



## PROJECT EXAMPLE: SENSOR AND CARRIER SYSTEM FOR THE AUTOMATED ANALYSIS OF SHALLOW WATER AREAS

### Motivation

The database for standing waters of the Brandenburg University of Technology Cottbus records more than 12,200 standing water bodies in Germany. Most of these waters, however, are largely uninvestigated in terms of the bottom structure or objects resting on the bottom or buried in the sediment. Alongside the vast number of inland waters, there are many shallow water and harbour areas along the German coast to which the same unsatisfactory situation applies. A regular, high-resolution and automated survey of these waters is currently not possible. The present surveying is only carried out on the most important waters, and is usually based on the use of small boats which are quite personnel-intensive and only carry out surveys sporadically. Waves, dunes, current and wind are a constant interference, making the survey boat move constantly relative to the measurement point so that corrections have to be made. If maps or images are composed of lots of such corrected measurements points, this leads to distortions which are difficult to correct in their totality.

The need for high-resolution, high-detail measurements that can be carried out by an automated sensor and measurement system is enormous. The applications range from mapping, the inspection of underwater installations and bridge piles to water quality controls, safety issues, searching for missing persons, right up to archaeology. The available systems for automated and high-precision execution of such diverse measurements are inadequate.

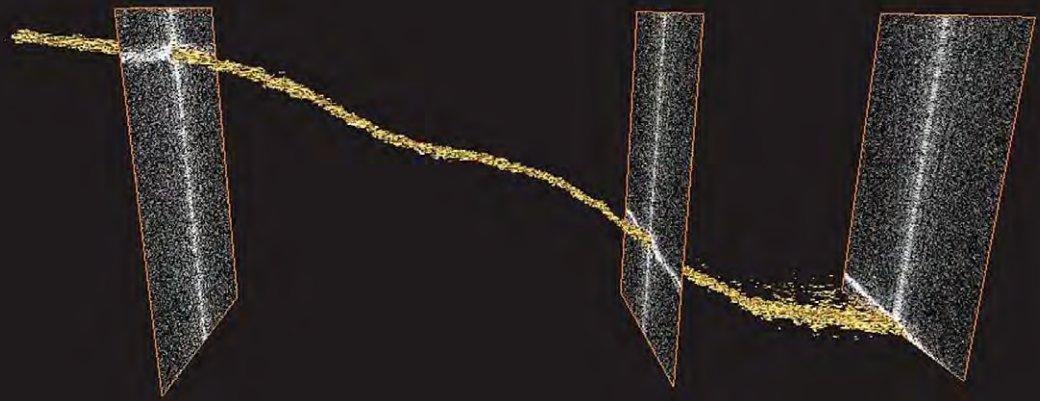
### Project description

A suitable sensor solution with mobile carrier platform sensors is being developed to solve the abovementioned problems. The characteristics of the mobile measurement system (the so-called "Hydrocrawler") will provide ideal operating conditions for the ultrasound sensor technology. This is achieved by an automated control system on the basis of phase-corrected differential GPS data with high manoeuvrability and free drive manoeuvres, rotation around the central axis, movement in all directions with free alignment of the sensor carrier (without prior repositioning), usability in flat water areas and freely defined measurement areas.

In the BMBF-funded project "HyMoBio Strategy", the abovementioned measurement system forms the technological basis for the precise surveying of the ground topography and the upper sediment structure in especially defined areas of Lake Constance (see also [www.hymobiostrategie.de](http://www.hymobiostrategie.de)).

Important steps on the way towards the development include, for example, the development of a Quadro-Pod measurement platform, the programming of suitable vehicle software including mission planning and control, as well as the development of the necessary special sonars. There are plans here for the development of a high-resolution multibeam echosounder as well as the development of a sub-bottom profiler for sediment layers near the bottom.

1 Carrier platform  
"Hydrocrawler".



Nach Abschluss der Technologieentwicklung werden die Messungen an den definierten Arealen des Bodensees durchgeführt und die Daten aufbereitet. Anschließend werden die Ergebnisse zur wissenschaftlichen Ausarbeitung den Partnern des Verbundprojekts wie z. B. dem Limnologischen Institut der Universität Konstanz, der Arbeitsstelle für Feuchtboden- und Unterwasserarchäologie des Landesamts für Denkmalpflege Baden-Württemberg oder dem Institut für Seenforschung der Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg zur Verfügung gestellt.

Wichtige Komponenten und Systemeigenschaften im Überblick:

- Fächer-Echolot (MBES) zur Bestimmung des Bodenprofils
- Sub-Bottom-Profiler zur Bestimmung der Sedimentschichtung
- Multiparametersonde zur Messung hydrographischer Parameter (PH, gelöster Sauerstoff, Trübung, Temperatur, Leitfähigkeit)
- Unterwasserkamera
- hohe Lagestabilität und Manövrierfähigkeit
- Fahrtrichtung und Sensorausrichtung unabhängig voneinander frei wählbar
- Mission frei programmierbar (z. B. auch Dreh- und Kreisfahrmanöver)
- hohe Positionsgenauigkeit (durch 3-fach-GPS-Antenne mit RTK (Genauigkeit +/- 3 cm))

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- 2 *Gemessene Bodentopographie.*
- 3 *Kompakter Multibeam-Echosounder zur Flächenvermessung unter Wasser.*



When the technology is developed, the measurements will be carried out in the defined areas of Lake Constance and the data processed accordingly. Then the results will be made available for scientific research to the partners in the joint project, e. g. the Limnology Institute of the University of Constance, the working group for wetland and submarine archaeology of the State Office for the Preservation of Monuments Baden-Württemberg, or the Institute for Limnology of the Regional Institute for Environment, Surveys and Wildlife Protection Baden-Württemberg.

Important components and system characteristics:

- multibeam echosounder (MBES) to determine the bottom profile
- sub-bottom profiler to determine the sedimentation
- multi-parameter probe for measurement of hydrographic parameters (PH, dissolved oxygen, haze, temperature, conductivity)
- underwater camera
- high stability and manoeuvrability
- drive direction and sensor alignment freely selectable and independent
- mission freely programmable (e. g. including rotating and circling manoeuvres)
- high positional accuracy (due to 3x GPS antenna with RTK (accuracy +/- 3 cm))

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2 Measured bottom topography.

3 Compact Multibeam  
Echosounder for underwater  
surface measurement.