Leica CoastalMapper

Superior bathymetric efficiency

Increased efficiency for river & coastal mapping

The Leica CoastalMapper, a new-generation airborne bathymetric LiDAR system, features a groundbreaking sensor that boosts productivity by 250%. This enhancement significantly reduces flight costs, project time, and carbon footprint, allowing for more projects and increased revenue.

Disruptive performance & flexibility

The system captures one million bathymetric and two million topographic points per second, covering 360 km² per hour with RGB imaging at 5 cm GSD and NIR at 7 cm GSD. The Leica helicopter pod enables surveys of complex, high-relief, mountainous coastlines and rivers.

Advanced seamless workflow

Leica Geosystems workflow processing suites provide full waveform analysis, automatic calibration, refraction correction and data classification to extract maximum detail. It includes comprehensive data QC tools for measurement, point density and statistical analysis.

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Leica Geosystems

Leica CoastalMapper product specifications

SENSOR HEAD

Consists of
1 x Theia bathymetric LiDAR unit
1 x Hyperion3 topographic LiDAR unit
1 x MFC250 RGB Camera, 45 mm lens
1 x MFC150 NIR Camera, 45 mm lens
1 x IMU class 5, 500 Hz

Dimensions (l/w/h)
Length: 660 mm
Width: 590 mm
Height: 640 mm
Diameter in mount: 410 mm
Depth under assembling surface: 392 mm

Weight	75 kg

Typical data resolution [1, 2]
Bathymetric data: 4 - 10 points per square m
Topographic data: 10 - 20 points per square m
RGB image: 4 - 5.5 cm GSD
NIR image: 5 - 7.5 cm GSD
Typical swath width bathymetry: Up to 800 m

BATHYMETRIC LIDAR

Laser wavelength [8]	515 nm / 1.030 nm (synchronised and co-aligned pulses)
Laser divergence	2.75 mrad (1/e²)
Bathymetric capture [2]	500 - 1.000 kHz
Depth penetration [1, 3, 7]	$K_d * D_{max} = 3.5$
Return Type	Bathymetric full waveform capture (programable number of returns per pulse)
Operating altitude	600 - 900 m AGL, nominal for bathymetric collection (other altitudes are feasible)
FOV	50° (fixed)
Scan pattern	Circular
Scan speed	Up to 84 Hz (168 scans per second)
Ranging accuracy [4, 11]	< 1 cm (1σ)
Elevation accuracy [3, 5, 6, 7]	IHO special order
Horizontal accuracy [3, 5, 6, 7]	IHO special order
Real-time processing / visualisation	Integrated
Laser classification [8]	Class 4
Water refraction correction	Automatic integrated in workflow

TOPOGRAPHIC LIDAR

Laser wavelength [8]	1.064 nm
Laser divergence	0.17 mrad (1/e²)
Topographic capture	Up to 2.0 MHz (altitude dependent)
Operating altitude [9]	300 m – 6.000 m AGL
FOV	10° - 60° programmable
Scanner pattern	Circular 10° - 60° FOV Elliptical 10° x 60° FOV Skew Ellipse 10° x 60° FOV
Scanner speed	33 - 166 Hz, programmable 66 - 333 scans per second
Return type	Programmable up to 15 returns per pulse at all pulse rates, including intensity (14 bit digitisation) Gateless Multiple Pulses in the Air (MPIA) Waveform recording for each return Waveform attributes for each return
Minimum vertical separation	0.5 m
Ranging accuracy [4, 11]	< 1 cm (1σ)
Vertical accuracy [10, 11, 12]	< 5 cm (1σ)
Horizontal accuracy [10, 11, 12]	< 13 cm (1σ)
Laser classification [8]	Class 4

IMAGING SPECIFICATION (RGB + NIR)

