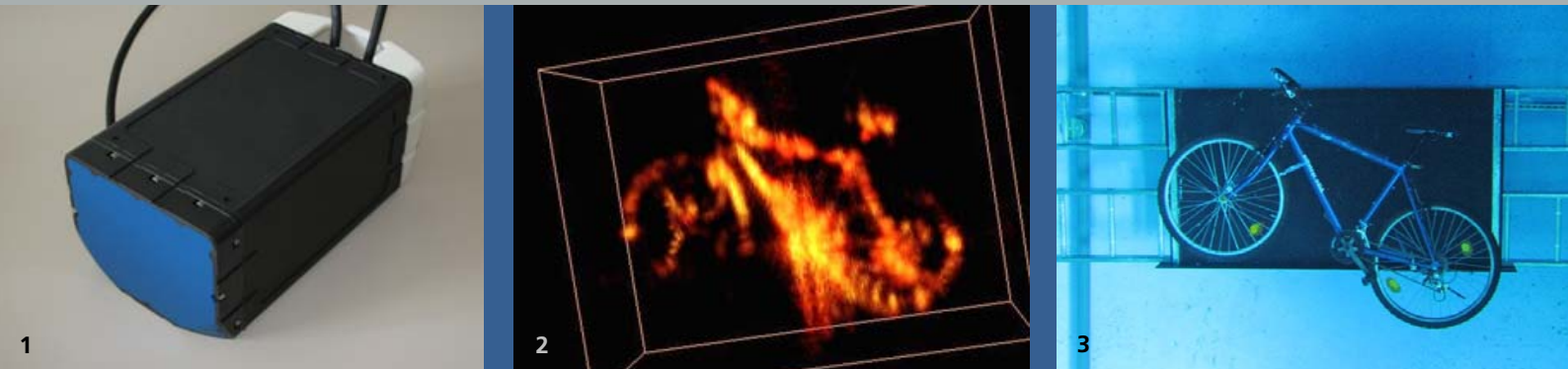




Fraunhofer

IBMT

FRAUNHOFER-INSTITUT FÜR BIOMEDIZINISCHE TECHNIK IBMT



- 1 1 MHz compact Multibeam Echosounder (MBES) for underwater vehicles (e. g. AUV's).
- 2 3D-reconstruction of bicycle shown in picture 3.
- 3 Measurement object "bicycle" in Fraunhofer IBMT tank.

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SONAR TRANSDUCERS AND SYSTEMS

Mapping, Identification, Safety

Modern oceanology and maritime traffic needs a plurality of sensor systems. Researchers and ship captains depend on the availability of reliable and accurate systems for underwater measurements.

Mapping, for example, is one of the basic measurement methods that needs to be performed in oceanology. Mostly Multi-beam-Echosounder (MBES) or Side-scanners are used for this measurement task. The success of such a measurement depends on many parameters. If a single parameter of a system does not meet the requirements of a measurement, the results cannot be ideal. Thus, a huge amount of time and money can be lost.

Therefore, it is very important to carefully adapt a system to the job that needs to be done.

Transducer Technology

Concerning the requirements for range and accuracy, single- or multi-beam sonar systems at different frequencies are developed at IBMT.

Applications like echo-sounding, floor mapping, fish-finding or even mine-hunting can be handled by combining appropriate piezoelectric transducer technology (bulk or composite material) with IBMT's advanced electronic hardware (e. g. DiPhAS, USS or TRM) and fast and robust signal analysis.

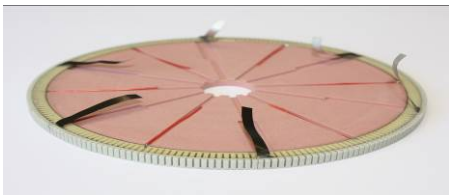
Sensitivity and bandwidth as well as opening angle are the most important acoustic parameters influencing the quality of an acoustic system for underwater measurements.

IBMT uses the complete development chain from transducer simulation, construction (CAD), material tests, prototyping, testing (phantoms, calibration targets) to provide customer-specific solutions for underwater



applications with excellent acoustic parameters.

It is IBMT's strength, building customized transducers. If large opening patterns in combination with high transmit coefficients are demanded, IBMT can use its patented technology to build special curved transducers.



Circular test transducer for antenna calibration.

2D- and 3D-Imaging System

IBMT's compact phased-array system is now available for sonar applications. The system works together with phased-arrays or combinations like mills-cross-antennas and allows 2D- or 3D-measurements. The electronic system works at frequencies of up to 20 MHz with 128 transmit- and 128 receive-channels.

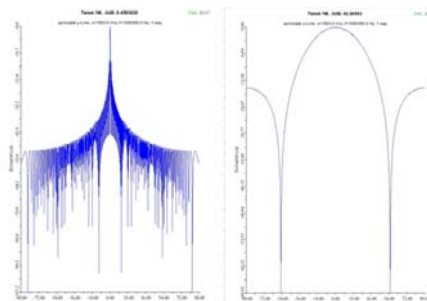
IBMT's latest implementation for harbor and ship hull inspection is a shoe box-sized multibeam echosounder-version of the above mentioned electronics with a compact 128-element, high-bandwidth antenna for high-resolution scanning (frontpage, image 1). Antenna and system form a unit that may easily be integrated in AUV's or ROV's.

Sidescanner

In its basic configuration, IBMT's side-scanner technology uses three sensors at frequencies of 250 kHz, 500 kHz and 1 MHz intended for depths of 180 m, 100 m or 35 m. Depending on the transmit signal resolutions, down to 4 cm can be achieved. For higher resolution e. g. for the crack inspection of concrete components higher frequencies and better resolution are available using the TRM technology. For the use to depths down to 6000 m, a pressure-tolerant setup can be provided.



IBMT 3-frequency sidescanner (electronic is normally pressure-tolerantly integrated in transducer).



Opening angles of 3-frequency sidescanner (250 kHz, 500 kHz, 1 MHz).

Echosounder

From shallow water to deep ocean, echosounders are used for navigational or scientific applications (depth, profile, obstacle, physical or biological structures, etc.). IBMT develops single- or multi-beam echosounder in form of single-element or complex antenna configurations (e. g. sparse-array approach). Combined with the DiPhAS, TRM or USS electronic system, stand-alone or embedded devices can be implemented.

Application-specific user interfaces and signal processing methods (envelope detection, correlation, etc.) can be programmed for an optimal result depending on depth and accuracy-requirements.

Logger

For speed measurement and profiling, IBMT develops Doppler- and correlation-based logger. The current implementation uses a five head Janus configuration with four side-looking and one bottom-looking transducer working at 500 kHz. Together with the Transmit Receive Module TRM both Doppler- and correlation mode can be used for speed logging. An implementation for current profiling (ADCP) is planned for the near future.

- 1 Sonar Test Tank (6 x 8 x 6 m³)
Front: Calibration phantoms.
- 2 AUV payload module with integrated cameras, illumination and IBMTs 3-frequency sidescanner.