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PRODUCT CATALOG

AMUSE ONESELF™

AMUSE ONESELF

TM

2025 PRODUCT

Our Complete Collection

CATALOG

TDOT™

DRONE LiDAR SYSTEM

Accurate surveying by anyone anywhere
New standard for drone laser surveying
DRONE LiDAR SYSTEM TDOT Series

What is a laser surveying device?

A laser surveying device consists of a combination of three cutting-edge technologies - a laser module that emits laser beams, a GNSS receiver that acquires accurate positioning information from satellites, and an inertial measurement unit (IMU) that precisely analyzes the attitude and acceleration of the drone.
This advanced system constantly and accurately records the angle and distance of the laser beam from the air to acquire high-density, high-accuracy 3D survey data.
Integrating these technologies, the TDOT Series also achieves a level of quality and reliability compliant with public surveying.

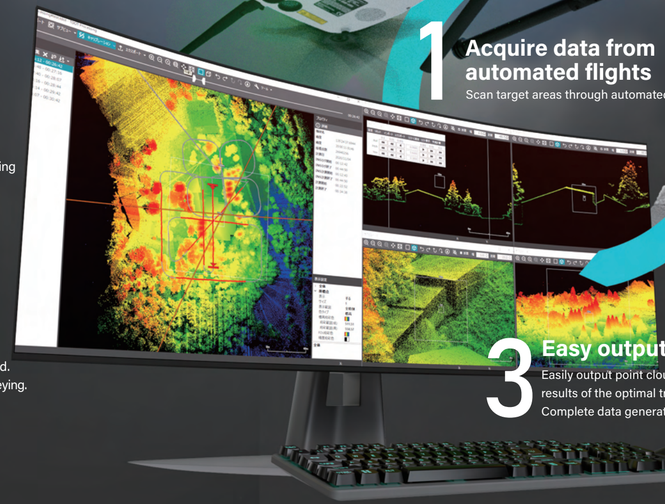
A reliable, high-accuracy system that also supports public surveying

The TDOT series does not rely solely on positioning information from the drone,
but also employs an advanced technology that analyzes the positional relationship between the TDOT system itself and a GNSS reference station and fixed station, which dramatically improves the accuracy of positions and heights in acquired data.
Links with these external references allow for extremely high-accuracy surveying while minimizing errors.
A surveying system that can be put to practical use can only be realized when laser beam emission, a GNSS, an IMU, and an external positioning reference are combined.
Every TDOT model is a drone-mounted laser scanner system dedicated to surveying, and is therefore capable of acquiring highly accurate data that can also be used for public surveying.
The performance of TDOT systems contributes greatly to a wide range of situations that require accurate data, such as construction and civil engineering works, disaster investigations, and topographic measurements.

WORK FLOW

Easy and accurate laser surveying for everyone

TDOT systems are intuitive, highly functional platforms designed to enable even those unfamiliar with surveying (laser surveying) to obtain high-accuracy results.
Each model is equipped with a variety of functions that, through instantaneous links with GNSS/IMU data, reflect surveying field know-how, including a cloud service that automatically performs operations, from downloading GNSS reference station data to optimal trajectory analyses.
These functions enable anyone to easily perform high-accuracy laser surveying without any complicated operations or expertise.
The TDOT Series is an innovative surveying system that greatly increases field efficiency and the quality of results.

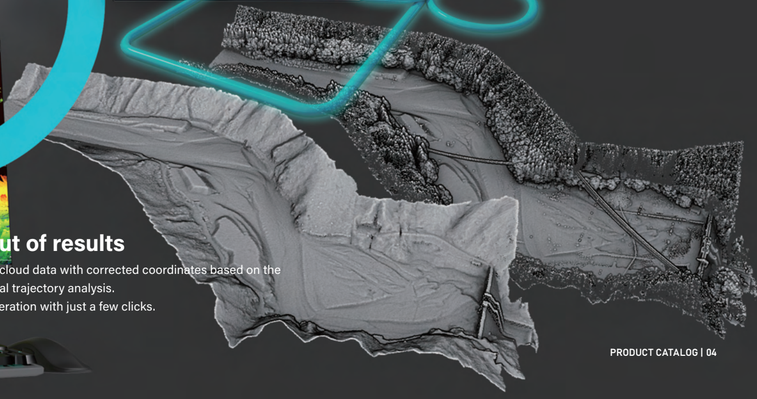


1 Acquire data from automated flights

Scan target areas through automated drone flights.

2 Upload acquired data, and its analysis will be completed

Simply upload acquired data to the cloud to complete the optimal trajectory analysis.
Automatically analyze the optimal trajectory using information acquired from a fixed station.



3 Easy output of results

Easily output point cloud data with corrected coordinates based on the results of the optimal trajectory analysis.
Complete data generation with just a few clicks.

Accurately capturing the drone's attitude and converting it with high accuracy

INS

INS combined navigation system

This core technology accurately captures the drone's attitude and converts it into data with the accuracy required for surveying

Every model in the TDOT Series comes standard with a high-performance GNSS/IMU combined inertial navigation system (INS).
This system plays an important role in supporting the accuracy of laser surveying by keeping track of changes in the position and attitude of the TDOT with high accuracy and in real time. Laser surveying measures the distance to the target based on the time difference between laser emission and return, but determines the emission position using a GNSS. However, the GNSS can only perform positioning measurements several dozen times per second, meaning that location information likely involves errors given the limited amount of data. Furthermore, even a slight error in the emission angle will result in a greater misalignment as the distance to the target increases. An inertial measurement unit (IMU) is one solution to this issue. An IMU precisely records the tiniest movements during flight, which a GNSS would miss, by tracking the movements of the TDOT using an acceleration sensor and by continuously detecting changes in attitude with a gyro sensor. The INS combined navigation system, which integrates an IMU and a GNSS, ensures high-accuracy corrections to the attitude and trajectory during flight, thereby enabling three-dimensional coordinate measurements down to the millimeter. TDOT can constantly acquire data with a high accuracy of less than a few centimeters while emitting laser beams hundreds of thousands of times per second.

TDOT series IMU Specifications

Positional accuracy	5mm
Heading	0.03°
Pitch/Roll	0.006°
Velocity	0.01m / sec.

A simple workflow tailored to survey sites that is easy for anyone to use

SETTING

A setup tool for checking the status of TDOT and changing settings

TDOT can be accessed from all browser-enabled devices, including tablets and smartphones.
Doing away with the need to install a dedicated application, this tool allows for operations and setting changes on site more easily and speedily. In addition to checking equipment status information, this tool supports a wide variety of settings, such as those for changing laser beam emission speed and scan rate, toggling the real-time cross-section display, operating the visible and thermal cameras, and enabling/disabling the RTK function. On site, the tool also allows for various setting changes through intuitive browser operations, which helps to greatly reduce the burden on the operator while enabling a more reliable and efficient surveying workflow.
*The RTK function is only available on models that support it.

DATA CHECK

A real-time cross-section display function for reliable data acquisition

Prevent surveying rework by confirming scanning status on-site

The TDOT system can display scanned cross-section data during measurement in real time through the drone's transmitter.
For example, it allows for the on-site, in-flight confirmation of the acquisition status for topography under vegetation in heavily wooded areas and the status of laser beam arrival at the bottom of water bodies along waterfronts or in areas of water.
This enables users to immediately determine whether the planned survey range has been thoroughly covered, and realizes an efficient workflow while preventing the trouble of performing measurements again.

*Real-time cross-section display is not supported by the TDOT 7 NIR-S.
*Using this function requires a drone equipped with an HDMI-connectable image transmitter (not all HDMI-connectable drones guarantee display).
*DJI Matrice 350 RTK can display cross-sections in real time via the DJI SkyPort.

FLAGSHIP MODEL

Our flagship model is a nexus of TDOT's capabilities

Survey both land and the bottom of water bodies from the air with this single unit
Equipped with high-performance GREEN LiDAR
Flagship model: "TDOT 7 GREEN"

As the flagship model from the TDOT series, TDOT 7 GREEN is capable of surveying land and the bottom of water bodies at the same time from the air.
Equipped with a green laser having a wavelength of 532 nm, which is resistant to absorption by water, TDOT 7 GREEN can even accurately measure underwater topography.
TDOT 7 GREEN is also equipped with a high-resolution camera, a thermal camera, an NVIDIA JETSON computer that enables real-time computations, and a real-time server transmission function via LTE communication to meet all drone surveying operation needs.
This is truly a next-generation surveying solution for all sites on land, in the sea, and in the air.

TDOT™ GREEN 7

DRONE LiDAR SYSTEM

MADE IN JAPAN

TDOT 7 GREEN Specifications

Laser wavelength	Pulse rate	Scan rate	Number of echoes	Scanning angle	Measuring accuracy (1σ)	Weight (approx.)	Visible camera
532nm	160,000Hz	80Line/sec.	6	120°	4mm	3.6kg	4000x3000 12MP

Surveying object

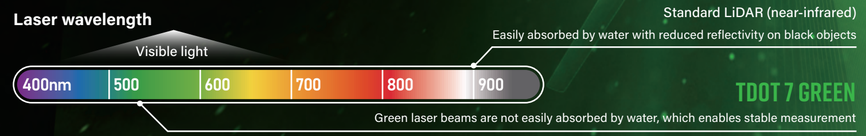
CONSTRUCTION | MOUNTAIN | STRUCTURE | RIVER | SHALLOW SEA | WET GROUND

GREEN LiDAR

Green lasers unleash the potential of underwater surveying

Wavelengths resistant to absorption by water capture both land and the bottom of water bodies at the same time

Many standard LiDAR systems use near-infrared wavelength lasers, which are absorbed the moment they touch water, resulting in a failure to acquire underwater data.
On the other hand, TDOT 7 GREEN is equipped with a green laser having an optical wavelength of 532 nm.
This wavelength is resistant to absorption by water, and can therefore be used to survey land topography and underwater topography at the same time.
This characteristic realizes reliable data acquisition with minimal failure from wet road surfaces, construction sites, and rivers and shallow water areas, as well as from areas inaccessible to boats and immediately after flood damage.
TDOT 7 GREEN is expected to demonstrate its potential even in environments that are difficult to survey with conventional LiDAR, and therefore to play an active role in a wide variety of situations.
*A laser is a means of measurement by light. Turbid water and water quality that is difficult for light to penetrate limit data acquisition.

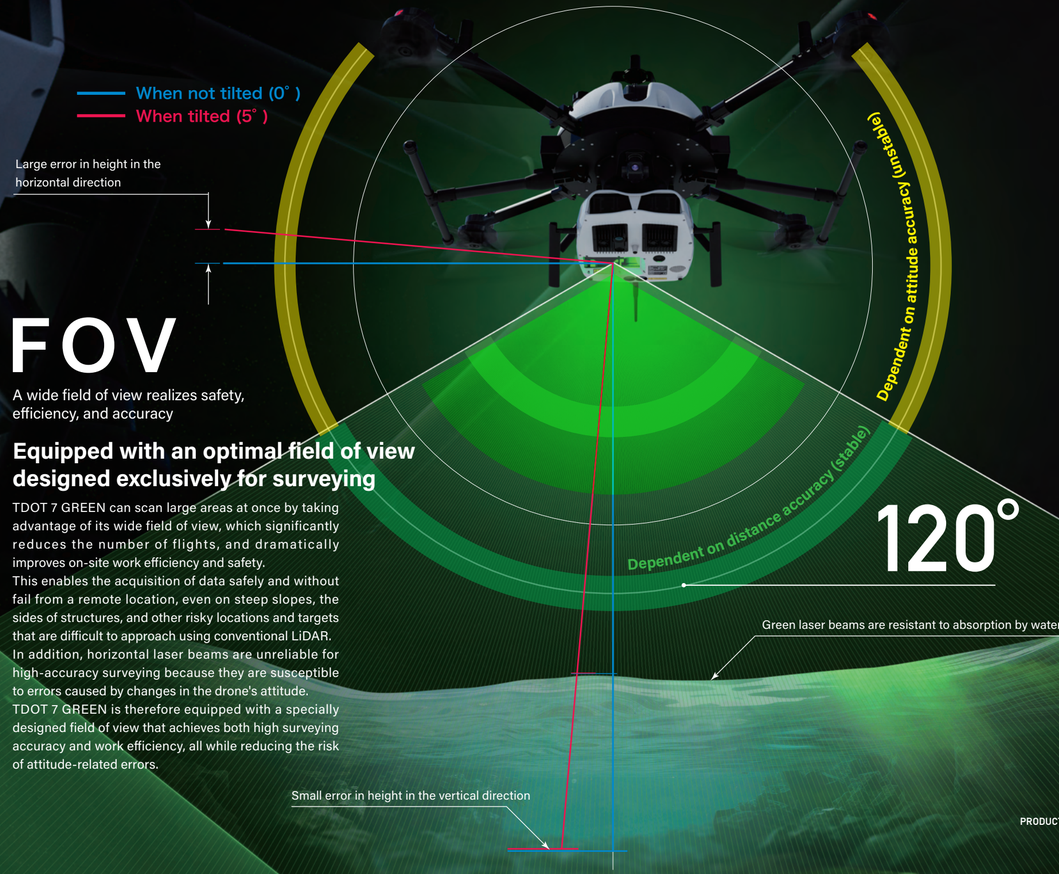


FOV

A wide field of view realizes safety, efficiency, and accuracy

Equipped with an optimal field of view designed exclusively for surveying

TDOT 7 GREEN can scan large areas at once by taking advantage of its wide field of view, which significantly reduces the number of flights, and dramatically improves on-site work efficiency and safety.
This enables the acquisition of data safely and without fail from a remote location, even on steep slopes, the sides of structures, and other risky locations and targets that are difficult to approach using conventional LiDAR.
In addition, horizontal laser beams are unreliable for high-accuracy surveying because they are susceptible to errors caused by changes in the drone's attitude.
TDOT 7 GREEN is therefore equipped with a specially designed field of view that achieves both high surveying accuracy and work efficiency, all while reducing the risk of attitude-related errors.



LTE × RTK

LTE communication × RTK positioning

Analyze coordinate data in real time during flight Instantaneously generate survey results with high on-site flexibility

TDOT 7 GREEN comes standard with an LTE slot, through which data can be received from control points in real time during flight.
This communication function enables real-time kinematic (RTK) positioning to provide highly accurate positioning information during survey flights.
The built-in high-performance computer processes and computes the acquired location information and laser data on the spot, and converts these into point cloud data with accurate coordinates in real time. This allows users to immediately check and promptly utilize data on the survey site, resulting in a more efficient workflow with minimal time loss.

