Fraunhofer IPM

# Airborne Bathymetric Laser Scanner

## Measuring seabed topography

### Multiwavelength LiDAR for highly precise 3D maps

*Coastline and water depth provide information about the erosion of coastal landscapes. The Airborne Bathymetric Laser Scanner ABS measures shallow waters from the air and provides data for detailed 3D maps.*

**Airborne measurements are particularly efficient for monitoring the depth and level of bodies of water or the course of coastlines. The Airborne Bathymetric Laser Scanner ABS from Fraunhofer IPM was specially developed for surveying shallow waters. Thanks to multi-wavelength pulsed time-of-flight measurement, the ultra-lightweight LiDAR scanner captures the topography of the water body bed very precisely.**

### Ultra-lightweight, compact design

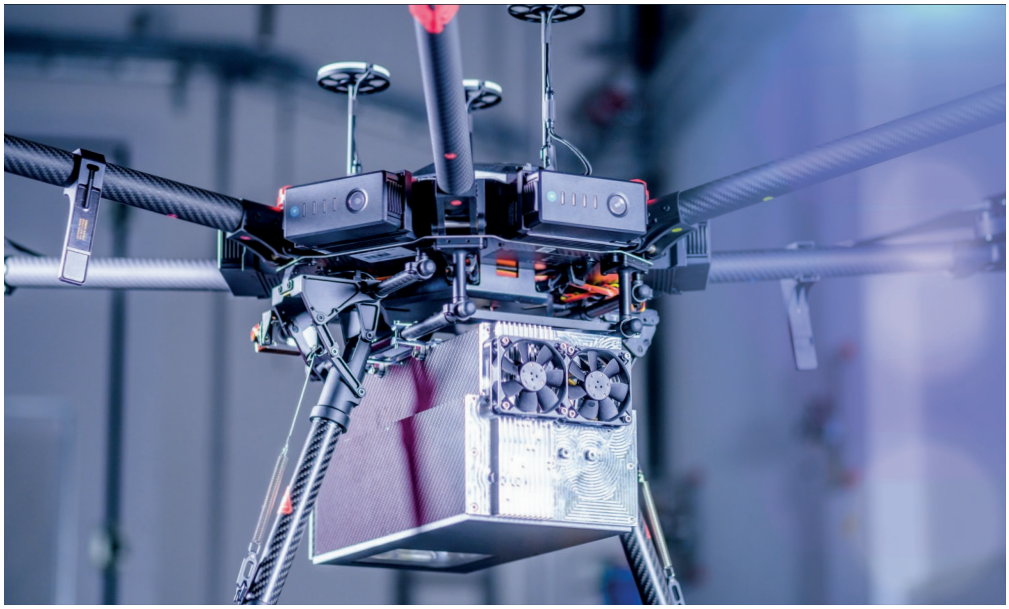
Digital terrain models of water bodies are important for safety in shipping, coastal and flood protection or for documenting the habitat of people, animals, and plants. The Airborne Bathymetric Laser Scanner ABS captures the water surface and depth, but also the peripheral area of water bodies including the adjacent terrain from the air, generating 3D data efficiently and quickly. The light-weight scanner with its compact design can be mounted on commercially available Unmanned Aerial Vehicles (UAV). Based on pulsed time-of flight ranging, it simultaneously captures the environment with two laser beams of different wavelengths. Using two lasers, the undesira-ble effect of light refraction, which makes the water depth appear optically less deep than it actually is, can be corrected. This makes topographic seabed measurements signific-antly more accurate than measurements with just one laser beam. The ABS measures from an altitude of up to 50 m. The recorded data is available as a complete full waveform as well as a point cloud in LAS format.

### Measuring water surface and floor

The laser pulses are emitted at different wave-lengths simultaneously via a nonlinear optical process and internal beam expansion ensures safe operation. A scanning unit deflects the beams, each with a diameter of 50 mm, over the water surface at a full angle of 30°. The infrared light (IR) of 1030 nm wavelength does not penetrate the water and thus provides an

### Advantages at a glance

- High-precision measure-ments multiwavelength laser scanning
- Ultra-lightweight system (approx. 3 kg)
- Deployable on commercial UAV / multicopters
- Customization according to application



*The ABS mounted on a UAV: The 3.3 kg scanner can be mounted on different drone platforms. A GNSS positioning solution is integrated for position determination*

undistorted signal of the water surface. By contrast, the green light (VIS) of 515 nm wavelength propagates to the bottom but is attenuated due to water turbidity. The backscattered light from the IR and VIS lasers is separated by a beam splitter and directed to a suitable detector using a collecting lens. To maximize light yield especially for the attenuated green light, extremely light-sensitive photomultiplier tubes (PMTs) in addition to conventional avalanche photodiodes (APDs) are used.

## Rapid signal conversion

In underwater surveying, the measurement signal consists of complex contributions from water surface, turbidity and water bottom rather than individually separable pulses. Instead of simple pulse detection, it is essential to record and interpret the entire waveform, which requires very fast data processing. The ABS' central FPGA/CPU unit processes up to 50 GB of raw data per second, performing intelligent data reduction. It controls and communicates with other system components and provides all the necessary interfaces. A GNSS/IMU positioning solution can be integrated.

## Integration on UAVs

The shoebox-sized system with a total weight of 3.3 kg can be carried by UAV with a take-off-weight under 25 kg. Fraunhofer IPM supports customers in the customization and integration of the scanner on different platforms.

### Technical specifications

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|---|---|
| Laser | 1030 nm and 515 nm wavelength<br>Class 2M according to EN 60825-1:2014 |
| Laser pulse repetition | 35 kHz |
| Measurement range | 1 Secchi |
| Scanning unit | Tilted rotating mirror |
| Scan unit | Nearly elliptical, 30° beam deflection |
| Dimensions | 325 mm × 155 mm × 165 mm (L × W × H) |
| Weight | 3.3 kg + GNSS positioning unit |
| Interfaces | Gigabit Ethernet, PTP or PPS + NMEA time synchronization, power supply 20 V – 24 V (6 s LiPo battery) |

*All specifications and features are subject to modification without notice.*

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