallow waters

- Sea area: Visualizing the shape of reefs and sandbars within a depth of about 6 meters.
- Land area: Meandering rivers with blocked estuaries, river beds, shorelines, and step topography near the shoreline are visualized.

Flight plan



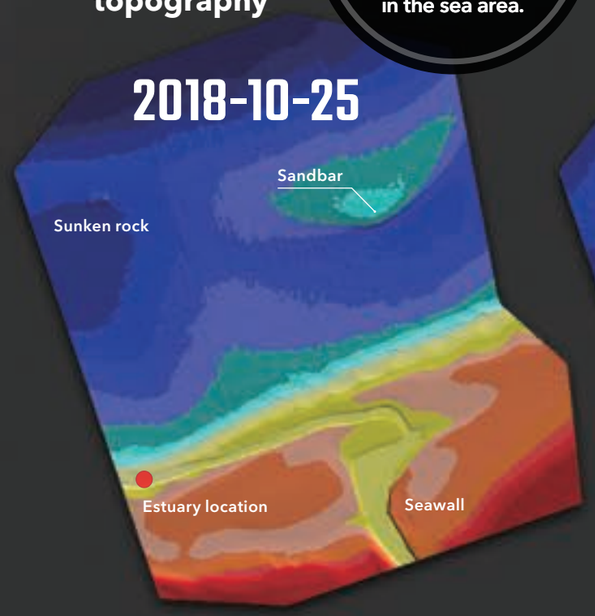
Cross-sectional position of the right cross-sectional view



Cross-sectional view

Comparative verification of seashore topography

Visualized sandbars formed at wave breaking points and confirmed the fluid topographic changes in the sea area.



Altitude tint map

TDOT3 -GREEN- TDOT3 -NIR-

Shallow sea Surveying in shallow sea area

Survey of microtopography in reef and tombolo* area

- Figuring out the seafloor topography of the sea area where deformed tombolo developed
- Tombolo is 150 meters offshore
- Figuring out the seafloor topography of the sea area where reefs developed
- Visualizing the microtopography of complex reefs in shallow water, which is difficult to survey even with a small boat

* Tombolo: a landform where a sandbar has developed and reached the opposite shore or nearby.

Flight plan

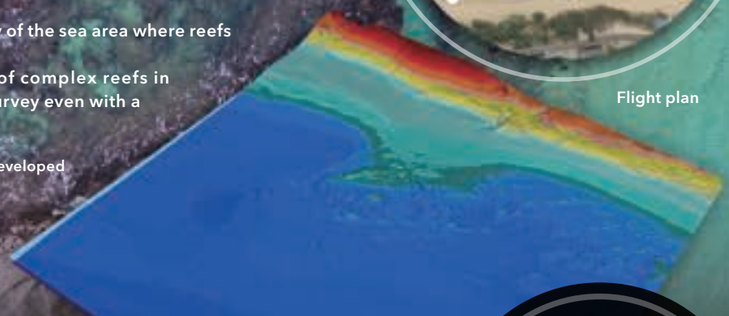
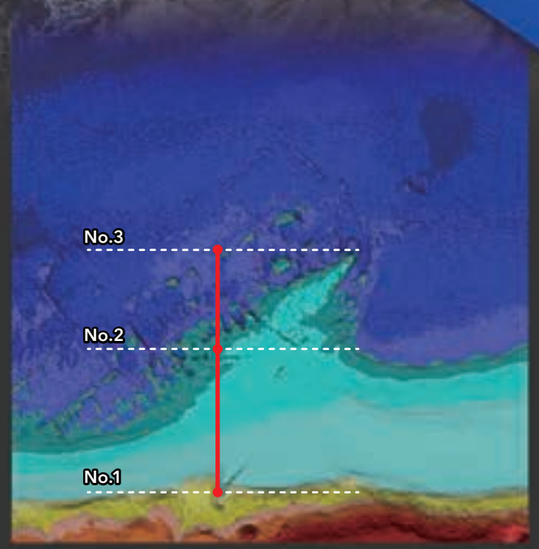


Photo of reef and tombolo site

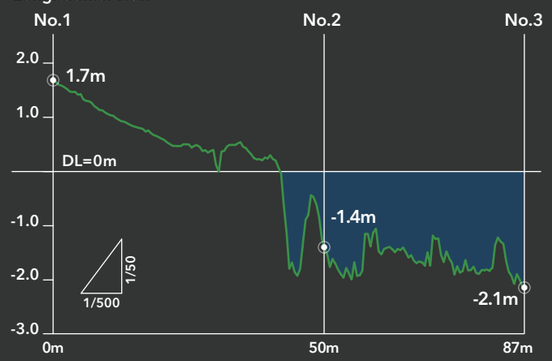
Succeeded in visualizing reef areas where previously no means were available.



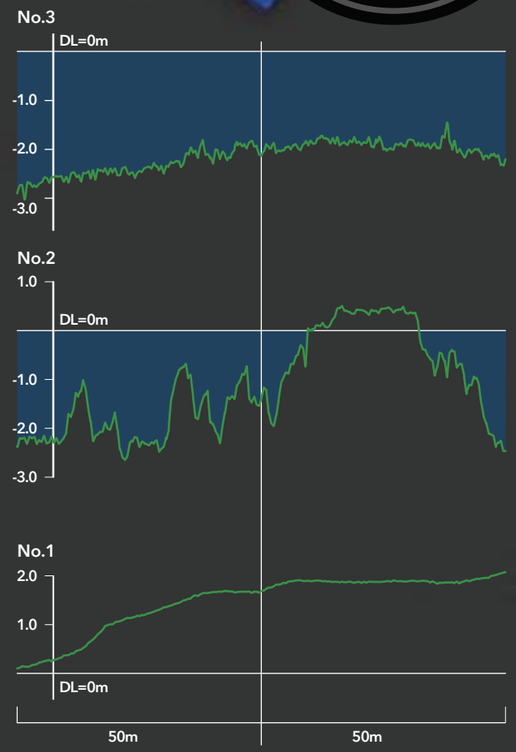
Altitude tint map

Figuring out the seafloor topography in reef-developed areas - Location of longitudinal and cross-sectional views

Longitudinal view



Cross-sectional view



Measurement of undersea topography in coral reef areas

- Successfully visualized data on the bottom of the water with deepest points of about 10 meters