TDOT 7 GREEN comes standard with a JETSON Xavier NX high-performance computer

Survey data is processed and analyzed in real time, and can be immediately visualized and checked

Visualizes point cloud data analyzed in real time on the spot

A real-time connection between the sky and the conference room supports immediate data sharing and decision-making

TRANSFER

Immediately transmit point cloud data on the spot

Share data with remote locations in real time through RTK analysis and LTE communication

TDOT 7 GREEN is capable of transferring point cloud data analyzed with high accuracy using RTK positioning to a server in a remote location in real time through an LTE line.
This function enables users to immediately view and utilize point cloud data in offices and disaster response headquarters far away from survey sites, which serves as a helpful means to promptly grasp the situation at the site.
The real-time data sharing function of TDOT 7 GREEN is expected to serve as an important technology that supports rapid decision-making and initial response in time-sensitive situations, such as the recent spate of heavy rain and earthquake disasters.

Scans and analyzes at the same time. Generates high-accuracy point cloud data.

intermediately sends analyzed data to the server through an LTE line.

Enables data on the server to be viewed from a PC in a remote location in real time.

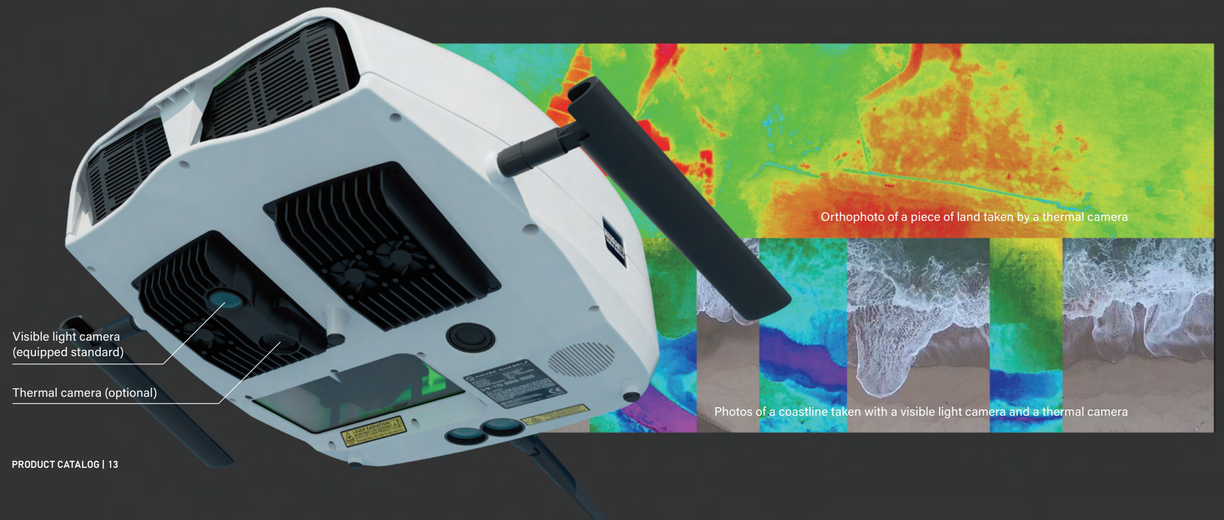
*1 LTE (Long Term Evolution): LTE is a mobile phone communications standard. TDOT 7 GREEN comes standard with an LTE slot. An agreement must be concluded separately with a telecommunications company to use an LTE line.
*2 RTK（Real Time Kinematic）: Technology that performs high-accuracy positioning down to the centimeter level in real time with the aid of a GNSS.

VISUALIZATION

Intuitively visualize high-accuracy data from visual and spatial perspectives
Add color and temperature information to make acquired data multidimensional

Add "color" and "temperature" to point clouds
Make invisible information "visible"

Color information acquired from photographs taken with the visible light camera mounted on the TDOT Series can be superimposed onto point cloud data to generate "color point clouds."
The same image can also be used to generate an orthophoto* with coordinates, ensuring highly accurate visualization from both visual and spatial perspectives.
In addition, an optional thermal camera can be mounted to add temperature information to the point cloud.
This combination allows users to visualize and analyze water inflow from slopes, geothermal heat distribution, and other phenomena that are difficult to visually identify.
Superimposing color, temperature, and other attribute information evolves point cloud data from a mere "set of shapes" into a multidimensional information source for reading the relationships between events and signs of change.
TDOT offers the power of visualization beyond the boundary of surveying.
*Additional SfM software is required to create orthophotos.



SPECIFICATION

TDOT 7 GREEN Specifications

Model name	TDOT 7 GREEN
Size (approx.)	W250 x D310 x H135mm
Weight (approx.)	3.6kg
Communication frequency band	920MHz, 2.4GHz, LTE
GNSS	GPS, GLONASS, Galileo, BeiDou
Input voltage	20V 5A, 24V 4V
Rated power consumption	96W
Standard equipment	NVIDIA JETSON, LTE slot, visible camera, rangefinder, SSD
Built-in SSD	2TB
Operating temperature	10 – 40°C (non-condensing)
Storage temperature	0 – 40°C (non-condensing)
Maximum Humidity Range	Below 80% RH (no condensation)

Laser Scanner Specifications

Max. measurement distance	≧10% 430m, ≧100% 1400m		
Min. measurement distance	2.5m		
Resolution	1mm		
Measuring accuracy (1σ)	Strong echo : 4mm, Weak echo: 15mm		
Accuracy	5mm		
Beam spread angle	1.5mrad		
Laser wavelength	532nm		
Pulse rate	160,000 Hz (measurement rate: 106,560 Hz)		
Scanning Mirror	4-sided polygon mirror		
	Scanning angle (FOV)	120°	
	Scanning speed	40Hz	80Hz
	Step accuracy	0.045°	0.09°
	Number of measuring points (120°)	2,666	1,332
Number of echoes	6		
Laser Class	Distance to the scan target 40m + (FULL) : class 3R		
	Distance to the scan target 25m – 40m (MEDIUM) : class 3R		
	Distance to the scan target 25m or less (LOW) : class 1		
Bathymetric performance (seawater) R=Reflectivity C=Beam attenuation coefficient	Clear Water R=0.40 @ Altitude 50m : 1.43 Secchi *1		
	Turbid Water R=0.40 @ Altitude 50m : 0.60 Secchi		
	Clear Water C=0.22 @ Altitude 50m : 13.5m		
	Clear Water C=0.22 @ Altitude 15m : 16.8m		

Built-in INS Specifications*2

Positional accuracy	5mm
Heading	0.03°
Pitch/Roll	0.006°
Velocity	0.01m / sec.

VISIBLE CAMERA specification

Number of pixels	4,000×3,000 12Mpixel
Sensor size	1/1.7 7.533(H) x 5.635(V) mm
Focal length(35mm equivalent)	approx.20mm
F value	F2.7
FOV	Approx. 94 degrees

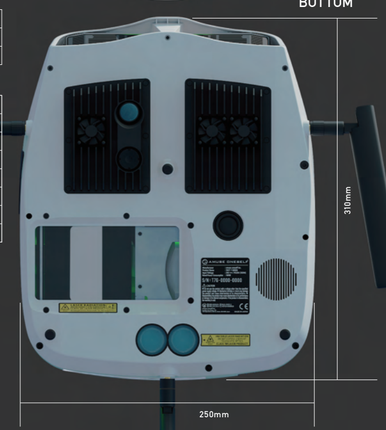
THERMAL CAMERA specification (option)

Number of pixels	640x512pixel
FOV	95° Radiation measurement possible
Radiation measurement	possible

PACKAGE

TDOT 7 GREEN Main unit
REMOTE GATEWAY
USB memory stick (64GB)
GNSS Antenna
Power cable
Mobile battery
Dedicated hard case
Instruction Manual

*1 One secchi is the depth at which a 30cm-diameter white disc (transparency plate or secchi plate) is submerged underwater and becomes invisible.
*2 Accuracy after post-processing with the POST-PROCESSING CLOUD cloud service. A separate contract is required to use the service.



TDOT 7 GREEN LITE

DRONE LiDAR SYSTEM

MADE IN JAPAN

LIGHTWEIGHT

Lightweight TDOT 7 GREEN model

Easy and accurate laser surveying for everyone

The "TDOT 7 GREEN LITE" GREEN LiDAR system was developed in pursuit of an extremely light weight and compact design, yet with the same high-performance green laser module used in TDOT 7 GREEN. TDOT 7 GREEN LITE realizes an outstanding level of agility that has been difficult to achieve using conventional Green LiDAR-equipped models, and enables a quicker response to a wider variety of sites. In particular, it is also designed to be installed and operated on DJI's "Matrice 350 RTK,"* which has been requested by many users, further expanding the flexibility of its introduction. Combining high accuracy and mobility, the LITE model will raise the potential of drone surveying to the next stage.

*Users must submit the prescribed modification application to install TDOT 7 GREEN LITE on DJI's Matrice 350 RTK.

TDOT 7 GREEN LITE
DJI MATRICE350RTK
Mounted Image

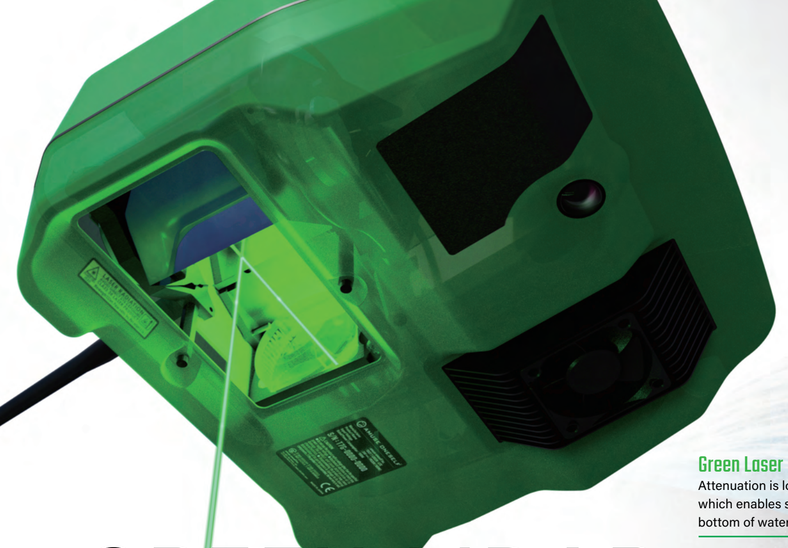
2.9kg

TDOT 7 GREEN LITE Specifications

Surveying object

CONSTRUCTION | MOUNTAIN | STRUCTURE | RIVER | SHALLOW SEA | WET GROUND

Laser wavelength	Pulse rate	Scan rate	Number of echoes	Scanning angle	Measuring accuracy (1σ)	Weight (approx.)	Visible camera
532nm	160,000Hz	80Line/sec.	6	120°	4mm	2.9kg	2860x2860 8MP



GREEN LiDAR

Survey both land and the bottom of water bodies at once

Green laser technology enables TDOT 7 GREEN LITE to survey land and the bottom of water bodies at the same time

Equipped with a green laser having a wavelength of 532 nm, TDOT 7 GREEN LITE can support underwater topographic surveying, which has been difficult for conventional LiDAR to offer. The near-infrared laser beams used in standard LiDAR systems are absorbed the moment they touch water, preventing underwater topographic data from being acquired. Green laser beams, however, penetrate water with extreme ease because they are resistant to absorption by water.
This characteristic ensures reliable data acquisition when surveying land areas, wet ground surfaces, construction sites, rivers and shallow water areas, and even extremely narrow water areas that are inaccessible to boats and other locations immediately after flood damage. A lightweight yet high-performance green LiDAR system that can handle a wide range of situations, TDOT 7 GREEN LITE resolves the issues that surveying previously struggled to manage.

Green Laser
Attenuation is low even underwater, which enables surveys to reach the bottom of water bodies.

Near-infrared Laser
Light is absorbed by water, preventing the acquisition of underwater data.

Water Surface

FOV

Cover a wide area at once with a 120° field of view

Survey expansive areas more safely in a single flight The wide 120° field of view dramatically improves both efficiency and safety

TDOT 7 GREEN LITE offers a wide field of view of up to 120°, thereby enabling users to scan larger areas in a single flight. This wide field of view also helps to significantly reduce the number of flights required for surveying, which directly improves the efficiency of the entire workflow. Furthermore, it enables users to perform accurate surveys from a sufficient distance away, even in very risky locations that would typically need to be approached to survey using a narrow field of view, such as steep slopes and the sides of structures. It also protects site safety. Improving work efficiency and protecting site safety the wide field of view design introduced for TDOT 7 GREEN LITE achieves both.

120°

PHOTOGRAMMETRY

Record the situation at sites in color using the standard-equipped visible light camera
Also supports color point cloud and orthophoto* generation

For more "visible" surveying with photographs and point clouds Also supports color point cloud and orthophoto generation with the visible light camera

TDOT 7 GREEN LITE comes standard with a visible light camera, which can be used at the same time as laser surveying to perform interval photography. This model can generate "color point clouds" by superimposing the color information acquired from these photographs onto the point cloud data. In addition, TDPT 7 GREEN LITE also supports the creation of orthophotos from location information based on photographic data. This allows it to produce consistent results from both visual and spatial perspectives.

Using color and photographic information makes it much easier for stakeholders to understand post-survey analyses and explanations, thereby facilitating the understanding of sites and improving reporting document accuracy.

*Additional Structure from Motion (SfM) software is required to generate orthophotos.

