

# Wireless underwater communication technology enables low-cost applications for underwater sensing, navigation and localization

## Summary

Profile type	Company's country	POD reference
<b>Technology offer</b>	<b>Germany</b>	<b>TODE20230525018</b>
Profile status	Type of partnership	Targeted countries
<b>PUBLISHED</b>	<b>Research and development cooperation agreement</b>	<b>• World</b>
Contact Person	Term of validity	Last update
<a href="#">Rita Elste - Tomsone</a>	<b>26 May 2023</b> <b>25 May 2024</b>	<b>26 May 2023</b>

## General Information

### Short summary

A Northern German institute has developed an acoustic underwater modem and investigates autonomous underwater use cases e.g. in aquaculture or environmental- and structural monitoring, where small devices, low power consumption and wireless systems are beneficial.

### Full description

A Northern German institute is conducting research in the field of acoustic underwater communication, localization and navigation for sensor networks and micro autonomous underwater vehicles ( $\mu$ AUVs).

Traditionally, underwater acoustic modems and positioning systems were developed for defence and Oil & Gas industries, that require deep water deployments and extremely reliable systems, focusing on high power expensive systems.

Conversely, recent developments of low-cost unmanned vehicles, such as remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs), suitable for shallow water coastal missions, and the need of sensors network deployments for measuring water quality and studying the effect of climate change in coastal areas, called to the need of low-cost and low-power acoustic modems and positioning systems. The use of these devices can enable a wide set of applications, often based on low-cost AUV swarm formations, where an acoustic link between the vehicles is required to coordinate the mission, perform the maneuvers, and maintain the formation along the time. Moreover, they can make environmental wireless sensor deployment cost effective by substituting wired systems. The institute has developed an underwater modem and holds expertise in the process design and software development

for the sensor equipped hardware that can be used to autonomously communicate and navigate underwater:

- The underwater modem is a miniature, low-power, low-cost wireless underwater communication device based on acoustics (ultrasound). The device has been integrated into  $\mu$ AUVs and a custom surface buoy. It can be easily used in custom devices (e.g., PC, Raspberry Pi, Arduino) via a serial connection. Both the hardware and software have been released under a permissive open-source license (BSD 3-clause), thus it can be used commercially. The device can be used for research purposes but can also serve as ready-to-use wireless communication device in commercial projects.
- The institute is conducting research in the domain of acoustic frequency shift chirp modulation (FSCM) similar to the wireless radio technique LoRa. The primary goal is to develop new modulation techniques for more reliable and higher-speed underwater communication.
- The institute investigates techniques for underwater acoustic localization with little or no additional infrastructure by fusing acoustic localization and inertial measurements. The goal is to achieve autonomous navigation of  $\mu$ AUVs at little overhead and cost.

The institute offers technical cooperation on customization of both, hard- and software to commercial partners, depending on the area of application.

Typical areas of application are environmental health monitoring (e.g. aquaculture monitoring and control, monitoring of illegal inflows in rivers), seabed and infrastructure monitoring, development of devices for data logging and wireless underwater acoustic data transfer etc.

Thanks to the open-source-license allowing commercial use, customization of the low-cost wireless underwater modem can be an innovation opportunity for companies with a background in underwater sensorics or underwater autonomous systems.

The technology has already been tested successfully in first pilot projects.

#### Advantages and innovations

- Microcontroller and software can be customised for specific needs, e.g. to complement or replace existing systems or parts of it.
- Small size and low power consumption.
- Minimized maintenance requirements, as the technology is based on acoustic signals and can transmit small amounts of data wirelessly.
- Available for research purposes, well below market price.

#### Technical specification or expertise sought

#### Stage of development

**Available for demonstration**

#### Sustainable Development goals

- **Goal 9: Industry, Innovation and Infrastructure**
- **Goal 14: Life Below Water**

IPR Status

**No IPR applied**

## Partner Sought

Expected role of the partner

Cooperation is offered to public and private partners that want to explore the technology with their specific use cases.

Type of partnership

**Research and development cooperation agreement**

Type and size of the partner

- **SME 11-49**
- **SME 50 - 249**
- **SME <=10**

## Dissemination

Technology keywords

- **01006009 - Signal Processing**
- **001001004 - Electronic engineering**
- **01006005 - Network Technology, Network Security**
- **01004006 - Environment Management Systems**
- **09003 - Electronic measurement systems**

Targeted countries

- **World**

Market keywords

- **01004005 - Modems and multiplexers**
- **01004003 - Communications processors/network management**
- **02001007 - Other mini and micro computers**
- **01004006 - Other data communication components**
- **01004002 - Data communication components**

Sector groups involved

- **Maritime Industries and Services**
- **Electronics**