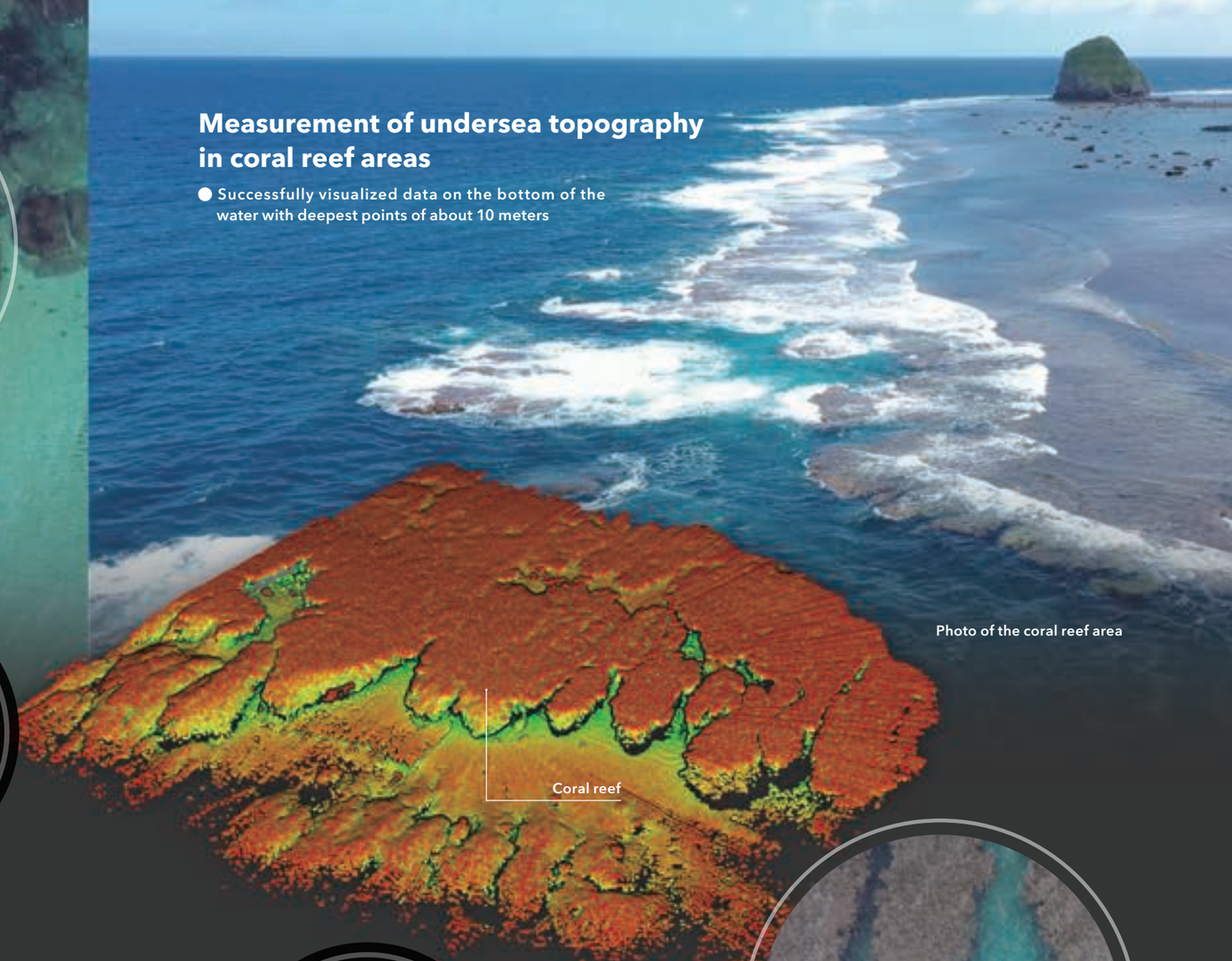
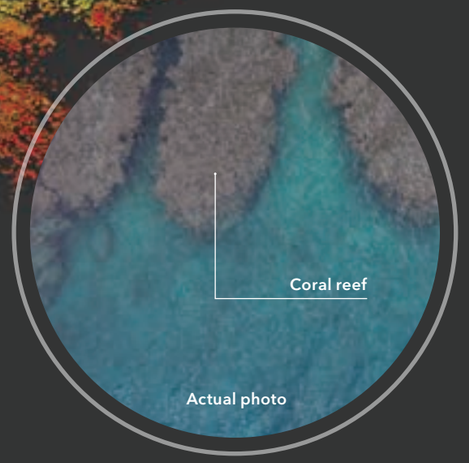
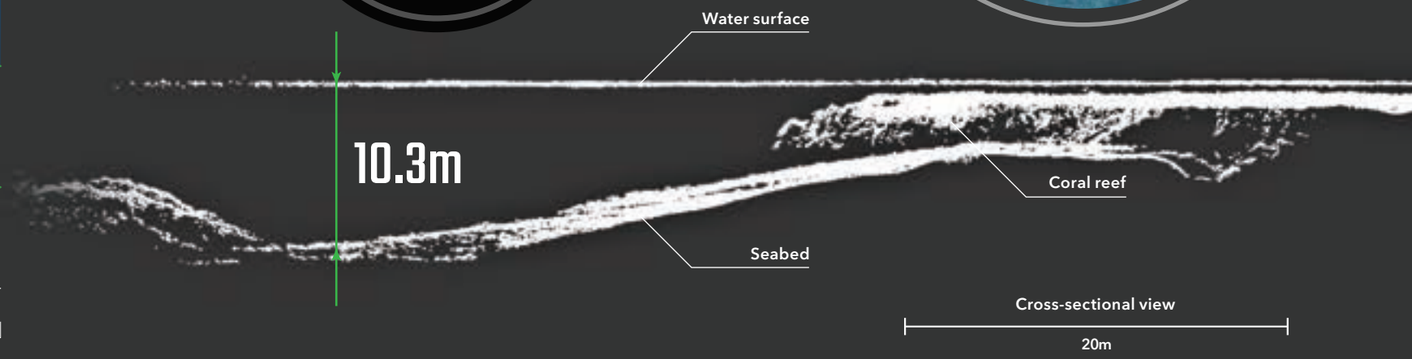


Photo of the coral reef area

Altitude tint map

Confirmed capability to measure depths in over 10 meters in clear water.





TDOT3 -GREEN- TDOT3 -NIR-

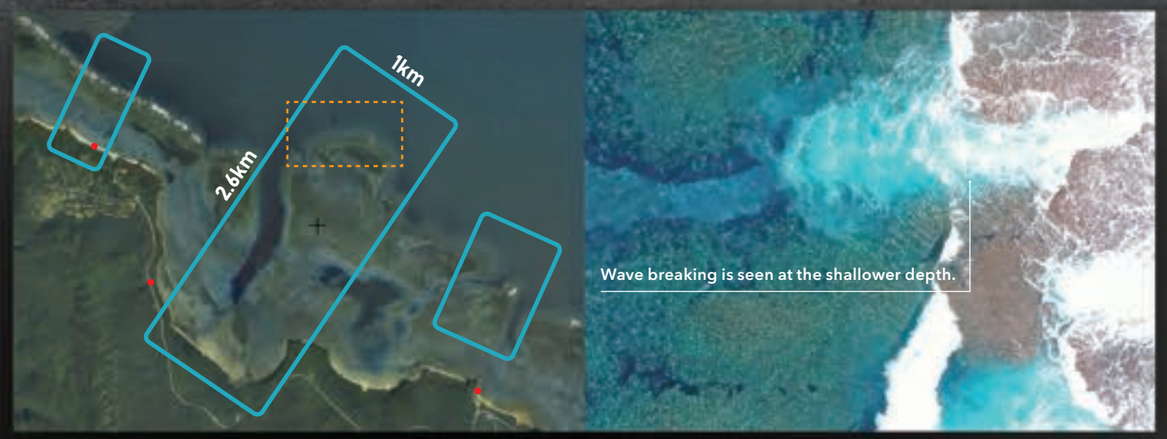
Shallow sea **Surveying in shallow sea area**

The world's first

Long-duration, long-range seafloor topography measurement by hybrid drone with TDOT.

Together with the Port and Airport Research Institute (PARI) of the National Institute of Maritime, Port and Aviation Research, we have demonstrated that TDOT GREEN, mounted on the newly developed hybrid drone "GLOW.H" can efficiently measure high-definition seafloor topography.
The proof of concept was conducted at Iriomote Island of Taketomi Town, Okinawa, measuring an area of about 2.6km in length and 1km in width from land to a depth of about 17m in about 4 hours and acquiring the continuous topography of the shallow sea area from land and the complex topography of coral reefs. The measured data (including both water surface and seabed) showed high density with an average interval of about 12cm, and high accuracy with an average error of ±2cm in height.

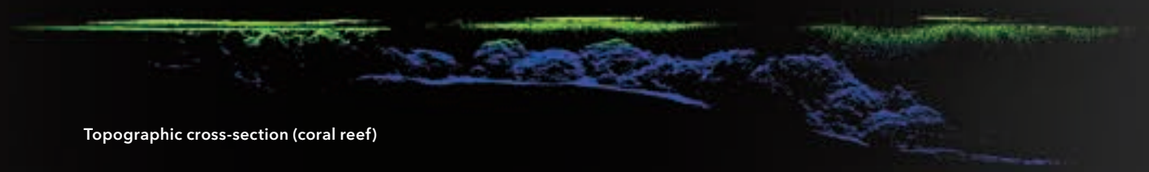
Hybrid drone:
a drone with a system that uses a gasoline-fueled generator to supply power.
Typical drones are powered by batteries only.



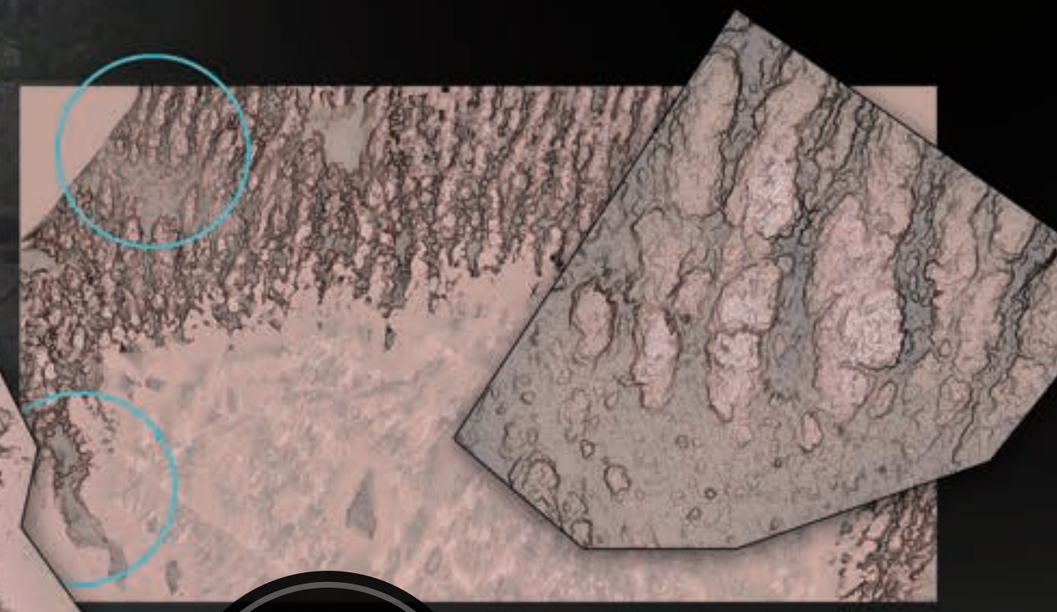
Measuring range
Take-off and landing point
Spur and groove formation