VISIBLE CAMERA specification

Standard Equipment

Number of pixels	2,840×2,840 8Mpixel
Sensor size	2/3 7.804(H) × 7.804(V) mm
Focal length (35mm equivalent)	17.3mm
F value	F1.8
FOV	102.6°

Orthophoto

SPECIFICATION

TDOT 7 GREEN LITE Specifications

Model name		TDOT 7 GREEN LITE
Size (approx.)		W260 x D250 x H150mm
Weight (approx.)		2.9kg
Communication frequency band		920MHz , 2.4GHz
GNSS		GPS, GLONASS, Galileo, BeiDou
Input voltage	Scanning	DC:24V-4A(96W) PD(USB Type-C):20V-5A(100W)
	Idle	DC:24V-3A(72W) PD(USB Type-C):20V-3.25A(65W)
Rated power consumption		96W
Standard equipment		Visible camera
Body color		White, Green
Operating temperature		10 – 40°C (non-condensing)
Storage temperature		0 – 40°C (non-condensing)
Maximum Humidity Range		Below 80% RH (no condensation)

Laser Scanner Specifications

Max. measurement distance	≧10% 430m, ≧100% 1400m	
Min. measurement distance	2.5m	
Resolution	1mm	
Measuring accuracy (1σ)	Strong echo : 4mm, Weak echo: 15mm	
Accuracy	5mm	
Beam spread angle	1.5mrad	
Laser wavelength	532nm	
Pulse rate	160,000 Hz (measurement rate: 106,560 Hz)	
Scanning Mirror	4-sided polygon mirror	
	Scanning angle (FOV)	120°
	Scanning speed	80Hz
	Step accuracy	0.09°
	Number of measuring points (120°)	1,332
Number of echoes	6	
Laser Class	Distance to the scan target 40m + (FULL) : class 3R	
	Distance to the scan target 25m – 40m (MEDIUM) : class 3R	
	Distance to the scan target 25m or less (LOW) : class 1	
Bathymetric performance (seawater) R=Reflectivity C=Beam attenuation coefficient	Clear Water R=0.40 @ Altitude 50m : 1.43 Secchi *1	
	Turbid Water R=0.40 @ Altitude 50m : 0.60 Secchi	
	Clear Water C=0.22 @ Altitude 50m : 13.5m	
	Clear Water C=0.22 @ Altitude 15m : 16.8m	

Built-in INS Specifications*2

Positional accuracy	5mm
Heading	0.03°
Pitch/Roll	0.006°
Velocity	0.01m / sec.

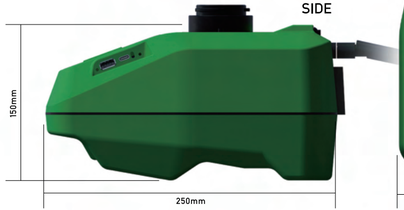
VISIBLE CAMERA specification

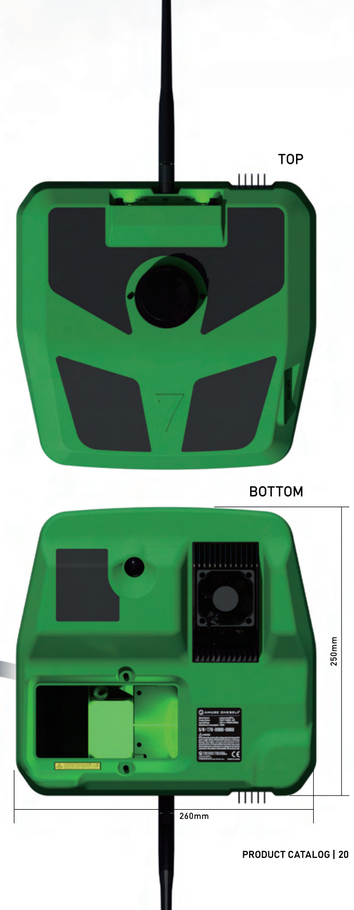
Number of pixels	2,840 x 2,840 8Mpixel
Sensor size	2/3 7.804(H) x 7.804(V) mm
Focal length(35mm equivalent)	17.3mm
F value	F2.7
FOV	102.6°

PACKAGE

TDOT 7 GREEN LITE Main unit
REMOTE GATEWAY
USB memory stick (64GB)
GNSS Antenna
Power cable
Mobile battery
Dedicated hard case
Instruction Manual

*1 One secchi is the depth at which a 30cm-diameter white disc (transparency plate or secchi plate) is submerged underwater and becomes invisible.
*2 Accuracy after post-processing with the POST-PROCESSING CLOUD cloud service. A separate contract is required to use the service.





TDOT™ NIR-S 7

DRONE LiDAR SYSTEM

MADE IN JAPAN

TDOT 7 NIR-S Specifications

Laser scanner module

RIEGL VUX120^{23}

Surveying object

CONSTRUCTION | MOUNTAIN | STRUCTURE | RIVER | SHALLOW SEA | WET GROUND

Laser wavelength	Pulse rate (max.)	Scan rate (max.)	Number of echoes (max.)	Scanning angle	Measuring accuracy (1σ)	Weight (approx.)	Laser class
Near infrared	2,400,000Hz	400Line/sec.	32	100°	10mm	2.7kg	Class 1

HIGH SPEED

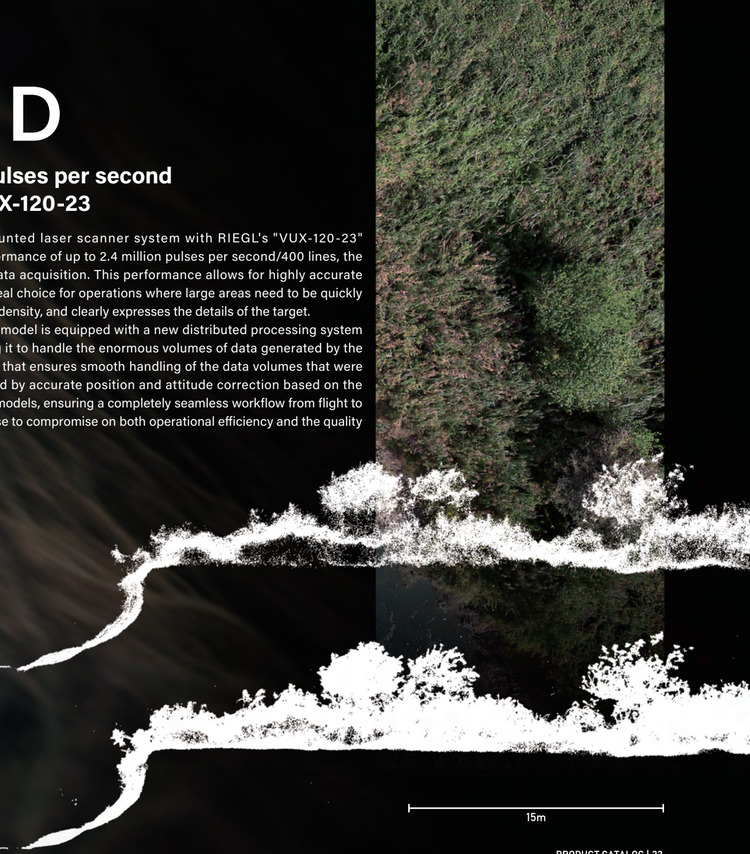
Ultra-high-speed scanning at 2.4 million pulses per second "TDOT 7 NIR-S" equipped with RIEGL's VUX-120-23

The high-end TDOT 7 NIR-S model combines our "TDOT" drone-mounted laser scanner system with RIEGL's "VUX-120-23" ultra-high-performance laser module. With an unparalleled scanning performance of up to 2.4 million pulses per second/400 lines, the VUX-120-23 realizes unprecedented ultra-high-speed and high-density data acquisition. This performance allows for highly accurate scanning at higher flying altitudes and speeds, making TDOT 7 NIR-S the ideal choice for operations where large areas need to be quickly surveyed at once. In addition, the acquired point cloud data is extremely high-density, and clearly expresses the details of the target.
It even accurately captures the details of structures and topographies. This model is equipped with a new distributed processing system composed of multiple computers for data analysis and processing, allowing it to handle the enormous volumes of data generated by the ultra-high-speed laser. It also provides a comfortable analysis environment that ensures smooth handling of the data volumes that were difficult to process in the past. Needless to say, TDOT 7 NIR-S is supported by accurate position and attitude correction based on the high-performance GNSS/INS navigation system common to all TDOT Series models, ensuring a completely seamless workflow from flight to data output. TDOT 7 NIR-S is specifically designed for professionals who refuse to compromise on both operational efficiency and the quality of results on site.

Overwhelming point density

DRONE LiDAR SYSTEM TDOT 7 NIR — Pulse rate 300,000Hz

DRONE LiDAR SYSTEM TDOT 7 NIR-S — Pulse rate 2,400,000Hz



3-BEAM

"Three-direction laser emission"
also handles vertical surfaces

Accurately captures those structures and topographies that were difficult to survey in the past

Installed on TDOT 7 NIR-S, RIEGL's VUX-120 is an advanced laser module that can continuously emit beams in three directions (downward, forward (+10°), and backward (-10°)), in addition to an overwhelming scanning speed of 400 lines per second. This enables more accurate and more extensive scanning of vertical building surfaces, steep cliff faces, narrow valley topographies, and other complex three-dimensional structures, all of which are difficult to scan using conventional LiDAR. Furthermore, its ability to preserve high-density, high-accuracy point cloud data even at higher flying speeds greatly improves the efficiency of the entire surveying workflow. Combining high speed, large area, and high accuracy, TDOT 7 NIR-S realizes a new era of laser surveying.

400 Line/s
3 beam

FOV

An optimal laser field of view realizes highly accurate altitude values

Precision altitude acquisition relies on the balance between the field of view and attitude accuracy

The most important aspect of drone-based laser surveying is an accurate altitude value for the target. Although altitude accuracy is determined by a combination of GNSS positioning accuracy and laser-based distance measurement accuracy, it is also significantly affected by the scan angle (field of view). The farther the laser beam emission angle deviates from the vertical axis (downward direction), the more errors caused by changes in drone attitude are likely to be amplified in altitude values. In other words, an excessively wide field of view may adversely affect altitude accuracy. For this reason, the VUX-120 installed on TDOT 7 NIR-S utilizes a 100° field of view (FOV), an angular design optimized for surveying applications. This configuration minimizes the impact of drone attitude accuracy while ensuring the necessary field of view, thereby ensuring the reliable acquisition of high-accuracy altitude values.
TDOT 7 NIR-S is a no-frills scanning system designed for professionals who pursue altitude accuracy.

SPECIFICATION

TDOT 7 NIR-S Specifications

Model name	TDOT 7 NIR-S
Size (approx.)	W220 x H180 x D115 mm(Excluding camera unit)
Body weight (approx.)	2.7kg
Communication frequency	2.4GHz、LTE
GNSS	GPS、GLONASS、Galileo、BeiDou
Laser scanner module	RIEGL VUX-120-23
Attachment	GLOW series or DJI SKYPORT selectable

Laser Scanner Specifications *1

Model name		RIEGL VUX120-23					
Pulse repetition rate PRR *2		150kHz	300kHz	600kHz	1200kHz	1800kHz	2400kHz
Max. surveying range *3,4 Natural targets	ρ≧20%	760	550	400	280	230	200
	ρ≧60%	1260	920	670	480	400	350
	ρ≧80%	1430	1050	760	550	450	400
Max. flight altitude *3,5	ρ≧20%	440	320	230	160	130	110
	ρ≧60%	720	530	380	280	230	200
Maximum number of echo return *6		32	32	24	11	7	5
Minimum range		5m					
Accuracy *7,9		10mm					
Precision *8,9		5mm					
Maximum scan speed (lines/sec)		50~400					
Laser class / Wavelength		Class 1 / Near infrared					
Beam spread angle *10		0.4mrad					

Built-in INS Specifications *11

Positional accuracy	5mm
Heading	0.03°
Pitch/Roll	0.006°
Velocity	0.01m / sec.

PACKAGE

TDOT 7 NIR-S Main unit	Preview application "TDOT PrePROCESSING"
GNSS Antenna	CF Card Reader
TDOT GATEWAY	Operating manual
Dedicated hard case	

OPTION CAMERA UNIT

Visible Camera	Resolution	4,000×3,000 12Mpixel
	FOV	100°
Thermal camera	Resolution	640×512pixel
	FOV	95°

*1 Specifications as of April 2023. For detailed specifications, please refer to the RIEGL's official website.
*2 Approximate value.
*3 Typical values for average conditions and average ambient brightness. In bright sunlight, the maximum range is shorter than under an overcast sky.
*4 Assumed the following conditions : Target size is larger than laser beam spot size, perpendicular angle of incidence, and for atmospheric visibility of 23 km. In bright sunlight, the maximum range is shorter than under overcast sky.
*5 Considering maximum effective FOV 100°,additional roll angle ±5°.
*6 If a portion of the laser beam hits more than one target, the laser pulse power is split and, accordingly, the achievable range is reduced.
*7 Accuracy is the degree of conformity of a measured quantity to its actual(true) value.
*8 Precision, also called reproducibility or repeatability, is the degree to which further surveying show the same result.
*9 1σ@150m range under RIEGL test conditions.
*10 Surveyed at 1/e2 points. 0.4mrad corresponds to an increase of 40mm of beam diameter per 100m distance.
*11 Accuracy after post-processing with the POST-PROCESSING CLOUD cloud service. A separate contract is required to use the service.

TDOT™ NIR 7

DRONE LiDAR SYSTEM

MADE IN JAPAN

TDOT 7 NIR Specifications

Laser scanner module

RIEGL miniVUX-3UAV

Laser wavelength	Pulse rate (max.)	Scan rate (max.)	Number of echoes (max.)	Scanning angle (max.)	Measuring accuracy (1σ)	Weight (approx.)	Laser class
Near infrared	300,000Hz	100Line/sec.	5	360°	15mm	2.4kg	Class 1

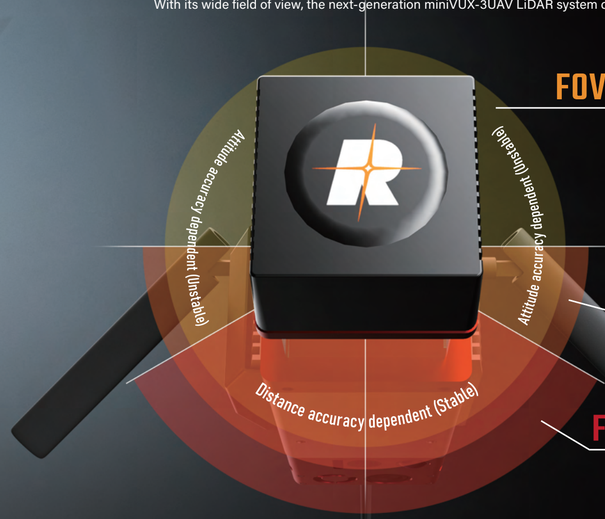
Surveying object

CONSTRUCTION | MOUNTAIN | STRUCTURE | RIVER | SHALLOW SEA | WET GROUND

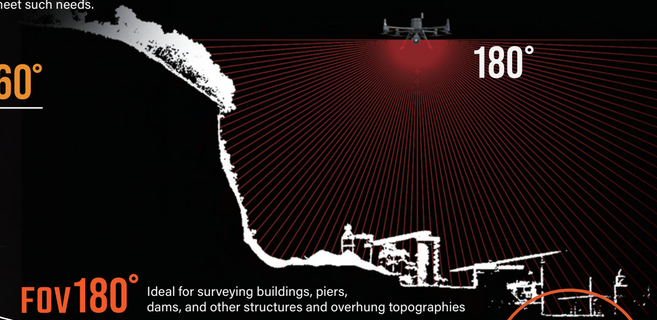
WIDE FIELD OF VIEW

Applicable for vertical faces, canyons, and wall-like topographies
A 360° wide field of view contributes to achieving safe and reliable surveying

This model is equipped with RIEGL's "miniVUX-3UAV," which offers high performance of up to 300,000 Hz per second/100 lines.
Having both outstanding surveying performance and operability, this system was developed by combining RIEGL's UAV with the "TDOT" drone-mounted laser scanner system we are so proud of. Its greatest feature is the 360° wide field of view. This field of view enables the users to acquire data safely and reliably without forcibly flying the drone close to vertical faces of buildings and structures, sheer cliffs, deep canyons, and other surfaces that have been difficult to survey with drones in the past. In addition, this model utilizes a selectable field of view (FOV) in consideration of actual operations. By cutting off the top 180° area of the 360° field of view, where laser beams strike the body of the drone, this function removes unnecessary data and prevents data inflation. Depending on the application, users can choose between two different scan modes, underside 120° (high-accuracy surveying and high laser intensity) and underside 180° (overall view of buildings, piers, dams, and overhung topographies). I want to capture the entire structure. I do not want to compromise accuracy while reducing risks.
With its wide field of view, the next-generation miniVUX-3UAV LiDAR system can meet such needs.