Resolution	RGB: 19.200 x 12.800 pixel (250 MP) NIR: 14.192 x 10.640 pixel (150 MP)
RGB / NIR ratio	1:1.4
FOV	60°
Sensor type	BSI CMOS
Dynamic range	83 dB
A/D conversion	14 bit
Motion compensation	Mechanical forward-motion-compensation (FMC)
Min frame rate	0.8 s
Spectral bands	R (580-660 nm) G (480-590 nm) B (420-510 nm) NIR (720-850 nm, monochrome)
Shutter type	Mechanical central shutter, designed for up to 500.000 cycles, field exchangeable
Aperture	Automatically controlled aperture, 7 half f-stop steps
Real-time processing	Data compression georeferenced thumbnails in flight visualisation and post-flight quality control

INTEGRATED GNSS/IMU SYSTEM

IMU	SPAN CNUS5-H, Class 5, 500 Hz, FOG no export license required US ECCN 7A994
GNSS	NovAtel SPAN OEM7, 555 channel multi constellation receiver with 10 Hz GNSS data rate
Additional feature	Real-time deeply coupled solution for position and attitude at the highest accuracies, fully integrated and embedded solution
Position RMS DGNSS	Post-processed (specification): X,Y ≤ 3-5 cm, Z ≤ 5-7 cm Post processed (typical): X,Y ≤ 2-3 cm, Z ≤ 3-5 cm
Attitude RMS	Post-processed (specification): R,P ≤ 0.005°, H ≤ 0.008° Post-processed (experienced): R,P ≤ 0.003°, H ≤ 0.004°

LASER COOLER

Liquid bathymetric laser cooler	Integrated in sensor head

SENSOR CONTROL UNIT

Dimensions (L/W/H)	640 / 310 / 620 mm
Weight	40 kg

PERIPHERALS

Mass memory [13]	Leica MM60 solid state drive,15.360 GB, 0.4 kg removable and portable Six MM60 required, recording time about [TBD] hours
Operator console	Dual Leica OC61 12.1" screen 3.9 kg
Pilot display	Leica PD61 6.3" screen 1.0 kg
Display stand	IS40-LW stand for dual Leica OC61 operator consoles 3.2 kg
Sensor mount	Leica PAV200 gyro-stabilised sensor mount for high-performance data acquisition, 36.0 kg compensation range: roll -7° to 7°, pitch -8° to 6°, drift -30° to 30°

ENVIRONMENTAL

Pressure	Non-pressurised cabin up to ICAO 25,000 ft
Humidity	0% to 95% RH according to ISO 7137 (non-condensing)
Operating temperature	-10°C to 35°C
Storage temperature	-20°C to 50°C

ELECTRICAL

Max avg. power consumption of complete system	2.300 W / 28 VDC
Max peak power consumption	2.800 W (< 60 s) / 28 VDC
Fuse on aircraft power recommended	2 x 50 A

SYSTEM WEIGHT

Total system installation	180 kg

SOFTWARE

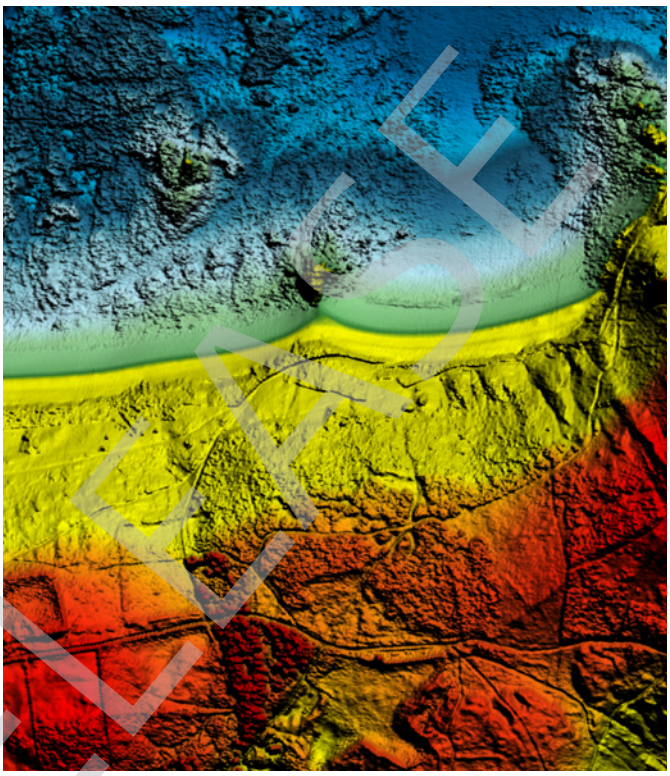
Mission planning	Leica MissionPro
Flight navigation and sensor operation	Leica FlightPro
Flight bathymetry operation	Leica AOC
GNSS / IMU processing	Novatel Inertial Explorer
Topographic point cloud / image processing	Leica HxMap
Bathymetric full waveform processing	Leica HxMap / Leica LiDAR Survey Studio