Aerial photo of the site
(coral reef in the northwest area)

Topographic cross-section (mangrove forest to coast)

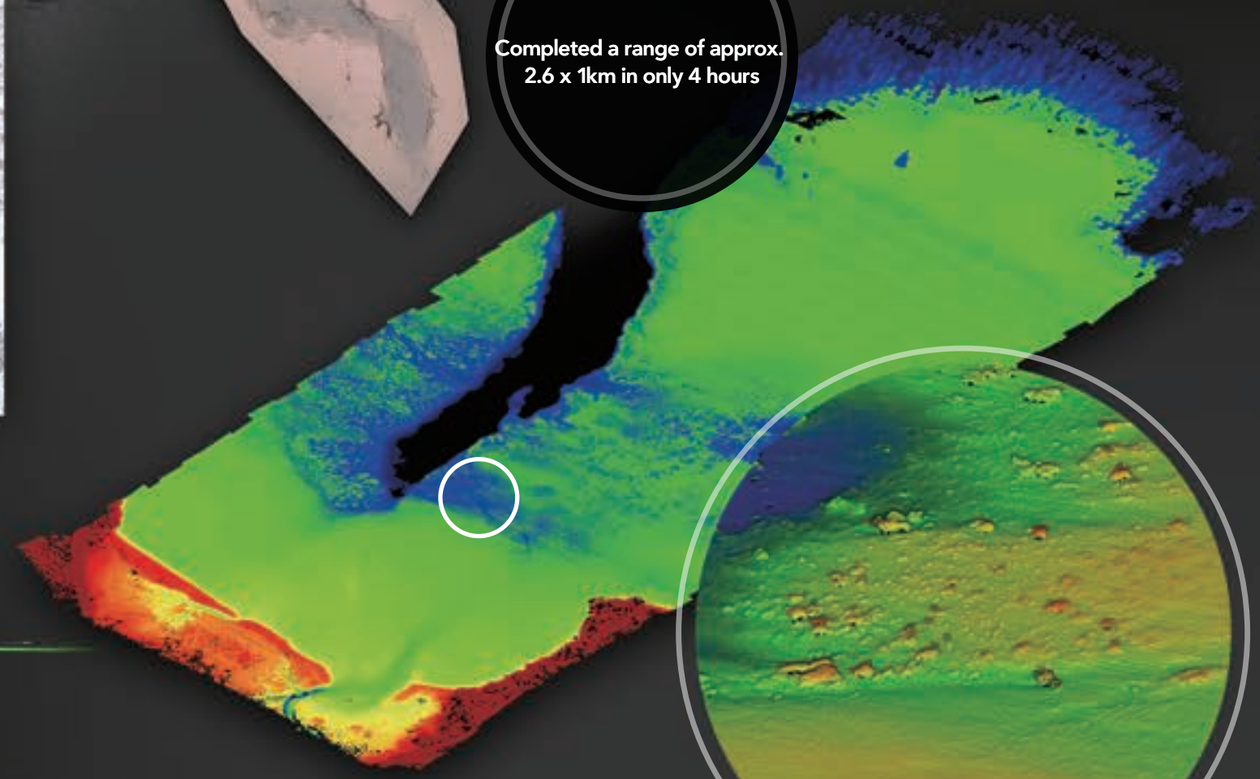


Topographic cross-section (coral reef)

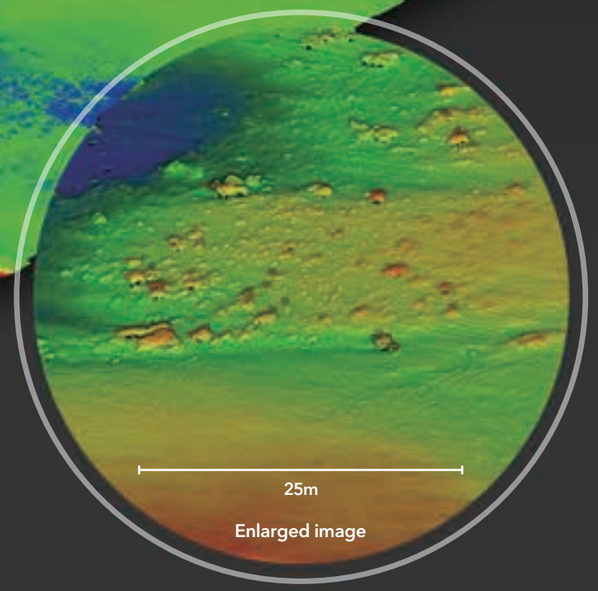


Microtopographic analysis map

Completed a range of approx.
2.6 x 1km in only 4 hours



Topographic map after water surface filtering treatment (entire central area)



Enlarged image

SURVEYING

TDOT3 -GREEN- TDOT3 -NIR-

Surveying Use in Construction DX

Construction DX is a reform (innovation) that incorporates the latest technologies, including ICT, in surveying, design, construction, and management to improve productivity through work style reforms.

TDOT is essential for the creation of 3D data, which is indispensable as digital data in constructional DX.

Lasers can acquire ground data even on tree-covered topography

General view side

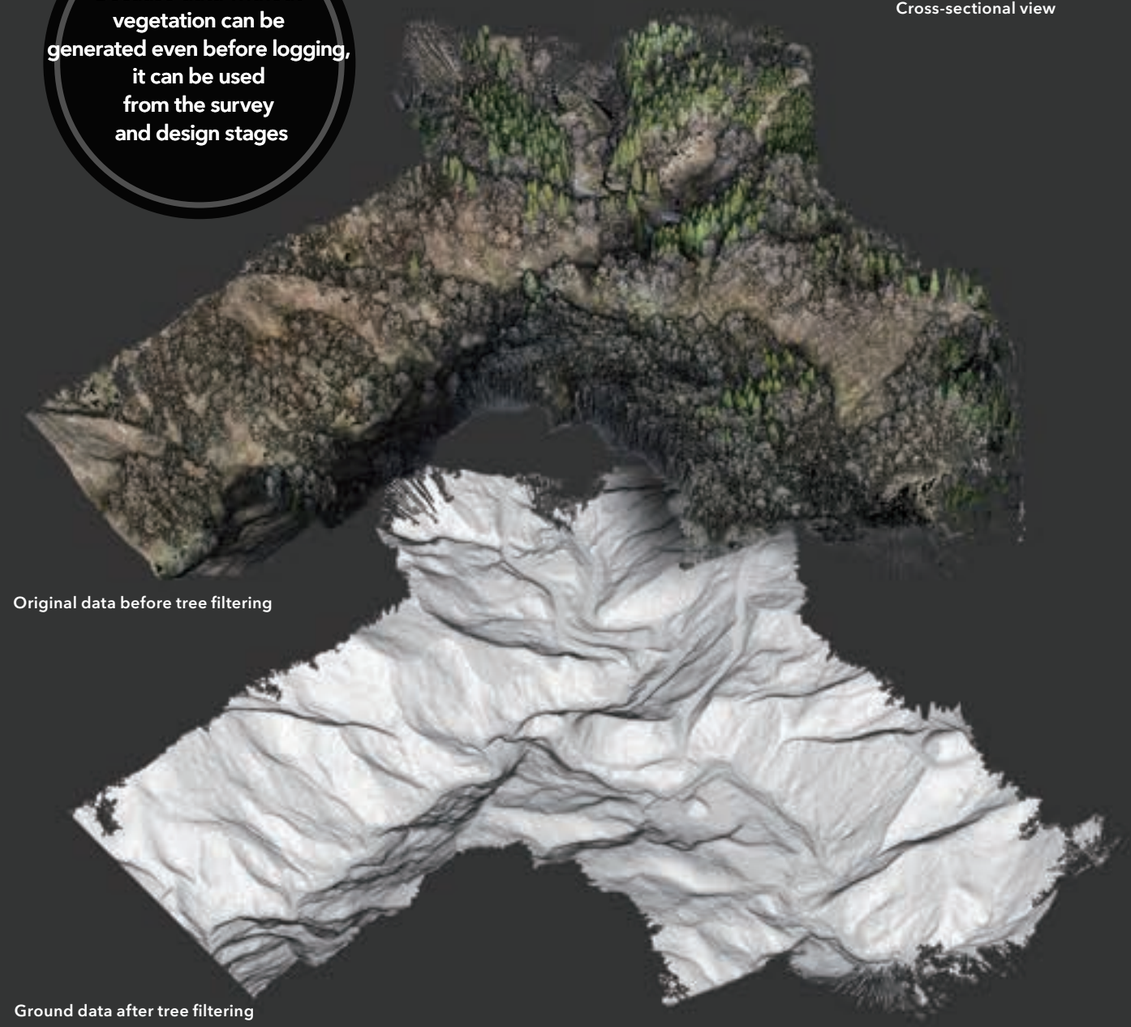
Cross-sectional view

Bird's-eye view

Data can be obtained efficiently even on steep slopes

Cross-sectional view

Because data without vegetation can be generated even before logging, it can be used from the survey and design stages