FOV360°



FOV180° Ideal for surveying buildings, piers, dams, and other structures and overhung topographies

Also acquires data on wall faces and steep slopes safely

FOV120° Ensures reliable data acquisition using high-accuracy distance measurements and a laser emission rate of 300,000 times per second
Even capable of safely and reliably surveying wall faces and steep slopes

LTE × RTK

Analyze and transmit point cloud data on the spot
Share data immediately from the site through real-time processing and LTE communication

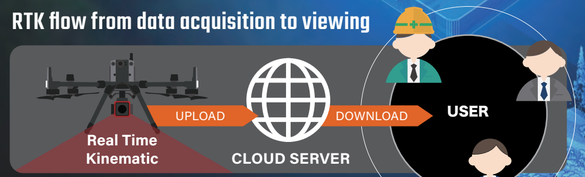
TDOT 7 NIR is an all-in-one, real-time processing system that can analyze and transmit on the spot point cloud data acquired at survey sites. The combination of the built-in LTE wireless communication module and the NVIDIA Jetson Xavier NX–a high-performance single-board computer that can also support AI processing–allows the user to immediately analyze, process, create, and store scanned data as point cloud data with accurate location information. Furthermore, the system uploads analyzed data onto a dedicated server in real time via LTE communication, making it immediately viewable and available from remote offices or command centers. TDOT 7 NIR can complete all of these processing operations on its own without using an external PC or analysis device. This innovative next-generation surveying solution is ready for use at disaster sites, emergency investigations and other time-sensitive situations.

Real Time Kinematic
RTK scanning via LTE wireless communication

Real Time Processing
Real-time analysis
Uploaded to a cloud server

Real Time View
Uploaded point cloud data
can be viewed from anywhere

RTK flow from data acquisition to viewing



SPECIFICATION

TDOT 7 NIR Specifications

Model name	TDOT 7 NIR
Size (approx.)	W315 x H140 x D110 mm
Body weight (approx.)	For RIEGL miniVUX-3UAV: 2.4 kg
Communication frequency	2.4GHz, LTE
GNSS	GPS, GLONASS, Galileo, BeiDou
Laser scanner module	RIEGL miniVUX-1UAV or RIEGL miniVUX-3UAV selectable
Attachment	GLOW series or DJI SKYPORT selectable

Laser Scanner Specifications *1

Model name		RIEGL miniVUX-1 UAV	RIEGL miniVUX-3UAV			
Pulse repetition rate PRR *2		100kHz	100kHz	200kHz (reduced)	200kHz	300kHz
Max. surveying range *3 Natural targets	ρ≥20%	150	170	150	170	170
	ρ≥60%	250	290	250	290	290
	ρ≥80%	-	330	280	330	330
Max. flight altitude *2,4	ρ≥20%	100	100	85	100	100
	ρ≥60%	-	160	140	160	160
Maximum number of echo return *5		5	5			
Minimum range		3m	2m			
Accuracy *6,8		15mm	15mm			
Precision *7,8		10mm	10mm			
Maximum scan speed (lines/sec)		10–100	10–100			
Laser class / Wavelength		Class 1 / Near infrared	Class 1 / Near infrared			
Beam spread angle *10		1.6x0.5mrad	1.6x0.5mrad			

Built-in INS Specifications *10

Positional accuracy	5mm
Heading	0.03°
Pitch/Roll	0.006°
Velocity	0.01m / sec.

PACKAGE

TDOT 7 NIR-S Main unit	Dedicated hard case
GNSS Antenna	Preview application "TDOT PrePROCESSING"
REMOTE GATEWAY	Operating manual

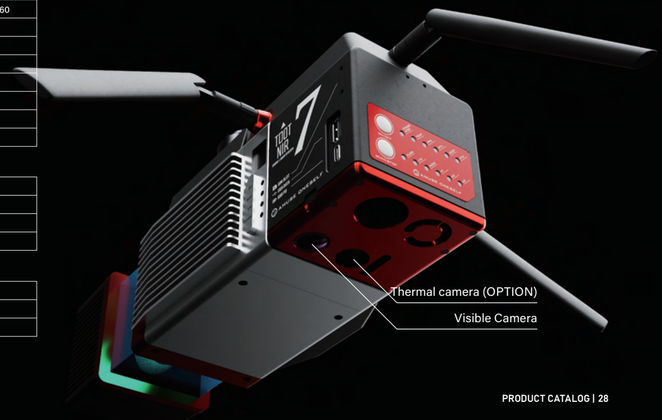
Visible Camera Specifications

Number of pixels	4,000×3,000 12Mpixel
FOV	100°

OPTION

Thermal camera	Resolution	640×512pixel
	FOV	95°

*1 Specifications as of April 2023. For detailed specifications, please refer to the RIEGL's official website.
*2 Approximate value.
*3 Assumed the following conditions : Target size is larger than laser beam spot size, perpendicular angle of incidence, and for atmospheric visibility of 23 km. In bright sunlight, the maximum range is shorter than under overcast sky.
*4 Flat terrain assumed, FOV ±45°.
*5 If a portion of the laser beam hits more than one target, the laser pulse power is split and, accordingly, the achievable range is reduced.
*6 Accuracy is the degree of conformity of a measured quantity to its actual(true) value.
*7 Precision, also called reproducibility or repeatability, is the degree to which further surveying show the same result.
*8 1σ@150m range under RIEGL test conditions.
*9 Surveyed at 50 % peak intensity. 1.6mrad corresponds to an increase of 160mm of beam diameter per 100m distance.
*10 Accuracy after post-processing with the POST-PROCESSING CLOUD cloud service. A separate contract is required to use the service.



TDOT GREEN R 3

DRONE LiDAR SYSTEM

MADE IN JAPAN

DJI MATRICE 350 RTK can be equipped with a lightweight green laser scanner system

The lightweight design also enables use with any topography, waterfront, or disaster area. TDOT 3 GREEN is a lightweight green laser scanner system that enables reliable data acquisition in complex mountainous topographies, as well as in environments with plenty of water and obstacles, such as riverbeds, coastal areas, and even disaster areas immediately after heavy rains. Compatible with DJI's "Matrice 350 RTK," the design ensures flexible and speedy deployment to and operation at these sites. This field-oriented surveying solution offers both high mobility and accuracy.

Surveying object

CONSTRUCTION | MOUNTAIN | STRUCTURE | RIVER | SHALLOW SEA | WET GROUND

Laser wavelength	Pulse rate	Scan rate	Number of echoes	Scanning angle
532nm	60,000Hz	30Line/sec.	4	90°

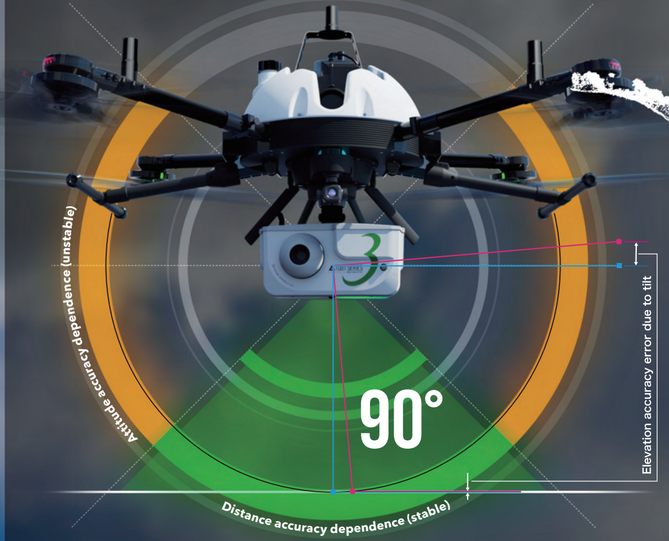
TDOT 3 GREEN R Specifications

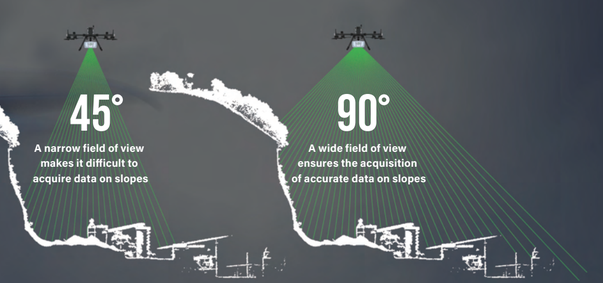
Product name	TDOT 3 GREEN R (Certified Refurbished Product)
Size (approx.)	W270 × D230 × H150mm
Weight (approx.)	2.7kg
Maximum measurement distance	≧10% 158m
Accuracy of measurement distance	≧10% ±15mm
Pulse rate	60,000Hz
FOV	90°(±45°)
Echo switching	1st&Last / 4echo
Scanning speed	30Line/sec.
Laser wavelength	532±1nm
Beam spreading angle	1.5mrad
Eye safe function	Ground altitude < 40m : Class 1M / > 40m : Class3R
Depth measurement capability (Height50m)	R=1.0,absorption coefficient=0.25(1/m) > 1.4 secchi *1

Built-in INS Specifications*2

Positional accuracy	5mm
Heading	0.03°
Pitch/Roll	0.006°
Velocity	0.01m / sec.

*1 A white disc (transparency plate or secchi plate) of 30 cm in diameter is submerged in water and the depth at which it becomes invisible is 1 secchi.
*2 This is the accuracy after post-processing with the "POST-PROCESSING CLOUD" cloud service. A separate contract is required to use the service.





Efficiently acquire data with a wide field of view optimal for drone laser surveying

An optimal field of view that emphasizes altitude accuracy
Acquires highly accurate altitude values by suppressing the impact of attitude errors

With drone-based laser surveying, the target's altitude value accuracy depends on a combination of the GNSS positioning accuracy and the laser ranging accuracy. However, the farther the laser scan angle diverges from the vertical axis (downward direction), the more errors caused by changes in drone attitude will be amplified, which may significantly affect amplitude accuracy. TDOT 3 GREEN limits the field of view (FOV) to 90° to minimize the impact of such errors. This model is designed with an emphasis on acquiring high-accuracy altitude values with the minimum required scanning range. On the other hand, a narrow field of view makes it difficult to acquire data on vertical (perpendicular) faces, which is why this model's FOV is optimized with an emphasis on "topographic height information."

Display data and system status in real-time during surveys

Check cross-sectional data on the spot
A real-time display realizes thorough surveys that do not leave any areas uncovered

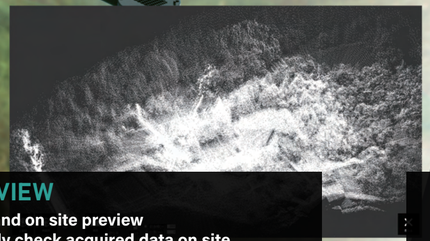
TDOT 3 GREEN can display cross-sectional data acquired during surveys on its monitor in real time. For example, users can check whether the laser beam reaches ground surfaces under vegetation and underwater topographies on the spot during flight to avoid leaving areas unsurveyed and to realize an efficient surveying workflow without rework. In addition, users can check the system status and sensor status during surveys from a smartphone.
This model supports on-site operation in a smarter and more reliable manner.
*For real-time display of cross-sectional data, the drone needs to be equipped with an image transmission device that supports HDMI connection.
*The DJI Matrice 350 RTK can display data via the DJI SkyPort.

APPLICATION

TDOT Application

PREVIEW APPLICATION

TDOT Pre PROCESSING

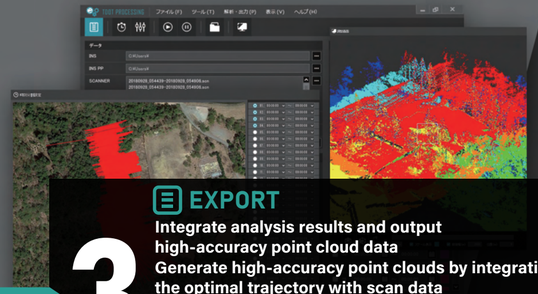


CLOUD SERVICES

POST-PROCESSING CLOUD

TDOT PROCESSING

DEDICATED POINT CLOUD OUTPUT APPLICATION ENABLES ACQUIRED DATA TO BE EASILY OUTPUT



1 PREVIEW

Scanning and on site preview
Immediately check acquired data on site to prevent unsurveyed areas

The TDOT Series is equipped with an application that enables users to preview scanned data on the spot. The success or failure of a survey can be checked on site, resulting in an efficient workflow with no rework. This series can be operated securely even in situations where an on-site judgment is required.

