

PRESS RELEASE

PRESS RELEASEOctober 28, 2025 || page 1 | 3

Hydrography

Researchers test underwater measuring systems in Indonesian waters

A team of German and Indonesian researchers tested sensor technology for underwater and bathymetric measurements in Indonesian waters. The study included two LiDAR sensors from the Fraunhofer Institute for Physical Measurement Techniques IPM. The sensors were purchased by HafenCity University Hamburg and used as part of a large-scale measuring campaign.

The global mapping of seabeds, coastlines, and marine ecosystems is far from complete. Meanwhile, the importance of oceans, lakes, and rivers for economic use is growing. Oil and gas production facilities, offshore wind farms, and dams are examples of an expanding underwater technical infrastructure that requires regular monitoring. To address the mapping gap, HafenCity University Hamburg (HCU) initiated the week-long surveying camp "Pramuka Field Work 2025" in collaboration with the Indonesian Institut Teknologi Bandung (ITB), which is based in Bandung, Java. The research mission was to test different measurement methods in a real marine environment, compare the data quality of various sensors, and subsequently combine all the data into a comprehensive model.

With visibility depths of up to 12 meters, the waters around the Indonesian island of Pramuka offer ideal conditions for underwater measurements. "We wanted to find out what data quality the individual sensor types deliver and how the data complement each other. Especially LiDAR systems offer very high spatial resolution. This allows us to create detailed 3D models of underwater structures," says Prof. Dr.-Ing. Harald Sternberg, head of the Hydrography and Geodesy department at HCU and member of the FIG/IHO/ICA International Board on Standards of Competence for Hydrographic Surveyors and Nautical Cartographers (IBSC).

First-ever combination of drone and underwater LiDAR data

The 34-person research team used various sensors to map the entire coastline of the small island. Test objects were installed at depths of up to 10 meters. The team used a multibeam sonar system (fan echo sounder), a photogrammetry sensor, and two high-end LiDAR systems from Fraunhofer IPM. Laser-based measurement techniques for

Editorial notes

Holger Kock | Communications and Media | Fraunhofer Institute for Physical Measurement Techniques IPM | Georges-Köhler-Allee 301 | 79110 Freiburg, Germany | www.ipm.fraunhofer.de/en | Phone +49 761 8857-129 | holger.kock@ipm.fraunhofer.de

FRAUNHOFER INSTITUTE FOR PHYSICAL MEASUREMENT TECHNIQUES IPM

underwater applications are becoming increasingly important, as they complement data from traditional acoustic or camera-based measurement systems. The Underwater LiDAR System ULi, for example, captures underwater objects in 3D with much greater precision than sonar systems. The Airborne Bathymetric Laser Scanner ABS enables high-resolution bathymetric measurements from the air. "In Indonesia, we used both systems simultaneously for the first time. That means we captured the same scene from the air and underwater with LiDAR. The merged data will once again demonstrate the power of these systems," says Prof. Dr. Alexander Reiterer, head of department at Fraunhofer IPM.

PRESS RELEASE

October 28, 2025 || page 2 | 3

Publicly accessible 3D data model

The processing and evaluation of the enormous amount of measurement data will take several more months. In addition to the generated measurement data, satellite data will be incorporated into the Pramuka coast's publicly accessible data model. The HCU and ITB plan to use the findings from the field trial to improve global hydrographic standards. One thing is clear: mapping bodies of water is becoming increasingly important due to increased economic activity. And the endangered marine ecosystem, with its threatened coral reefs and tons of plastic waste floating on the ocean's surface, also creates challenges for innovative measurement technology.



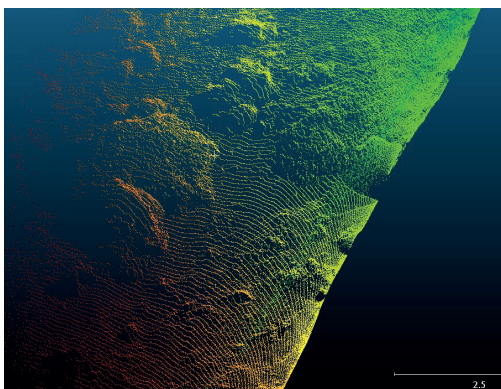
PRESS RELEASEOctober 28, 2025 || page 3 | 3

Employees of the local research partner, ITB, install the Underwater LiDAR System ULi, developed by Fraunhofer IPM, on the boat approx. 50 cm below the water's surface. The ULi measures 3D structures underwater and can dive to depths of hundreds of meters. The scanner detects objects with millimeter precision from distances of up to several tens of meters, depending on the turbidity.

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The Airborne Bathymetric Laser Scanner ABS captures coastal waters from the air and generates a high-resolution image of the underwater topography. © Lars Rathmann



The Underwater LiDAR Scanner ULi collects data from a moving boat. The underwater point cloud, which covers an area of 5×8 m, shows structures such as rocks and plants at a depth of approx. 8 m with high resolution. The scan lines generated by the scanner are also visible. © HCU

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Other contacts

Prof. Dr. Alexander Reiterer | Head of Department Object and Shape Detection | Phone +49 761 8857-83 | alexander.reiterer@ipm.fraunhofer.de | Fraunhofer Institute for Physical Measurement Techniques IPM | www.ipm.fraunhofer.de/en