Original data before tree filtering

Ground data after tree filtering

TDOT3 -GREEN- TDOT3 -NIR-

Surveying Use in Construction DX

The success of ICT construction depends on how quickly and accurately the survey data can be communicated to the construction workers.
Even without 3D surveying know-how, TDOT allows you to quickly obtain the data required for i-Construction.

High accuracy 3D surveying is possible without troublesome marking points required for photogrammetry.

Photo of the construction site

Ortho at the construction site

Bird's eye view

TDOT's small beam size and high point cloud density enables it to grasp the shape of electric cables and signs, thus improving the maintenance work of infrastructure.

Bird's eye view

Bird's-eye view

Easy calculation of accurate soil quantities and heat maps for work progress control.

* a separate application is required.

RESEARCH

TDOT3 -GREEN- TDOT3 -NIR-

Investigation Use in disaster research

TDOT is also an effective tool in disaster response that requires rapid investigation.
It can acquire necessary data immediately, instantly convert it into data without waste, and visualize the scale and the status of the disaster and allows users to utilize it on site quickly.

On-site data is acquired in short time.

Disaster scale is instantly visualized.

Dangerous zones are safely measured.

Photo of the collapse site

Before collapse slope filtering

After collapse slope filtering

Enlarged cross-sectional view

Cross-sectional view

Point of the cross section

Original data before tree filtering

Trees can be removed by filleting process.

Ground data after tree filtering

Conditions under vegetation are visualized quickly.

Cross-sectional view

TDOT3 -GREEN- TDOT3 -NIR-

Research Use in research applications

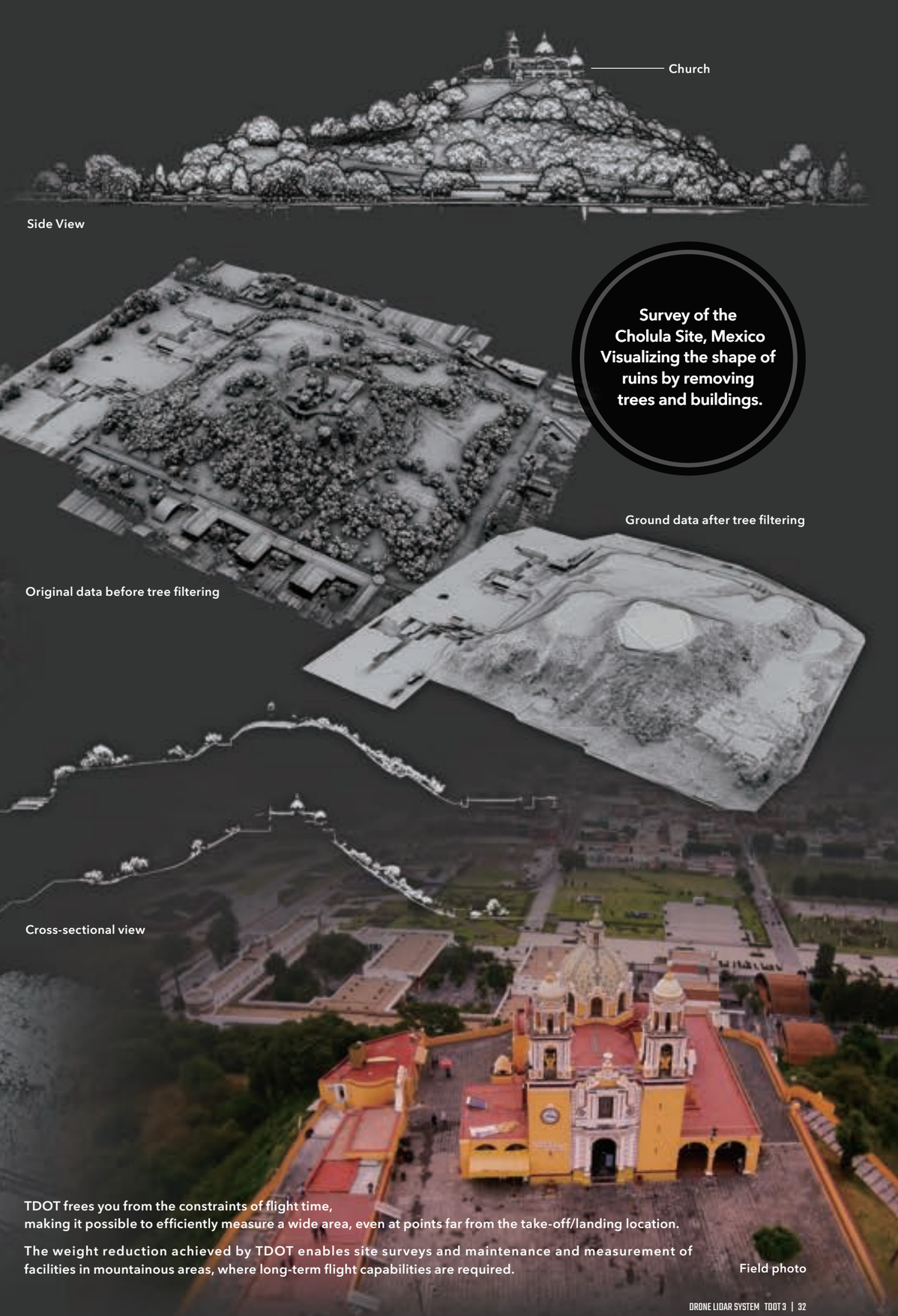
When making drone measurements in mountainous areas, the distance between the take-off/landing site and the destination is far, making the requirements for flight time very strict. TDOT has succeeded in reducing its weight to an unprecedented level, enabling a significant improvement in the measurement time in the field.
TDOT will allow you to conduct extensive inspections of archaeological sites and facilities in mountainous areas without worrying about battery replacement interrupting the measuring work.

Field photo of power line isolation survey

Cross-sectional view
Power lines can be recognized.

By using TDOT that enables long-distance flight, you can efficiently inspect long-distance power lines in mountainous areas.

Bird's-eye view



Side View

Survey of the Cholula Site, Mexico
Visualizing the shape of ruins by removing trees and buildings.

Original data before tree filtering

Ground data after tree filtering

Cross-sectional view

TDOT frees you from the constraints of flight time,
making it possible to efficiently measure a wide area, even at points far from the take-off/landing location.

The weight reduction achieved by TDOT enables site surveys and maintenance and measurement of facilities in mountainous areas, where long-term flight capabilities are required.

Field photo

TDOT3 -GREEN- TDOT3 -NIR-

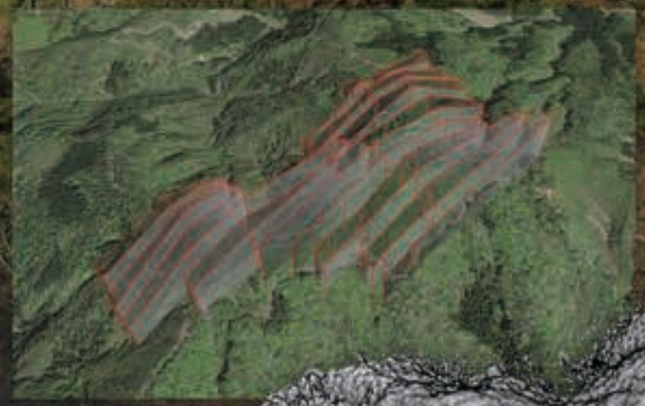
Investigation Use in disaster research

When laser measurement is used for disaster prevention inspection, the reproduced topography varies depending on the density of laser point clouds, and as a result, the scale of hazardous locations that can be found varies.