2 KINEMATIC

Cloud based optimal trajectory analysis service
Perform an optimal trajectory analysis with high accuracy simply by uploading acquired data

Simply upload the GNSS/IMU data onto the cloud service to automatically perform an optimal trajectory analysis (POS analysis) based on the INS data. This step obtains highly accurate processing results even without expertise, thereby contributing to improved work efficiency and preventing the dependency of work on individuals. (Available for a charge)

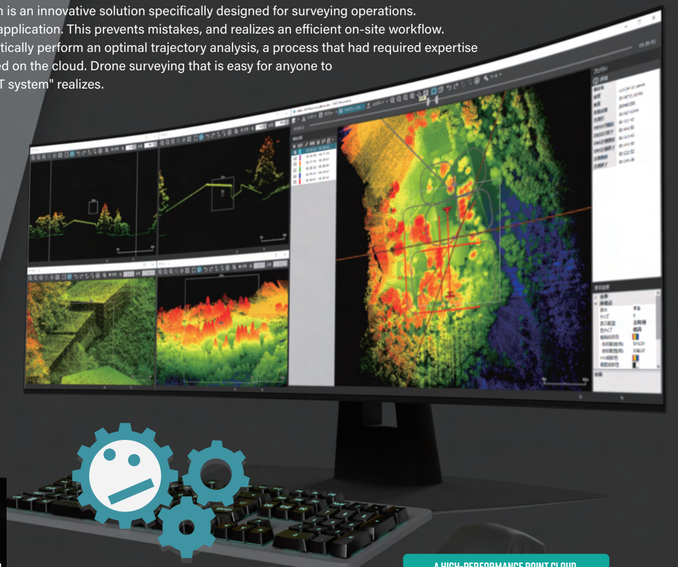
3 EXPORT

Integrate analysis results and output high-accuracy point cloud data
Generate high-accuracy point clouds by integrating the optimal trajectory with scan data

Integrate the optimal trajectory analysis results acquired via the cloud with scan data on a PC. Output high-accuracy point cloud data that precisely reflects positional and attitude information. This system supports seamless data use for the next process at a level of accuracy that is also compatible with public surveying (Japan).

A one and only TDOT system that realizes "drone surveying anyone can use"

Developed based on the concept of "drone surveying anyone can use," the TDOT system is an innovative solution specifically designed for surveying operations. Users can immediately check acquired scan data on site using the high-speed preview application. This prevents mistakes, and realizes an efficient on-site workflow. Furthermore, the user simply needs to upload the data onto the cloud service to automatically perform an optimal trajectory analysis, a process that had required expertise in the past. Automatically acquire high-accuracy trajectory data from the results analyzed on the cloud. Drone surveying that is easy for anyone to perform with accuracy, from surveying professionals to beginners this is what the "TDOT system" realizes.



TDOT PROCESSING PRO

A HIGH-PERFORMANCE POINT CLOUD OUTPUT APPLICATION VERSION SUPPORTS ADVANCED PROCESSING AND MULTIPLE FUNCTIONS

- Preview viewer for checking flight routes
- Optimized automatic calibration function to correct for misalignment
- Support for outputting reports based on survey results

TDOT PROCESSING PRO

TDOT's vaunted all-in-one software pursues surveying solutions

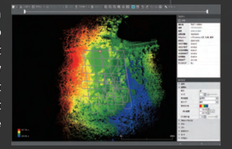
	Viewer mode (without license key)	Professional mode (with license key)
Browse survey data	●	●
Check flight route	●	●
Timeline		●
Calibration		●
Analysis process		●
Export		●

Viewer Mode

Display simultaneous previews of survey data and flight routes

Equipped with a viewer mode that does not require a license
Achieve surveying workflows that enable immediate checking on site and zero rework

TDOT software has a "viewer mode" that can be activated even without inserting the USB license key. This allows the user to instantly check the data acquired together with the drone's flight trajectory on site to determine on the spot whether the survey has been carried out as planned. This supports an efficient surveying workflow free of rework because the system does not need to be connected to the Internet, and is not affected by the site environment.

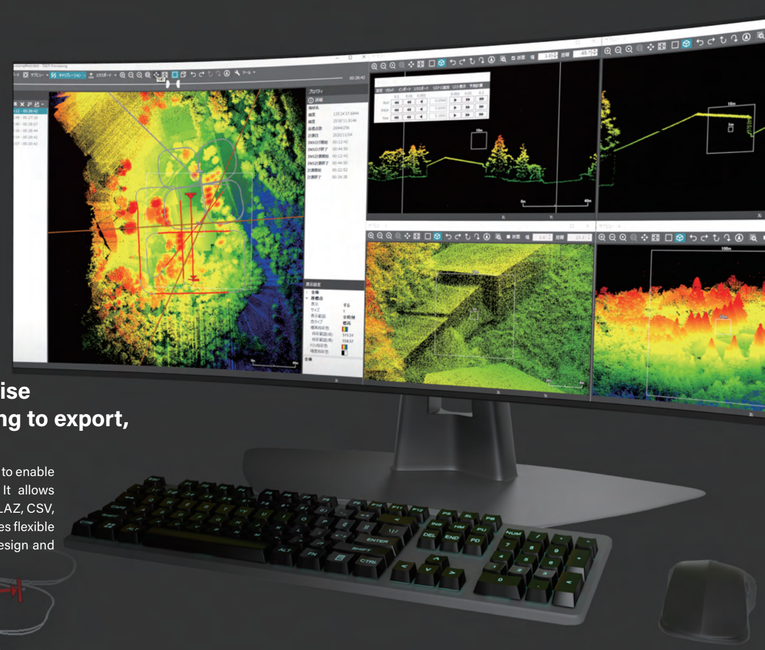


Professional Mode

Equipped with advanced functions that realize the ultimate user experience

A new GUI combines operability and practical availability
Intuitive operations and automation, from accuracy control to report output

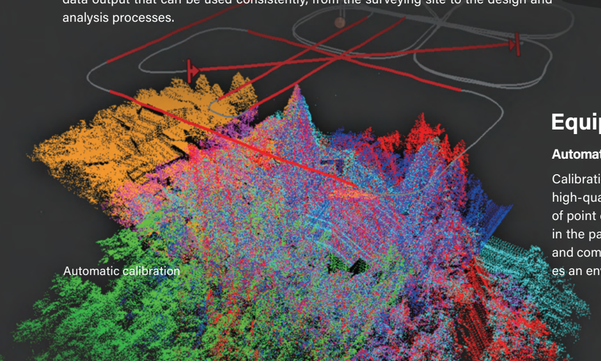
Ensures smooth operations, from analysis processing to export



Enables anyone to perform high-accuracy processing without expertise

All operations, from point cloud processing to export, can be smoothly performed

TDOT software is designed to automate advanced point cloud analyses, and to enable users to acquire highly accurate processing results without expertise. It allows analyzed data to be exported at high speed in a variety of file formats (LAS, LAZ, CSV, etc.) supported by various types of operation software. TDOT software realizes flexible data output that can be used consistently, from the surveying site to the design and analysis processes.



Automatic calibration

Equipped with an automatic calibration function

Automate important processes that determine accuracy at the press of a button

Calibration work that properly sets INS adjustment values (misalignment values) is essential for acquiring high-quality laser surveying data. This work is an important step that greatly affects the positional accuracy of point clouds. TDOT Processing Pro fully automates this calibration process that was manually performed in the past. It also supports "bore site calibration," which is specified in the work regulation rules (JAPAN) , and complies with institutional requirements. This frees users from cumbersome calibration work, and realizes an environment in which anyone can create high-accuracy point cloud data in a consistent manner.

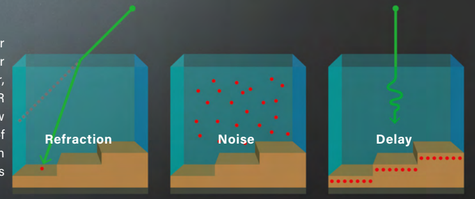
Correct refraction

UNDERWATER CORRECT

A dedicated application for correcting point cloud data underwater

"UNDERWATER CORRECT" accurately corrects underwater coordinates Automatically correct errors due to water refraction with a single click

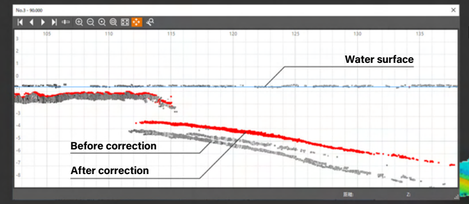
Green laser beams are able to penetrate water and visualize underwater topography. The travel direction of laser beams in water, however, changes due to refraction, which causes an issue where riverbeds and seabeds appear deeper than they actually are. The refractive index of water varies from one measurement point to another, making it difficult for users to accurately identify and correct for this issue. TDOT software's “UNDERWATER CORRECT” feature solves this problem. Simply designate the water's surface from the cross-sectional view displayed on the screen, and this system will automatically make corrections taking into account the effects of refraction. This user-friendly design enables users to acquire accurate underwater coordinate information even without any expertise. Developed under the concept of "drone surveying anyone can use," this correction tool is directly linked to actual operations on site.



Riverbed survey workflow

1 Noise removal

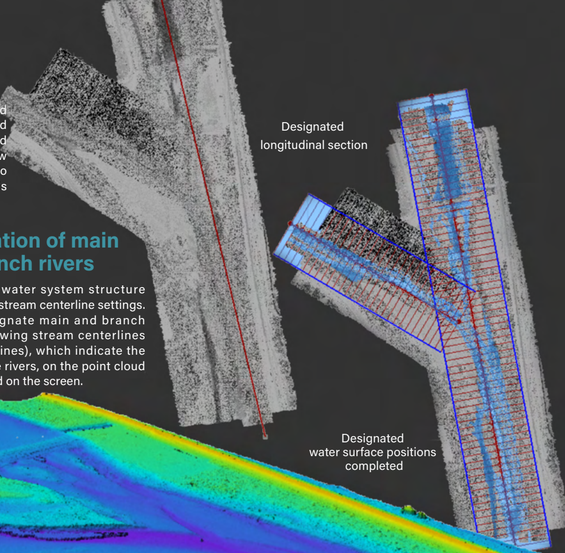
Visualize point clouds, including underwater point clouds, and quickly eliminate unnecessary data. Display laser point cloud data, including underwater topographies, on the screen, and remove unnecessary noise data for measurements in a few simple steps. Compile the data into a clean point cloud to improve the accuracy and efficiency of subsequent analysis and correction processing.



Designated water surface positions

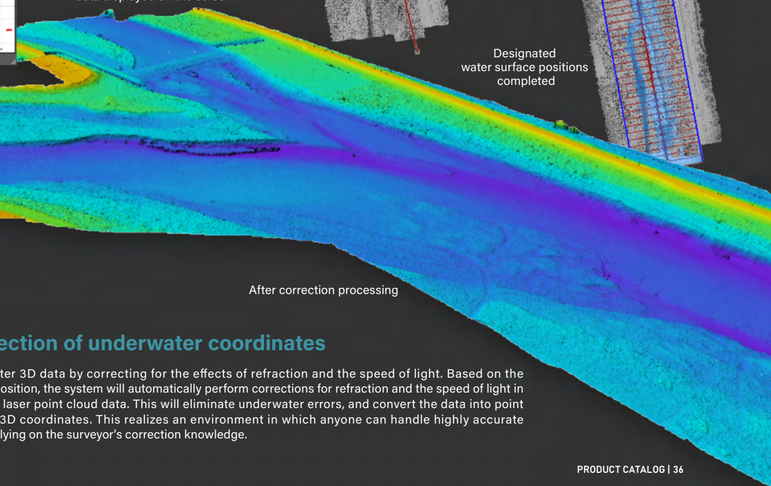
2 Designation of main and branch rivers

Classify the water system structure based on the stream centerline settings. Clearly designate main and branch rivers by drawing stream centerlines (river centerlines), which indicate the centers of the rivers, on the point cloud data displayed on the screen.



3 Designation of water surfaces

Automatically generate cross-sections to easily set water surface positions on the cross-sectional data. Automatically create measuring lines perpendicular to each stream centerline. This will automatically generate the cross-sectional data. Simply use the mouse to intuitively designate water surface positions on the cross-section displayed on the screen to complete preparations for underwater corrections.



After correction processing

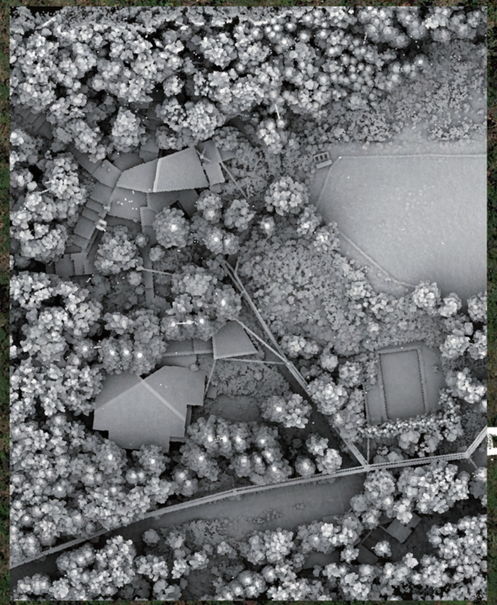
4 Automatic correction of underwater coordinates

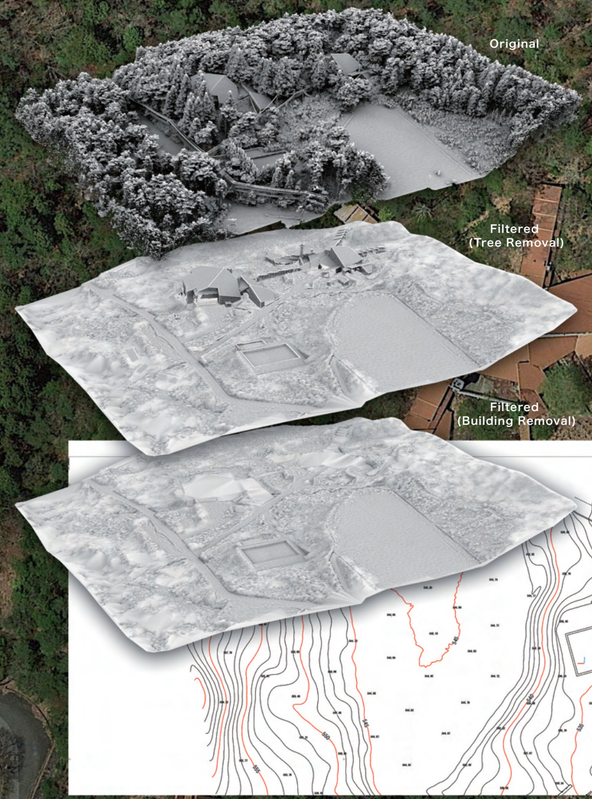
Create accurate underwater 3D data by correcting for the effects of refraction and the speed of light. Based on the designated water surface position, the system will automatically perform corrections for refraction and the speed of light in relation to the underwater laser point cloud data. This will eliminate underwater errors, and convert the data into point cloud data with accurate 3D coordinates. This realizes an environment in which anyone can handle highly accurate underwater data without relying on the surveyor’s correction knowledge.