STANDARDS

RTCA DO-160G, EUROCAE-14G, USA FCC Part 15, ISO 7137, EN/IEC 60825-1:2014, IHO S-44 Ed 6.0

EXPORT CONTROL

Subject to European export regulations EU 2021/821, classifications
- 6A008j.3 (Hardware)
- 6D002 (Software)



[1] Assumed typical bathymetric flight cases 600 m to 875 m AGL flight altitude, 65 m/s flight speed.

[2] Using Leica Geosystems' proprietary 4X technology.

[3] Preliminary at 600 m AGL, system settings optimised for depth penetration. K_d is the water down-dwelling diffuse attenuation coefficient. Formula valid for $0.1 < K_d < 0.4$, even though data can be captured in significant more turbid water up to approximately $K_d = 1.0$.

[4] In Leica Geosystems test lab environment towards flat target.

[5] Stated vertical and horizontal accuracies after calibration and registration using Leica Geosystems workflow and with an assumed GNSS position error of 4 cm. Post-processed data with GPS reference station within 30 km and under good satellite coverage conditions. Wind speed < 5 m / second. Sea-state 3.

[6] Referenced to IHO S-44 Ed 6.0 specification. Transformation errors between ellipsoid and chart datum (not measured by the system) assumed neglectable.

[7] Sea-bed and sea-bed object diffuse reflection assumed =15%

[8] Visible and Invisible laser radiation, avoid eye or skin exposure to direct or scattered radiation. Class 4 laser product in accordance with EN/IEC 60825-1:2014.

[9] Maximum operating altitude is specified for 90% detection at 20% reflectivity (e.g., old dry asphalt), target larger than laser footprint, 100% laser output at 60 degrees FOV.

[10] Accuracy stated is acquired @1,000 m AGL, max. FOV and, 150 knots aircraft speed.

[11] The standard deviation σ represents the 68% confidence interval. Typically, the RMSE value represents 1 σ.

[12] Stated vertical and horisontal accuracies after calibration and registration using Leica HxMap workflow and with an assumed GNSS position error of 4 cm.

[13] Data collection is based on typical image and LiDAR recording modes.

[14] General note on usage of port glass: Leica Geosystems does not guarantee Leica CoastalMapper operation/performance with a port glass installed under the sensor. For operation with port glass a special investigation is needed, where special requirements of port glass coating are defined, the geometry between sensor and port glass is evaluated and restrictions of use cases for sensor are defined, in order to minimise interference between the sensor and port glass.

Revolutionising the world of measurement and survey for nearly 200 years, Leica Geosystems creates complete solutions for professionals across the planet. Known for premium products and innovative solution development, professionals in a diverse mix of industries, such as surveying and engineering, safety and security, building and construction, and power and plant, trust Leica Geosystems to capture, analyse and present smart geospatial data. With the highest-quality instruments, sophisticated software and trusted services, Leica Geosystems delivers value every day to those shaping the future of our world.

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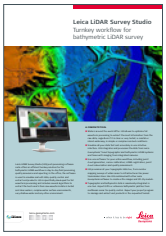
1021137 en – 02.25

Leica Chiroptera-5

Leica HawkEye-5



Leica LiDAR Survey Studio

Leica Geosystems AG
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