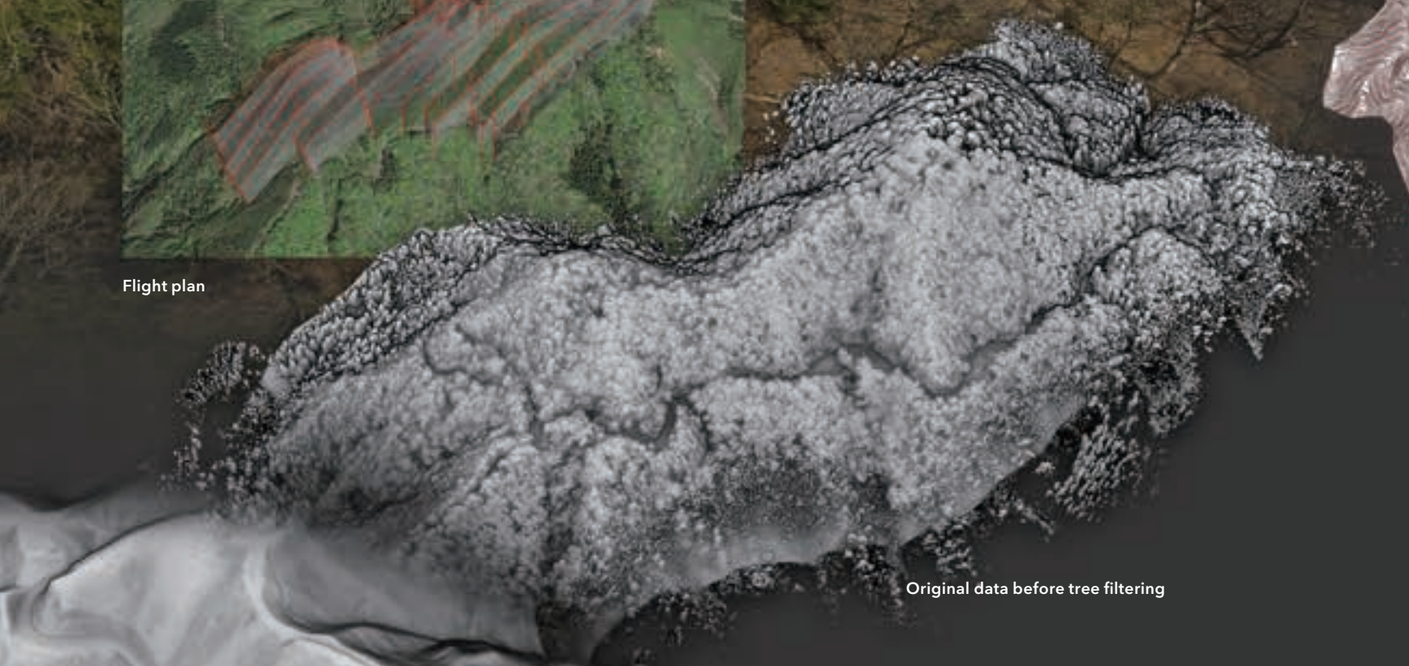
Drone measurements using TDOT deliver high-density lasers from the low sky, so there are no hazardous areas to miss, which is a problem with aerial laser surveying (LP: laser profiler).

TDOT will enable you to conduct reliable inspections for road disaster prevention.

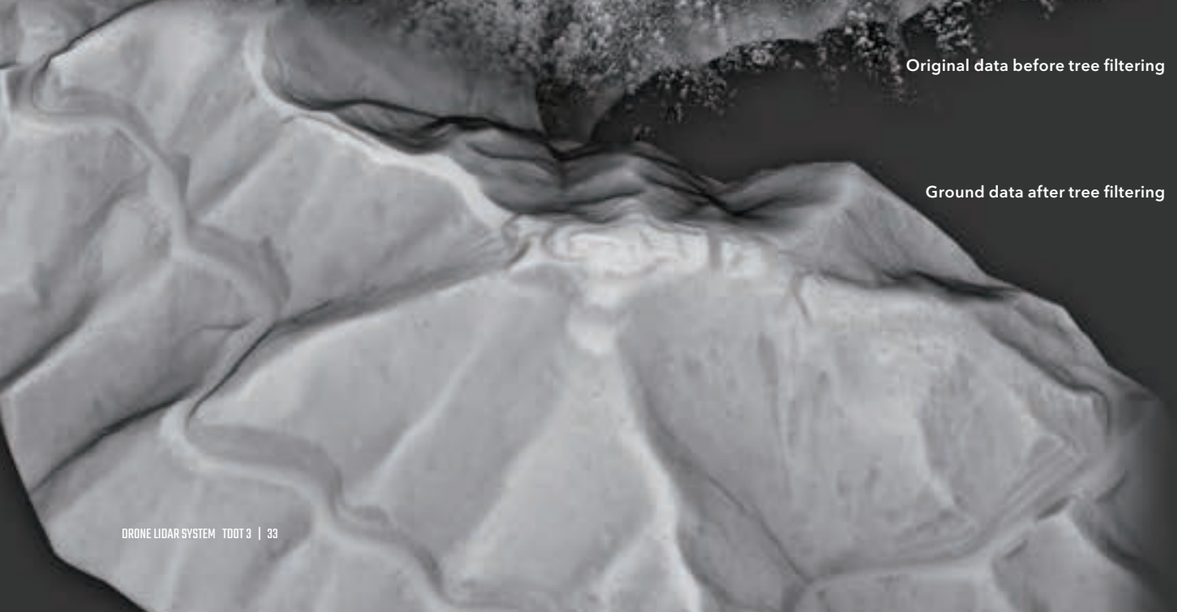
When inspecting slopes using LP, the laser density reaching the ground depends on the vegetation conditions. Using TDOT, the topography can be reproduced with a high-density laser without being affected by vegetation.



Flight plan



Original data before tree filtering



Ground data after tree filtering

When using LP to measure slopes with thriving vegetation, it is sometimes difficult to see steep cliffs of even a few meters that are at risk of collapse.

By using TDOT to irradiate high-density laser beams from the low sky, you can extract even minute steep cliff topography without being affected by vegetation.

Contour map

Microtopographic analysis map

The contour and slope diagrams created by TDOT capture minute topographic changes. You can conduct reliable desktop surveys that enable on-site exploration without leakage during disaster prevention inspections.

APPLICATION

TDOT PROCESSING PRO

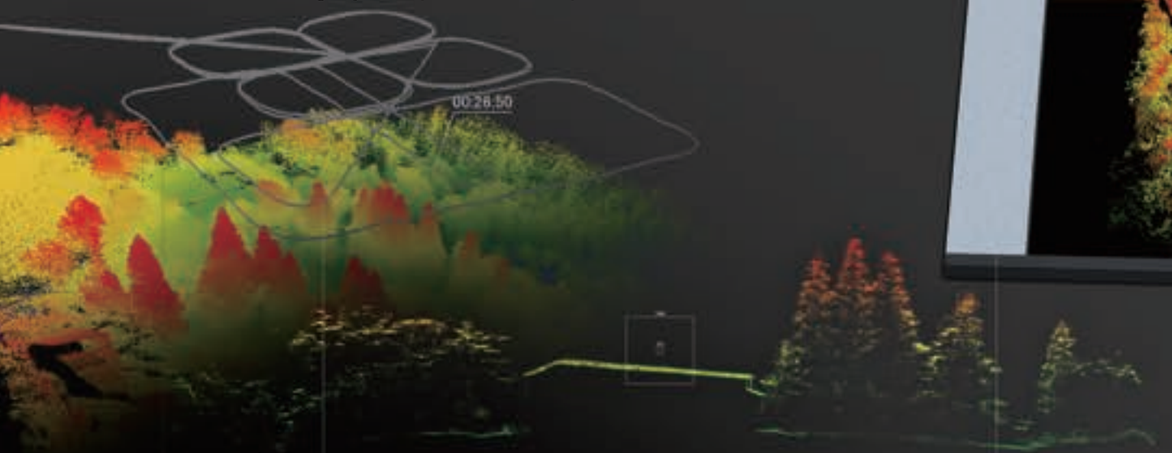
All-in-one analysis application with automatic calibration function

PREVIEW MODE

Preview display of acquired data

If you start the application without the protect key HASP connected, you can use it as a preview mode where you can only view.

No network environment is required.
After a measurement flight, you can preview it on the spot.



PROFESSIONAL MODE

Long-awaited functions included

User interface such as time division method and point cloud display method has been renewed.
Equipped with automatic calibration and form output functions, etc., point cloud data is output with simple instantaneous operations.