CASE STUDIES

Compatible Models | TDOT 7 GREEN | TDOT 7 GREEN LITE | TDOT 3 GREEN R | TDOT 7 NIR-S | TDOT 7 NIR

Surveying



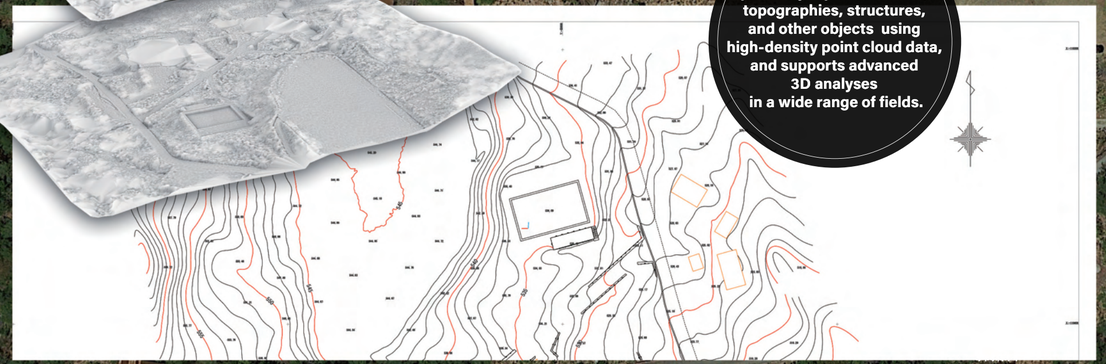


Fully supports the building of a national land infra-structure platform

The TDOT Series supports the era of digital twins

"Digital twin" technology, which faithfully reproduces real geospatial information in digital space, is now attracting attention in various fields. This technology is increasingly being used in a variety of community planning fields, including disaster prevention/mitigation planning and smart city design. The TDOT Series provides an environment in which anyone can easily acquire and utilize this kind of 3D virtual space infrastructure data by continuously visualizing and reproducing trees, topographies, structures, and power lines, for example, using cross-sections. As a tool that enables anyone to participate in the use of digital twins without relying on highly specialized skills, the TDOT Series contributes to the future of social infrastructure.

The TDOT system can precisely reproduce trees, topographies, structures, and other objects using high-density point cloud data, and supports advanced 3D analyses in a wide range of fields.



CASE STUDIES

Compatible Models | TDOT 7 GREEN | TDOT 7 GREEN LITE | TDOT 3 GREEN R | TDOT 7 NIR-S | TDOT 7 NIR

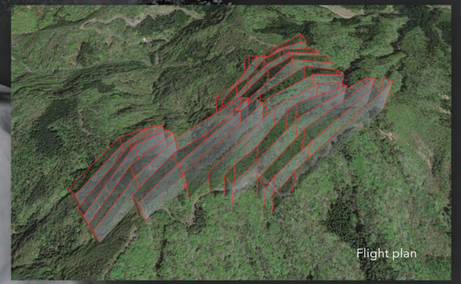
Surveying

An optimal drone surveying solution as an alternative to aerial laser profilers

The density of laser point clouds in slope surveys directly connects to the reproducibility of topographies and to the detection of hazardous areas.
The TDOT Series can emit high-density laser beams from low altitudes at a lower cost than aerial laser profilers, thereby capturing hazardous areas that are often overlooked by aerial profilers.
This ensures more reliable and efficient slope surveys.

Original data before tree filtering

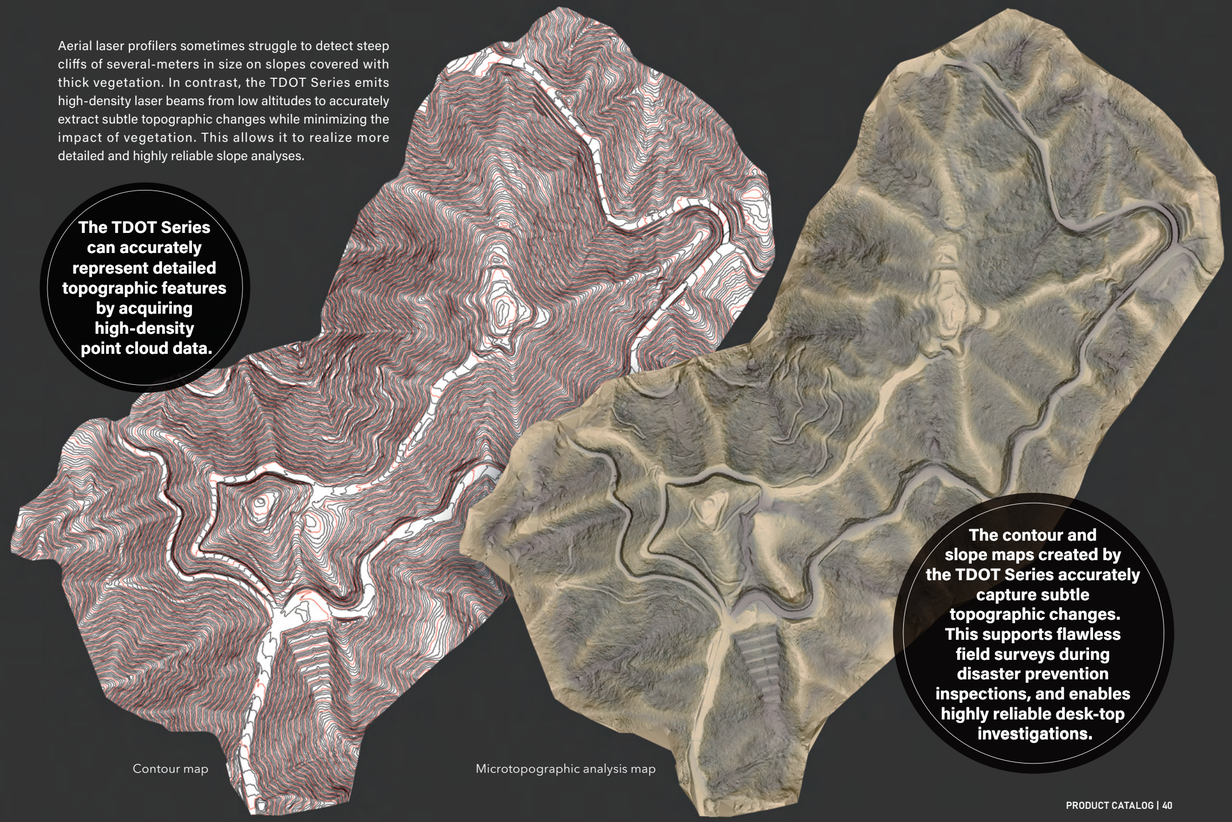
Ground data after tree filtering



Flight plan

Aerial laser profilers sometimes struggle to detect steep cliffs of several-meters in size on slopes covered with thick vegetation. In contrast, the TDOT Series emits high-density laser beams from low altitudes to accurately extract subtle topographic changes while minimizing the impact of vegetation. This allows it to realize more detailed and highly reliable slope analyses.

The TDOT Series can accurately represent detailed topographic features by acquiring high-density point cloud data.



Contour map

Microtopographic analysis map

The contour and slope maps created by the TDOT Series accurately capture subtle topographic changes. This supports flawless field surveys during disaster prevention inspections, and enables highly reliable desk-top investigations.

CASE STUDIES

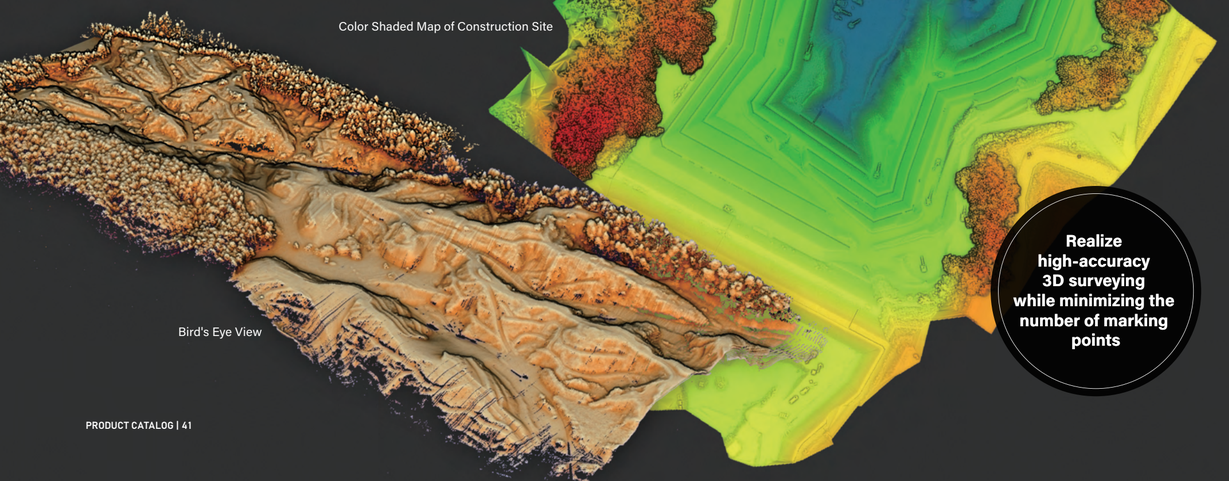
Compatible Models TDOT 7 GREEN | TDOT 7 GREEN LITE | TDOT 3 GREEN R | TDOT 7 NIR-S | TDOT 7 NIR

Construction Sites

Robust support for realizing construction digital transformation

The success of ICT construction depends on a quick and accurate understanding of the site conditions. With the TDOT Series, anyone can operate the drone and perform surveys with ease. In addition, automated analysis processing enables users to immediately check daily construction progress, and thereby realize efficient ICT construction that does not rely on outsourcing.

Color Shaded Map of Construction Site



Bird's Eye View

Realize high-accuracy 3D surveying while minimizing the number of marking points

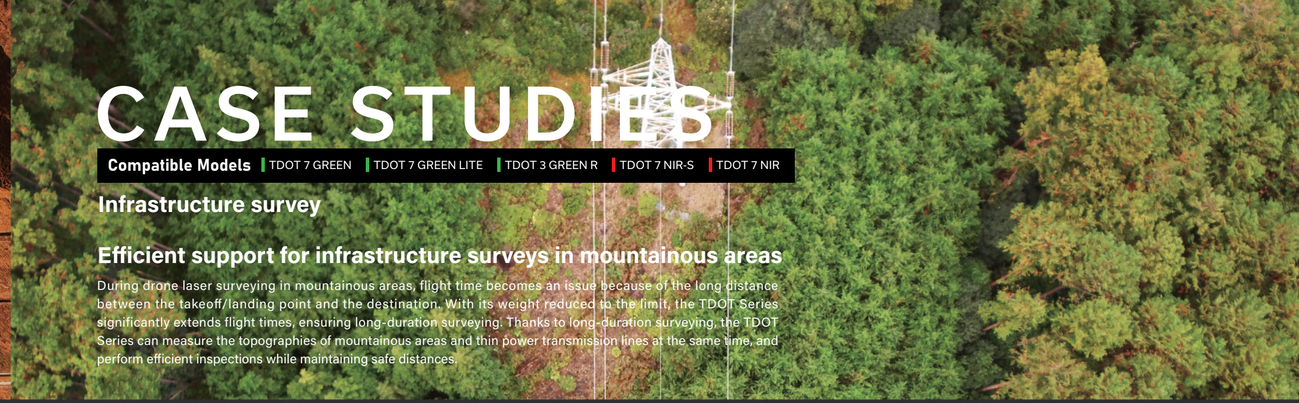
CASE STUDIES

Compatible Models TDOT 7 GREEN | TDOT 7 GREEN LITE | TDOT 3 GREEN R | TDOT 7 NIR-S | TDOT 7 NIR

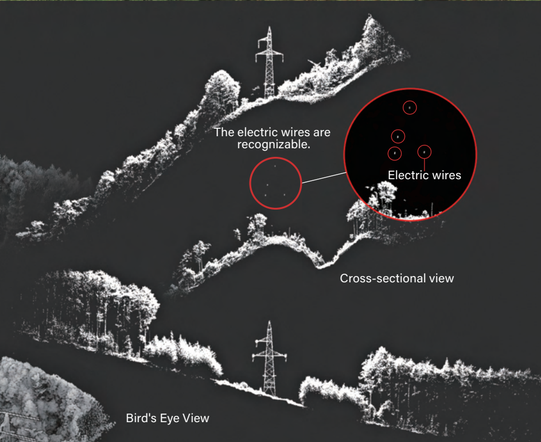
Infrastructure survey

Efficient support for infrastructure surveys in mountainous areas

During drone laser surveying in mountainous areas, flight time becomes an issue because of the long distance between the takeoff/landing point and the destination. With its weight reduced to the limit, the TDOT Series significantly extends flight times, ensuring long-duration surveying. Thanks to long-duration surveying, the TDOT Series can measure the topographies of mountainous areas and thin power transmission lines at the same time, and perform efficient inspections while maintaining safe distances.



Bird's Eye View



Cross-sectional view

Bird's Eye View

CASE STUDIES

Compatible Models | TDOT 7 GREEN | TDOT 7 GREEN LITE | TDOT 3 GREEN R | TDOT 7 NIR-S | TDOT 7 NIR

Surveying

Robust support for slope disaster prevention consulting services

Although slope surveying field work requires a great deal of labor, a preliminary desk-top study using the 3D data acquired by the TDOT Series can identify landforms that should be checked along with their exact locations. This greatly improves work efficiency and safety. Currently, many municipalities in Japan are actively promoting the use of 3D data for mountainous areas as part of their road disaster prevention DX.