NEW

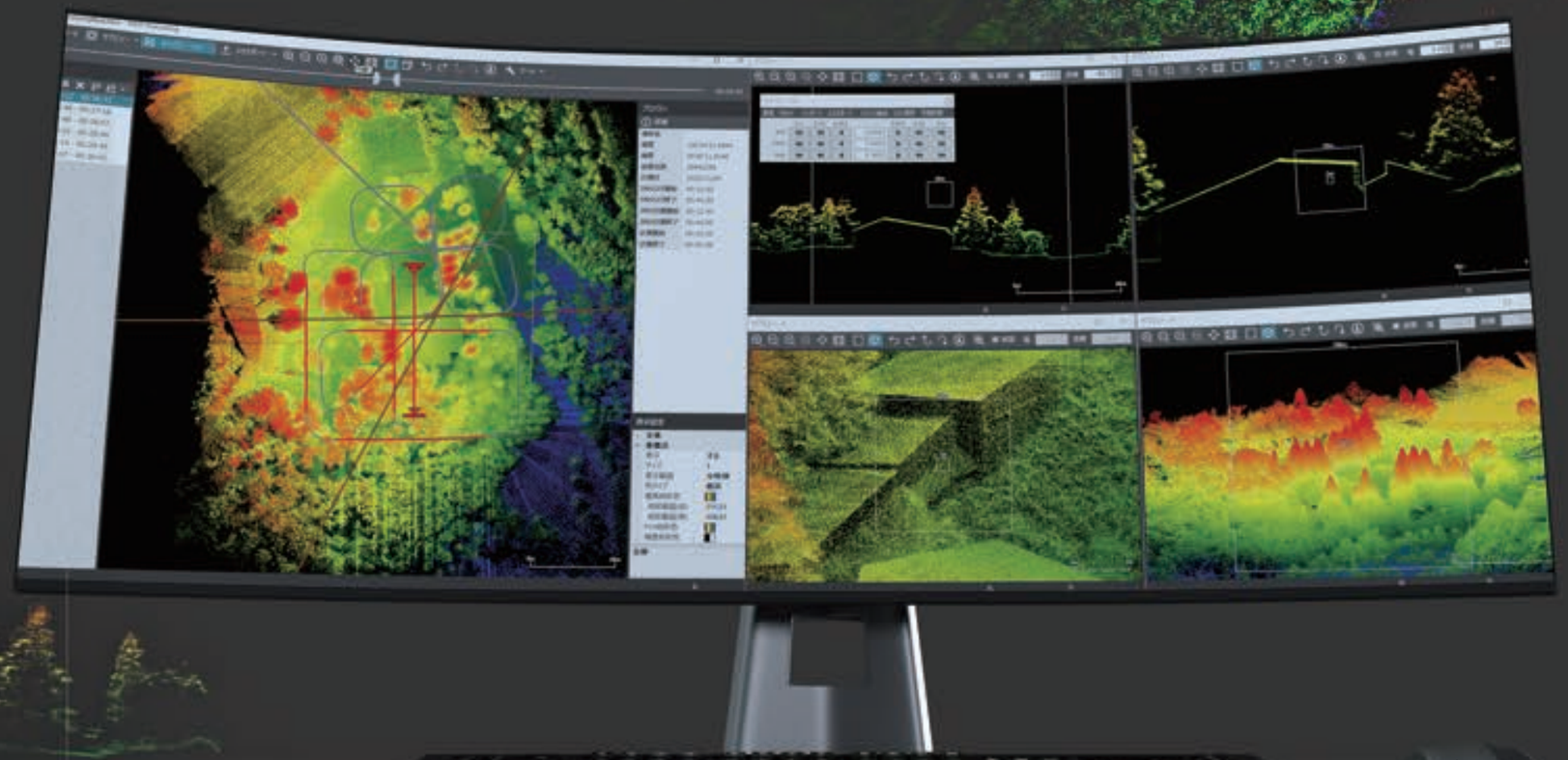
Automatic calibration

TDOT Processing PRO has a new auto-calibration feature that significantly reduces the amount of time it took to adjust.

NEW

Form output

Supporting form output for laser surveying operations.
Creation of reports, such as accuracy control charts from flight trajectories, has been automated as much as possible



TDOT Pre PROCESSING

Applications specialized in checking data immediately on-site.

Is the recorded data normal?
Is the required range being measured?
You can check them in a few minutes on the spot where you acquired them.
This is an application to prevent troubles from happening.

POST-PROCESSING CLOUD

Just by uploading INS data to the cloud system, it performs optimal trajectory analysis.

Checking measurement data at the site, analyzing the optimum trajectory, and outputting point cloud data
A series of these tasks is completed with simple operation.

Previously, the process of outputting point cloud data required expertise and experience in areas such as optimal trajectory analysis.
TDOT optimizes the applications so that anyone can easily output point cloud data.
Optimal trajectory analysis is completed by simply checking the measured data taken in the field with the high-speed viewer and uploading the data to the cloud service.
Output of highly accurate point cloud data using the downloaded optimal trajectory data is completed in the minimum necessary process.

TDOT PROCESSING

Outputs high-precision point cloud data with simple operation instantly.

It outputs highly accurate point cloud data from the data output by optimal trajectory analysis and measurement data.

UNDERWATER CORRECT

Underwater correction system

Laser light is refracted at the water surface. And in the water, the speed of light is slower than in the air.
By simply specifying the water surface position from the cross-sectional view, the calculation to correct for the effect of water is completed.

Operating Environment

OS	MicrosoftR Windows 10/8.1/8/7 (all Japanese version 64bit)
CPU	Intel Core i5 or higher or AMD A10 or higher recommended
Storage medium	Built-in SSD+HDD 2TB or higher or HDD 2TB or higher recommended
Memory	8GB or more
Graphics Board	Onboard or higher recommended
Display	Resolution of 1024×768px (HD) or higher is recommended.

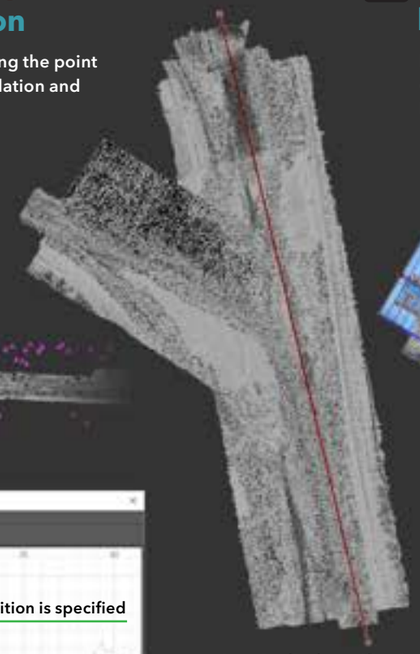
1 Noise reduction by range specification

The noise is removed by opening the point cloud data for correction calculation and setting the exclusion range.

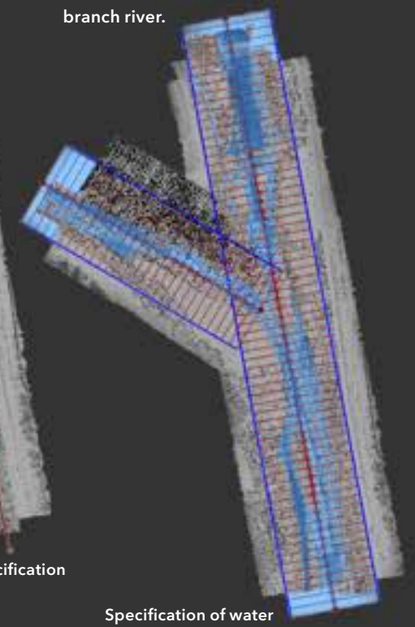
Excluded points are displayed by setting the exclusion range.

2 Specifying main and branch rivers

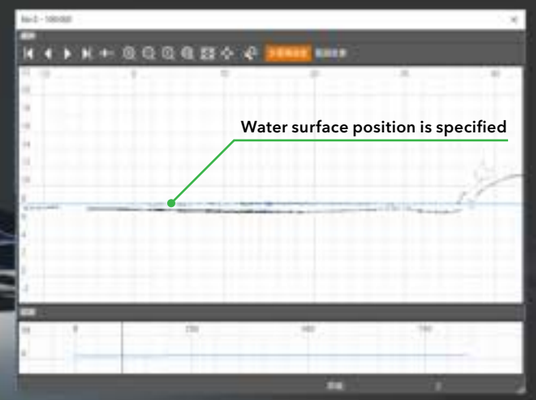
Draw center lines on the river channels to set the main river and branch river.



Longitudinal specification



Specification of water surface position



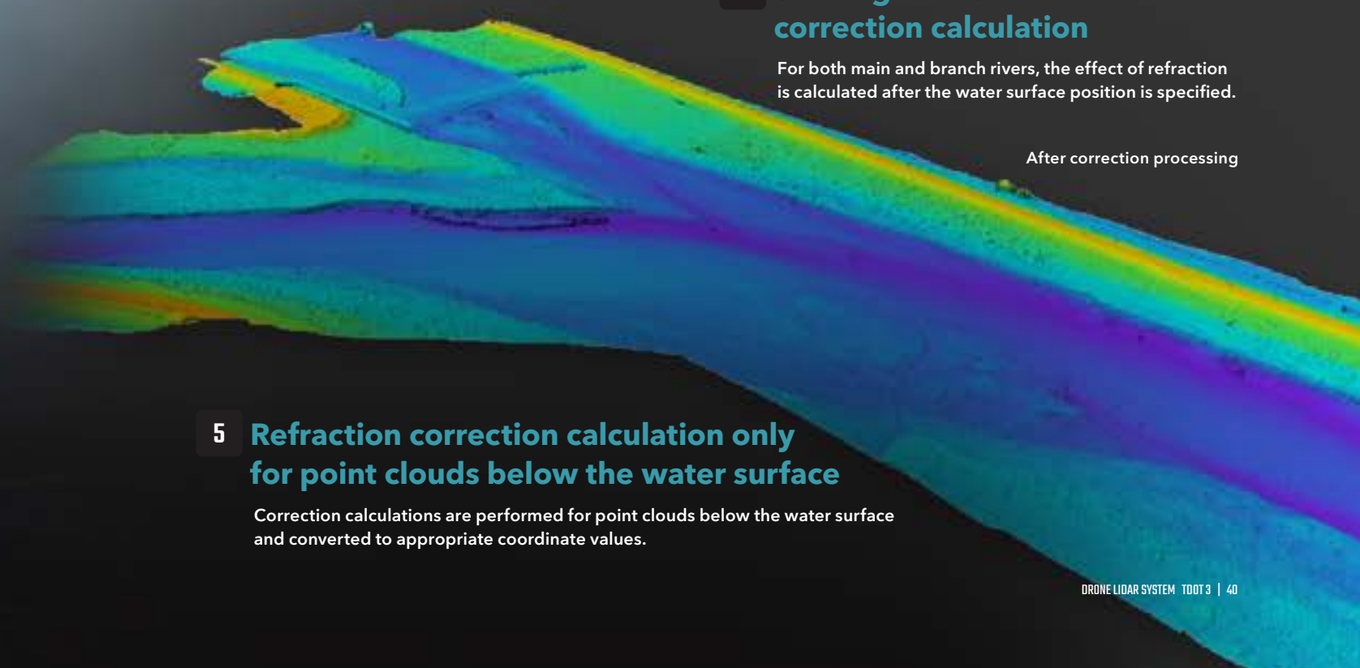
Specifying water surface position

3 Specifying the water surface

Survey lines crossing the rivers are automatically generated at specified intervals for the specified centerline.
Specify the water surface position of the river from the cross-sectional view.

4 Starting refraction correction calculation

For both main and branch rivers, the effect of refraction is calculated after the water surface position is specified.



After correction processing

5 Refraction correction calculation only for point clouds below the water surface

Correction calculations are performed for point clouds below the water surface and converted to appropriate coordinate values.

3D-BASE PRO

AMUSE ONESELF EDITION

Point cloud data after filtering

Green color in the photo is the point cloud to be filtered

Filtered model

Created triangle meshes after removing the filtering target

Application capable of processing over 20 billion point clouds.
Quick, comfortable, and reliable processing.

High-volume point cloud processing	ICT support	Filtering	Display & Edit function	Map display
20 billion points Operation verified	**LandXML** Import and export support	**Real-time preview Improves work efficiency**	**CAD display Contour lines routes etc**	**Geospatial Information Authority of Japan Tile display support**

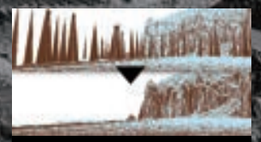
High-spec machine not required

Operating Environment

OS	MicrosoftR Windows 10/8.1/8/7 (all Japanese version 64bit)
CPU	Intel Core i5 or higher or AMD A10 or higher recommended
Storage medium	Built-in SSD+HDD 2TB or higher or HDD 2TB or higher recommended
Memory	8GB or more
Graphics Board	Onboard or higher recommended
Display	Resolution of 1024×768px (HD) or higher is recommended

Filtering function

Ground surface filter



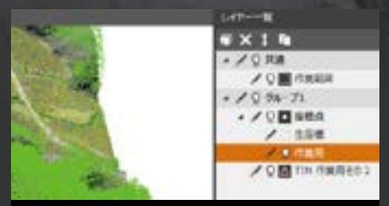
Convex filter

Cross-sectional angle filter

- **Ground surface filter**
  Retains data of low altitude and removes point clouds of high altitude.
- **Convex filter**
  Filters using the slope of triangle meshes.
- **Noise reduction filter**
  Detects and removes noise automatically.
- **Cross-sectional angle filter**
  Specifies the angle of the cross section and removes point clouds that exceed the specification.
- **Building filter**
  Removes buildings and other artificial structures.
- **Seabed filter**
  Keeps point clouds of high altitude and removes the rest.
- **Thinning filter**
  Extracts one point of the point clouds between the specified ranges and removes the rest.
- **Approximate point filter**
  Recognizes approximate coordinates as the same point and removes them.
- **High/low difference filter**
  Sets the height difference and removes the point clouds that do not apply.
- **Regression point filter**
  Flats out the steep part and runs the ground surface filter.

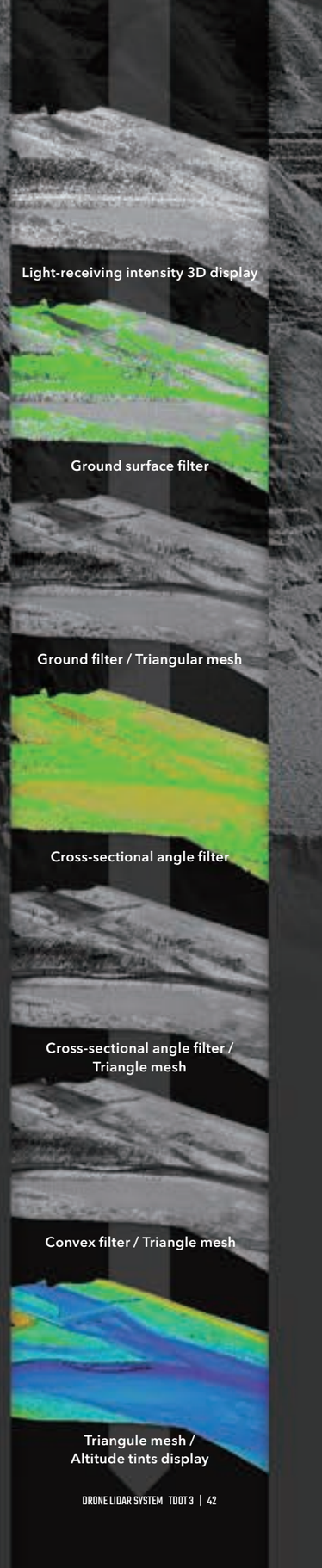
Function Introduction

Preview function



Layer function

- **Filtering Preview**
  Previews post-processing status before filtering.
- **Layer function**
  Automatically generates layers for each process.
- **CAD data import**
  CAD data can be displayed in the background.
- **Coordinate import**
  poi, txt, csv, las, e57, xml, mpoi, and mpcd
- **Coordinate Export**
  poi, txt, las, e57, and bos2
- **Triangular mesh generation**
  Can generate with data of several 1 billion points or more.
- **Triangular polygon**
  Import and export of LandXML data.
- **Route**
  Import and export of linear SIMA data.
  Edit and export of longitudinal and transverse SIMA data.
- **Square mesh generation**
  Soil volume can be calculated by layer comparison.
- **Display function**
  2D, 3D, bird's-eye, ortho, and cross-section.
- **Contour line**
  Contour line creation, deletion and export (dwg, dxf).
- **Color point cloud**
  Color info is added to the coordinate data at the same position as ortho image.
- **Measurement (of two-point and range)**
  Measurement between two points:
  Measures start and end point XY, distance, slant distance, slope, and △XYZ.
  Range measurement: Measures area, outer boundary, and △XY.