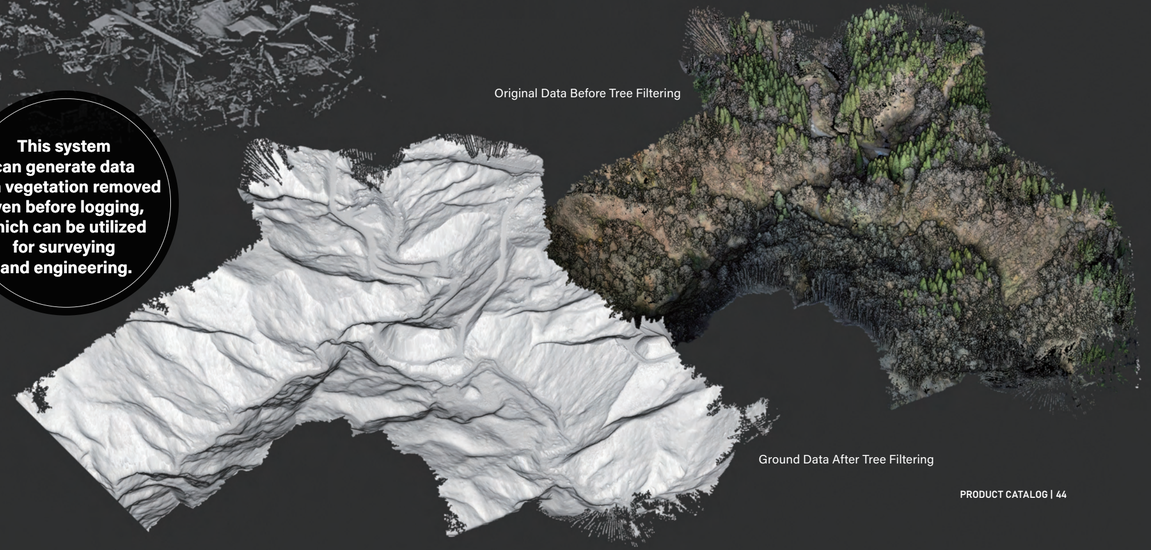
Drone laser surveying enables the acquisition of high-density ground surface data even in mountainous areas covered with trees.

Cross-Section

Bird's Eye View

Cross-Section

Acquire data efficiently and safely even on steep slopes.



Original Data Before Tree Filtering

This system can generate data with vegetation removed even before logging, which can be utilized for surveying and engineering.

Ground Data After Tree Filtering

CASE STUDIES

Compatible Models | TDOT 7 GREEN | TDOT 7 GREEN LITE | TDOT 3 GREEN R | TDOT 7 NIR-S | TDOT 7 NIR

Robust support for understanding the current situation of disaster-stricken areas and disaster assessment operations

The TDOT Series is also an effective tool for disaster sites where a rapid response is required. The lightweight system is easy to carry to the site, and can take off and land by remote control while avoiding hazards. TDOT 7 GREEN, in particular, can acquire accurate data even on wet ground surfaces immediately after torrential rains, and can take advantage of long-duration flights to quickly assess the situation of disaster-stricken areas. It immediately provides the information required for damage assessments.

Before point cloud filtering of collapsed

after point cloud filtering of collapsed

Cross-section view

Filter data to remove trees and visualize the details of landslide terrain.
(Additional software required)

Cross-section part

Enlarged view of the cross-section

CASE STUDIES

Compatible Models | TDOT 7 GREEN | TDOT 7 GREEN LITE | TDOT 3 GREEN R | TDOT 7 NIR-S | TDOT 7 NIR

Investigation

Support for streamlining archaeological site surveys and detailed analyses

The TDOT Series can efficiently measure a large area from takeoff/landing points to remote areas while greatly reducing constraints on flight times. The lightweight design enables mounting on a wide variety of drones, and allows researchers to operate the system themselves even during overseas surveys, making it easy to find structures hidden in trees. Furthermore, the TDOT Series, backed by its long-duration flight performance, can quickly grasp the situation of disaster-stricken areas and provide the data necessary for a damage assessment without delay.

Original data before tree filtering

Cholula, Mexico, site survey case study Trees and buildings are removed to clearly visualize the layout of the archaeological site.

Ground data after tree filtering

Cross-sectional view

Church

Side view

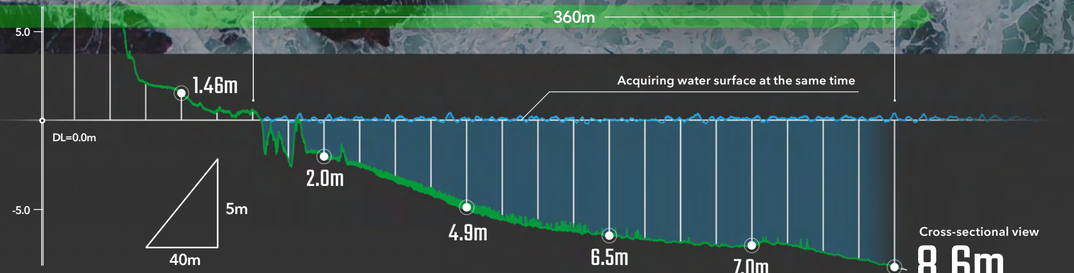
CASE STUDIES

Compatible Models | TDOT 7 GREEN | TDOT 7 GREEN LITE | TDOT 3 GREEN R | TDOT 7 NIR-S | TDOT 7 NIR

Drone-based green laser surveying is expected to acquire effective data for the region-specific countermeasures applied to protect coastal environments because it can capture the detailed seabed topographies of coastal areas that constantly change due to fluctuations in the sea level, coastal currents, wind, and waves.

Efficient support for surveying operations in coastal areas with wave breaking

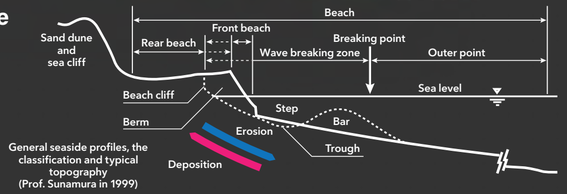
Multi-beam sonic bathymetry is commonly used to survey marine areas, but oceanographic ships struggle to enter shallow waters. For this reason, drone-based green laser surveying, which is capable of immediately identifying the fine topographies of coastal areas, is expected to be utilized for surveying shallow waters. The TDOT GREEN Series employs a high-density laser to accurately acquire data on seabed topographies that are affected by wave breaking, even between waves.



Performed seabed topography surveys 400 m offshore with high accuracy

- **Simulatenously acquired data on the water surface and seabed**
- **Succeeded in surveying to the deepest point of approximately 9 m in a 400-m area offshore**

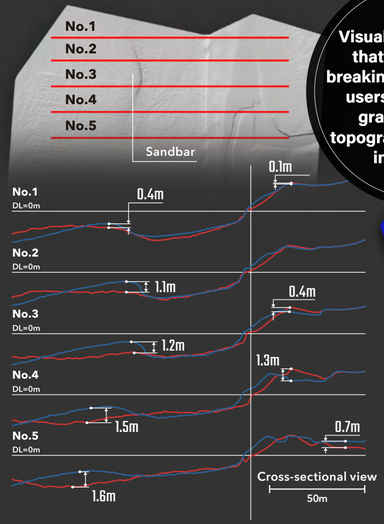
While Japan's coastal areas are an important environment for the growth of marine life, they are strongly affected by changes in sea levels and sea water temperatures due to recent climate change. The TDOT GREEN Series is expected to play an important role in coastal protection projects because it can quickly and efficiently identify subtle topographic changes in coastal areas.



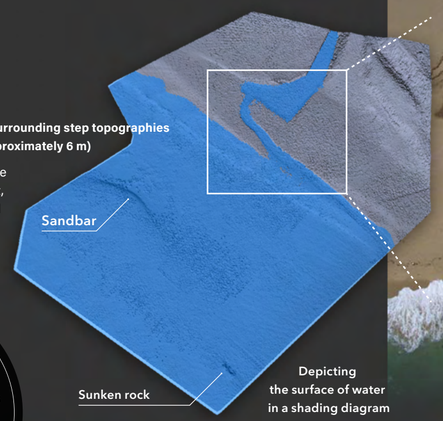
Capable of scanning extensive reaches of shallow sea areas as surfaces

- **Visualized blocked river estuaries, meandering river riverbeds, and shorelines and surrounding step topographies**
- **Accurately visualized the fine shapes of reefs and sandbars in shallow sea areas (approximately 6 m)**

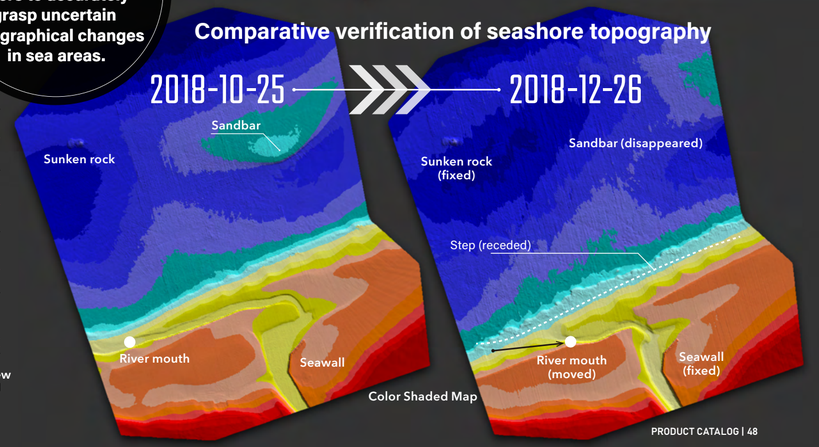
The sandbar previously identified below the water's surface no longer exists, and the entire seabed is extensively flattened. The location of the estuary has significantly shifted east, and the step has receded landward. A beach cusp, an arched shoreline with a rhythmical pattern, is also observed on the landward side of the step. This beach cusp is an important topographical feature when considering the impact of waves on the beach. Surveying with the TDOT GREEN Series is able to clearly detect such topographic changes. Visualizing sandbars that form at wave breaking points enables users to accurately grasp uncertain topographical changes in sea areas.



Visualizing sandbars that form at wave breaking points enables users to accurately grasp uncertain topographical changes in sea areas.



Comparative verification of seashore topography



CASE STUDIES

Compatible Models | TDOT 7 GREEN | TDOT 7 GREEN LITE | TDOT 3 GREEN R | TDOT 7 NIR-S | TDOT 7 NIR

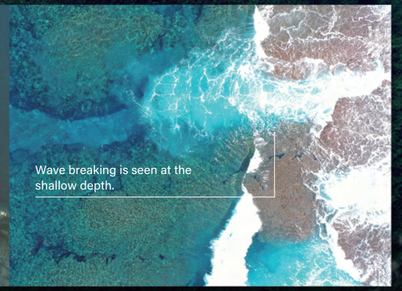
Performed seabed topography surveys with high accuracy in a shallow sea area

The world first **Successfully performed a long-duration seabed topography survey with a hybrid drone-mounted green laser scanner**
Realized efficient and high-definition topographic surveying

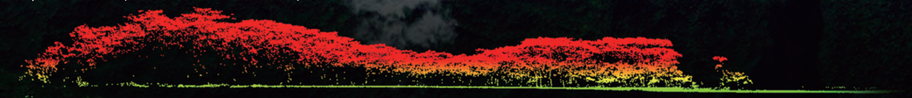
This example demonstrated high-definition and efficient surveying of a seabed topography using TDOT GREEN (early model) mounted on a GLOW.H hybrid drone developed in collaboration with the Port and Airport Research Institute of the National Institute of Maritime, Port and Aviation Technology. The demonstration test was conducted on Iriomote Island in Taketomi Town, Okinawa Prefecture, and surveyed an area of approximately 2.6 km in overall length and 1 km in width from land to a point with a depth of approximately 17 m in four hours. This example successfully acquired the continuous topography of a shallow sea area and the complex topography of coral reefs at high density (spacing: approximately 12 cm) and high accuracy (average height error: ±20 mm). TDOT GREEN revealed topographical features, such as wave breaking zones*1, which are difficult for ships to access, and the spurs and grooves*2 unique to coral reefs.
TDOT GREEN is significantly helping to improve accuracy when predicting wave and landform changes in coastal areas, and to develop coastal geomorphology science.

*1 Wave breaking zone:
An area where waves are affected and deformed by the topography of the seabed as they break up with turbulence.
In particular, a wave breaking zone is likely to occur in locations where the water becomes shallower.
*2 Spurs and grooves:
A topographical feature of coral reefs that consists of grooves and ridges (raised portions) extending perpendicular to the coastline.
Spurs and grooves are seen down to a depth of approximately 20 m, and also affect wave deformation.

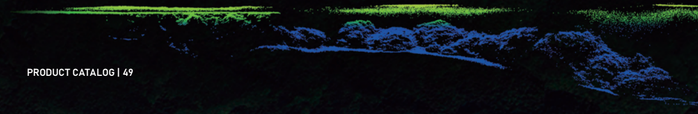
Surveying area
Take-off and landing point
Spurs and grooves



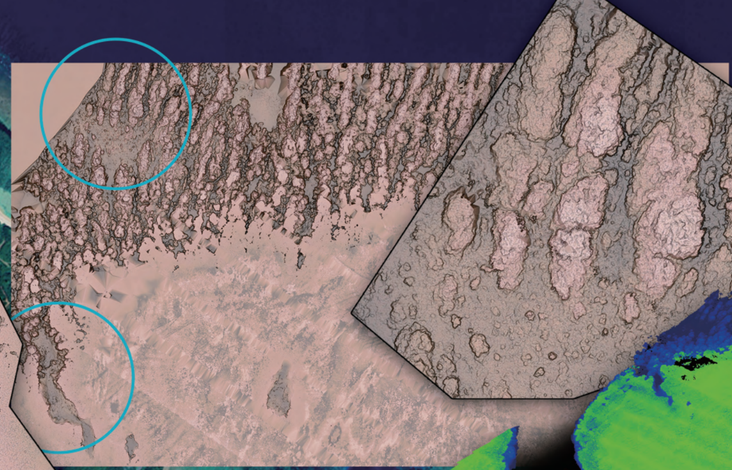
Aerial photo of the site (coral reef in the northwest area)



Cross-sectional view (mangrove forest to coast)



Cross-sectional view (coral reef)



Microtopography analysis map

The survey of this large area of approximately 2.6 km x 1 km was completed in only four hours.

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

Enlarged image

CASE STUDIES

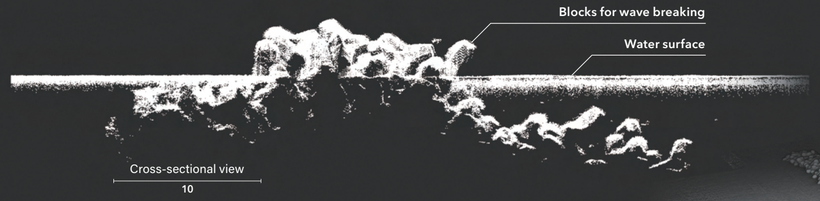
Compatible Models | TDOT 7 GREEN | TDOT 7 GREEN LITE | TDOT 3 GREEN R | TDOT 7 NIR-S | TDOT 7 NIR

Shallow water survey

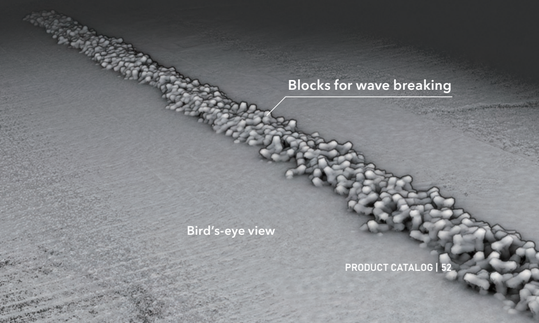
A surveying solution capable of realizing detailed surveys of shallow sea areas

Upstream sediment is constantly carried by rivers, and occasionally remains near the estuary, which may cause concerns regarding river channel blockage from sediments carried downstream after a heavy rainfall. Dynamic monitoring is therefore important after rainfalls. The TDOT GREEN Series facilitates these observations.

Bird's-eye view



In addition, the TDOT GREEN Series can check the status of offshore wave-dissipating blocks to a certain depth, making a significant contribution to the preservation of port facilities during normal times, as well as during typhoons and storm surges.



CASE STUDIES

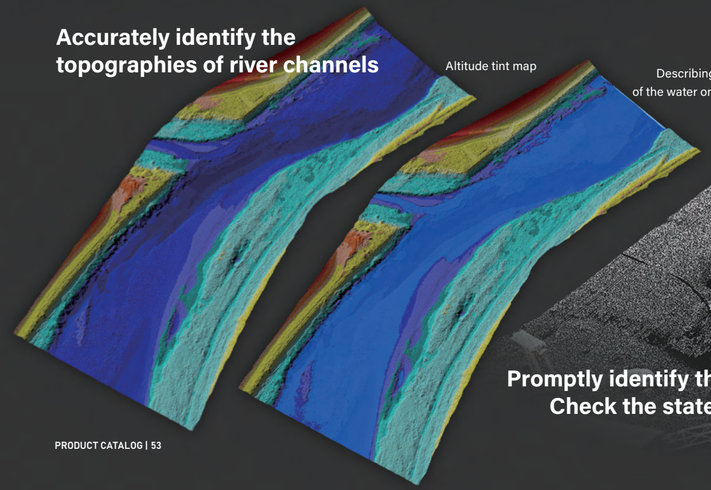
Compatible Models | TDOT 7 GREEN | TDOT 7 GREEN LITE | TDOT 3 GREEN R | TDOT 7 NIR-S | TDOT 7 NIR

River Survey

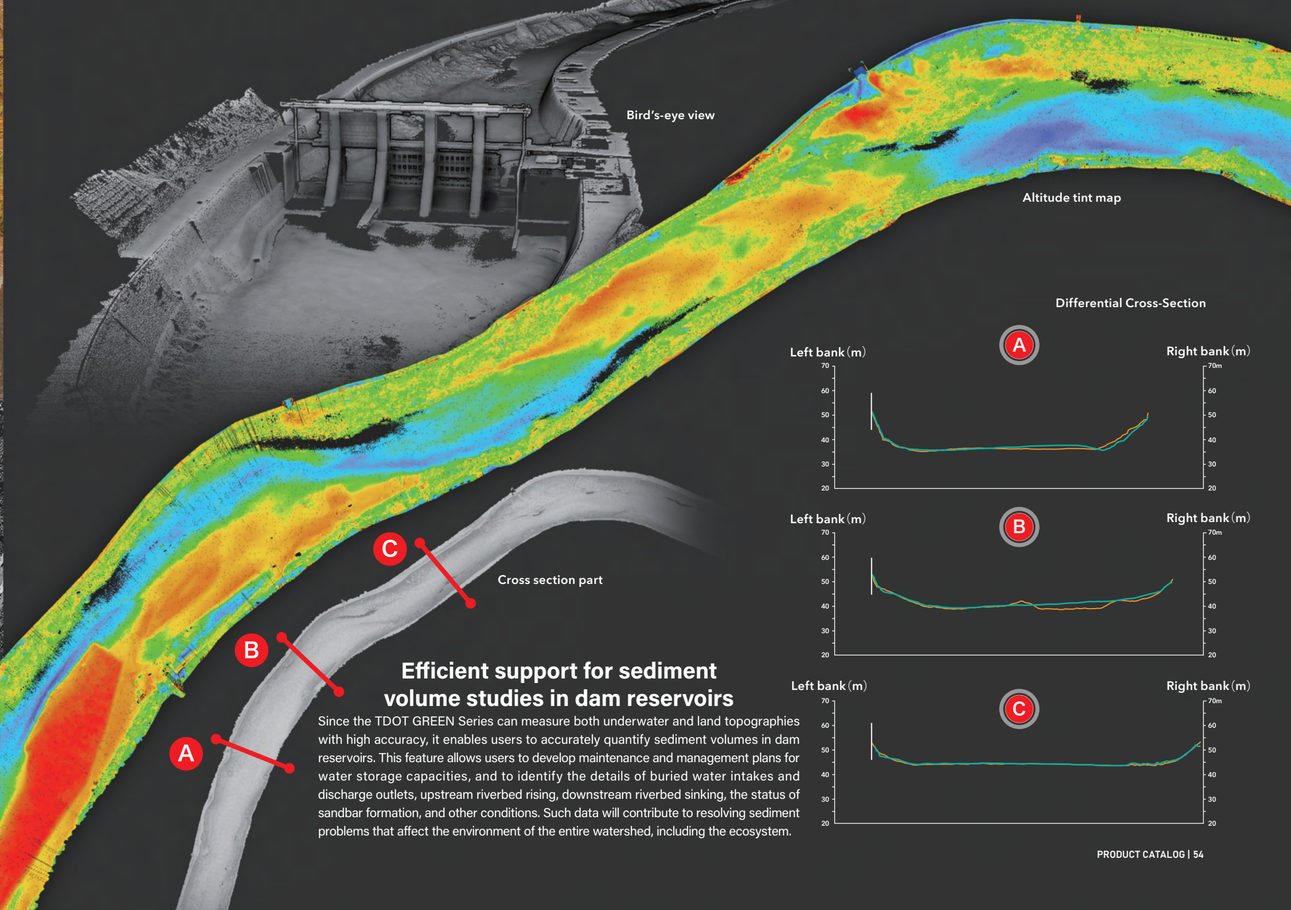
Efficient support for river surveying operations

The TDOT GREEN Series enables surveys of riverbeds in addition to land and targets under vegetation, thereby enabling river channel management using planar 3D data that could not be acquired with conventional regular longitudinal cross-section surveys. Furthermore, evaluating the distribution of trees in the river channel and the shape of the canopy makes it easier to predict sudden changes in river channel cross-sections and the occurrence of dead water areas caused by riparian forests, resulting in improved accuracy for runoff analysis models and water level calculations. This will enhance flood control capabilities and enable community-based river management that considers the preservation and maintenance of the river environment for future generations.

Accurately identify the topographies of river channels



Promptly identify the state of collapsed areas from flooding
Check the state of submerged bridge piers in detail



Efficient support for sediment volume studies in dam reservoirs

Since the TDOT GREEN Series can measure both underwater and land topographies with high accuracy, it enables users to accurately quantify sediment volumes in dam reservoirs. This feature allows users to develop maintenance and management plans for water storage capacities, and to identify the details of buried water intakes and discharge outlets, upstream riverbed rising, downstream riverbed sinking, the status of sandbar formation, and other conditions. Such data will contribute to resolving sediment problems that affect the environment of the entire watershed, including the ecosystem.

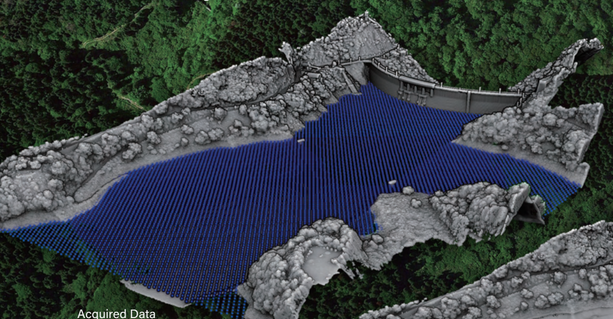
CASE STUDIES

Compatible Models | TDOT 7 GREEN | TDOT 7 GREEN LITE | TDOT 3 GREEN R | TDOT 7 NIR-S | TDOT 7 NIR

Dam Survey

Comprehensive support for dam inspections and surveys

Regularly monitoring the state of sediment in dam reservoirs is essential for maintaining the functionality of dams. While multi-beam bathymetry is effective in deep, turbid water areas, its effect is limited when surveying shallow waters and the water's edge. This is where the TDOT GREEN Series can demonstrate its strengths. By combining these systems, the topographic condition from the depths to the water's edge can be seamlessly identified, resulting in more accurate sediment control and dam preservation.



Acquired Data

Data after water surface removal

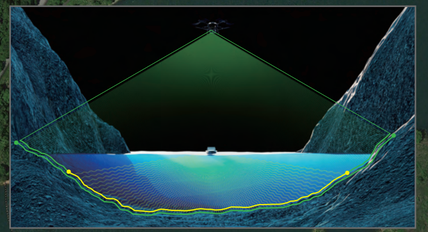
Data after water surface and tree removal

Acquired Data

Data after water surface removal

Data after water surface and tree removal

Boats equipped with multi-beam systems struggle to enter shallow waters

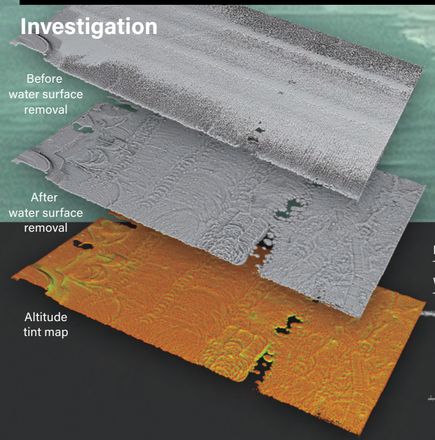


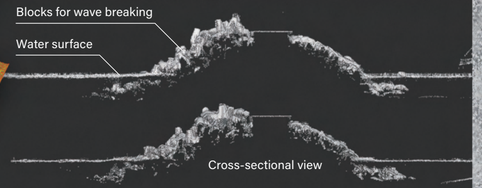
The TDOT GREEN Series, which can perform measurements from the air, realizes extensive and efficient surveying. Multi-beam bathymetry is effective when the water is deep or turbid, but is incapable of acquiring sufficient data up to the water's edge. In such situations, the combination of the TDOT GREEN Series with multi-beam bathymetry ensures flawless data acquisition from the depths to the water's edge. This approach identifies highly accurate topographical features and integrated survey results.

CASE STUDIES

Compatible Models | TDOT 7 GREEN | TDOT 7 GREEN LITE | TDOT 3 GREEN R | TDOT 7 NIR-S | TDOT 7 NIR

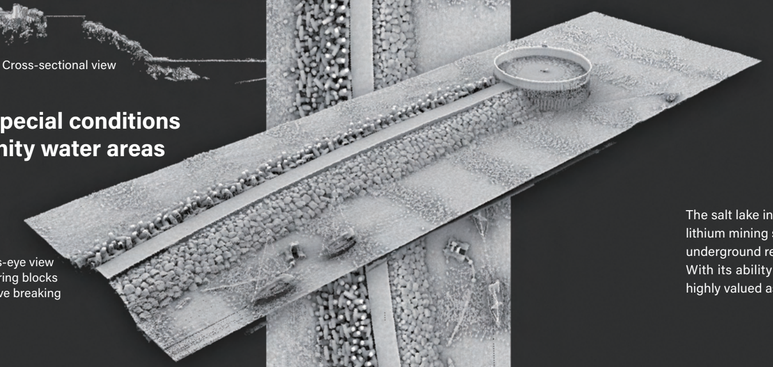
Investigation



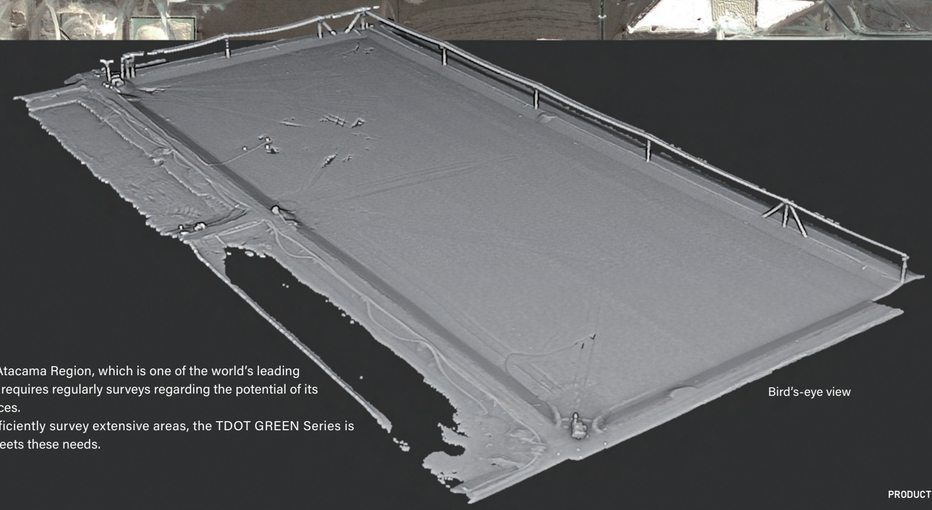


Accurate support for seabed topography surveys under special conditions
Accurately survey seabed topographies even in high-salinity water areas

Laser beams travel slower in water than in air, and become refracted by the water's surface. Underwater surveys therefore require users to designate the position of the water's surface, calculate the impact of laser beam refraction, and correct the coordinates of the underwater point cloud. By using the dedicated "UNDERWATER CORRECT" application, the user only needs to designate the position of the water's surface on the cross-sectional diagram to automatically correct for the impact of the refractive index. In fact, we have succeeded in visualizing the exact seabed topography even in Israel's Dead Sea, a unique salt lake with a salinity of more than 30%.



Bird's-eye view
Capturing blocks for wave breaking



Bird's-eye view

The salt lake in the Atacama Region, which is one of the world's leading lithium mining sites, requires regularly surveys regarding the potential of its underground resources.
With its ability to efficiently survey extensive areas, the TDOT GREEN Series is highly valued as it meets these needs.