SPECIFICATION

MAIN SPECIFICATIONS

LASER PULSE RATE	FOV (FIELD OF VIEW)	SCAN SPEED
60,000 Hz	90°	30 Line/s

RANGING ACCURACY	WEIGHT	LASER WAVELENGTH
≧10% ±15 mm ≧60% ±5 mm	2.7 kg	532 nm / GREEN

PRODUCT SPECIFICATIONS

Product name	TDOT 3 GREEN	
Size (approx.)	W270 × D230 × H150mm	
Weight (approx.)	2.7kg (main unit only / excluding antenna)	

LASER SCANNER SPEC

Longest measuring distance	≧10% 158m	≧60% 300m over
Ranging accuracy	≧10% ±15mm	≧60% ±5mm
Pulse rate	60,000Hz	
Viewing angle	90°(±45°)	
Echo switching	1st&Last / 4echo	
Scan rate	30 scans per second	
Laser wavelength	532±1nm	
Beam divergence angle	1.5mrad	
Operational temperature range	0 to 40°C (non-condensing)	
Life span	10,000 hours	

INS SPEC *1

Position accuracy	5mm
Heading	0.03°
Pitch/Roll	0.006°
Speed	0.01 m/sec

PACKAGE

- Laser Scanner Unit "TDOT 3 GREEN" Main Unit
- Dedicated Hard Case
- Instruction Manual
- TDOT GATEWAY
- Preview application "TDOT PrePROCESSING"

OPTION

- TDOT Mounting Kits (for DJI Matrice300RTK / DJI Matrice600 Pro / Miscellaneous Drones)
- Processing application "TDOT PROCESSING"
- Processing application "TDOT PROCESSING PRO"
- Underwater correction system "UNDERWATER CORRECT"
- Mass point cloud application "3D-BASE PRO -amuseoneself edition-"

Eye safe function

Eye safe function in provided to limit the laser output according to the altitude relative to the ground. It complies with laser class 1M.

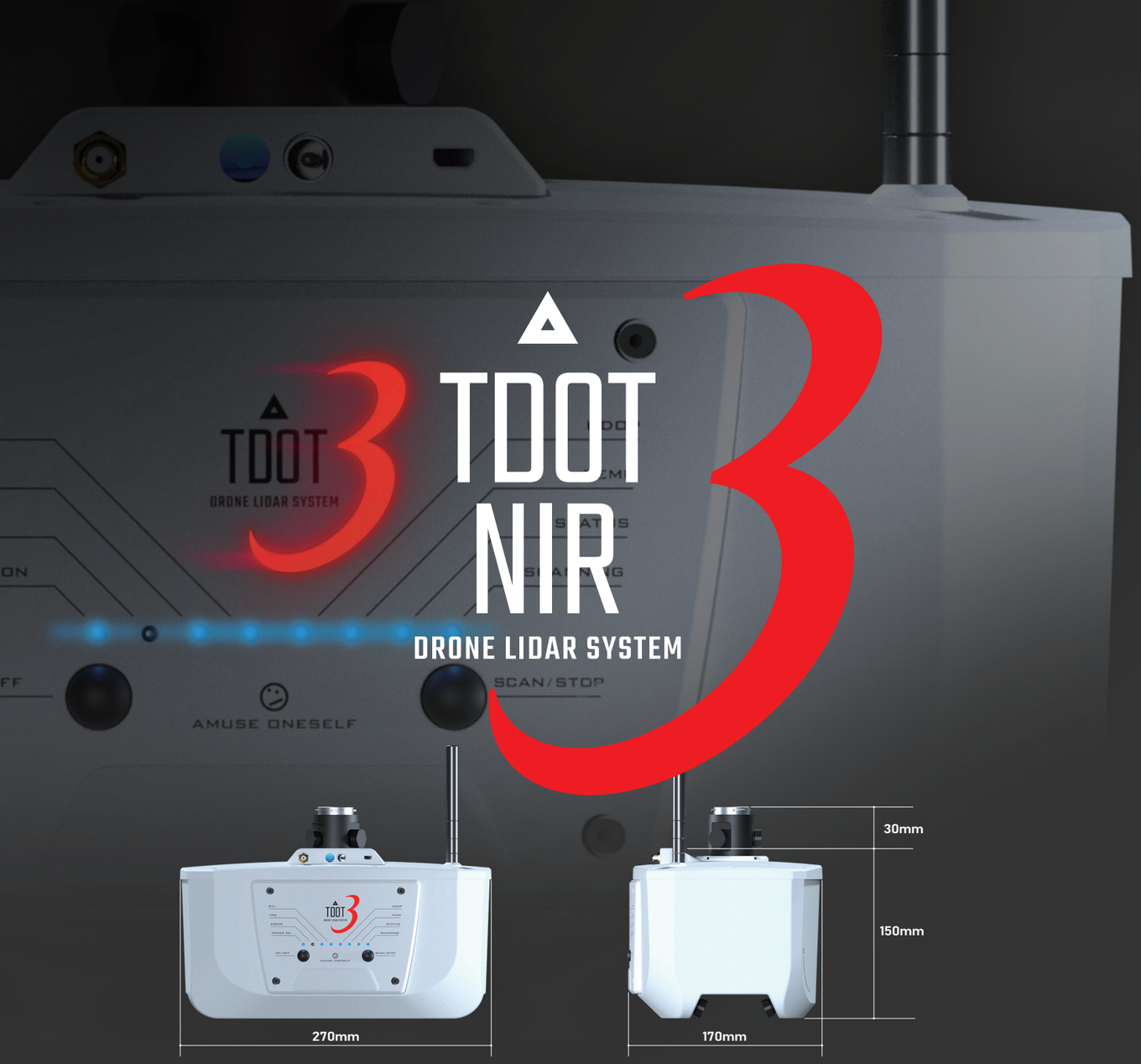
- Altitude to ground < 40m : Class 1
- Altitude to ground > 40m : Class 3R (NOHD *2 : < 40 m)

Depth measurement capability

At a distance of 50m from the water surface

- R=1.0, absorption coefficient=0.25(1/m) > 1.4 secchi *3
- R=0.5, absorption coefficient=0.25(1/m) > 1.25 secchi
- R=0.2, absorption coefficient=0.25(1/m) > 1 secchi

*1 Accuracy after post-processing in the cloud service "POST-PROCESSING CLOUD". A separate contract is required to use the service.
*2 NOHD: Nominal Ocular Hazard Distance
Distance from the laser source where the beam irradiance or radiant exposure equals the maximum allowable exposure to the eye. Laser light, however, has a spread angle, so the farther it expands, resulting in less energy per unit area. Even if the level is dangerous at the launch site, it becomes a so-called safe level below MPE at a remote location.
*3 A 30cm diameter white disc (transparency plate or secchi plate) is submerged in water, and the depth at which it becomes invisible is 1 secchi.



TDOT 3 NIR

DRONE LIDAR SYSTEM

MAIN SPECIFICATIONS

LASER PULSE RATE	60,000 Hz
FOV (FIELD OF VIEW)	90°
SCAN SPEED	30 Line/s
RANGING ACCURACY	150m ±20 mm, 50m ±4 mm
WEIGHT	1.8 kg
LASER WAVELENGTH	905 nm / Near Infrared (NIR)

PRODUCT SPECIFICATIONS

Product name	TDOT 3 NIR
Size (approx.)	W270 × D170 × H150mm
Weight (approx.)	1.8kg (main unit only / excluding antenna)

LASER SCANNER SPEC

Distance	≧30%～200m over	
Ranging accuracy	±4mm@50m	±20mm@150m
Pulse rate	60,000Hz	
Viewing angle	90°(±45°)	
Echo switching	1st&Last / 4echo	
Scan rate	30 scans per second	
Laser wavelength	905±1nm	
Beam divergence angle	0.5x1.7mrad	
Laser class	Class 1 M	
Operational temperature range	0 to 50°C (non-condensing)	
Life span	10,000 hours	

INS SPEC *1

Position accuracy	5mm
Heading	0.03°
Pitch/Roll	0.006°
Speed	0.01 m/sec

PACKAGE

- Laser Scanner Unit "TDOT 3 NIR" Main Unit
- TDOT GATEWAY
- Dedicated Hard Case
- Preview application "TDOT PrePROCESSING"
- Instruction Manual

OPTION

- TDOT Mounting Kits (for DJI Matrice300RTK / DJI Matrice600 Pro / Miscellaneous Drones)
- Processing application "TDOT PROCESSING"
- Processing application "TDOT PROCESSING PRO"
- Underwater correction system "UNDERWATER CORRECT"
- Mass point cloud application "3D-BASE PRO -amuseoneself edition-"

*1 Accuracy after post-processing in the cloud service "POST-PROCESSING CLOUD". A separate contract is required to use the service.