

UNMANNED SURFACE VEHICLES

FOR BATHYMETRIC DATA ACQUISITION



OUR SYSTEMS OPERATES UNMANNED IN THE AIR....



Maritime Robotics is a leading provider of innovative Unmanned Vehicle Systems (UVS) for maritime operations in harsh environments.

Our Unmanned technologies and products operate and collect data in the air, on the surface, and on the sea. Our products are within 3 main segments, Unmanned Aircraft Systems (UAS), Moored Balloon Systems (MBS) and Unmanned Surface Vehicles (USV).

With technology and products developed in cooperation with and on demand from civilian, governmental and military users, Maritime Robotics focuses on delivering high-quality system solutions and products that are cost-efficient, reduces HSE risk exposure and are highly deployable, in any conditions.

We believe that the future of maritime operations will enable more unmanned data acquisition, driving industry

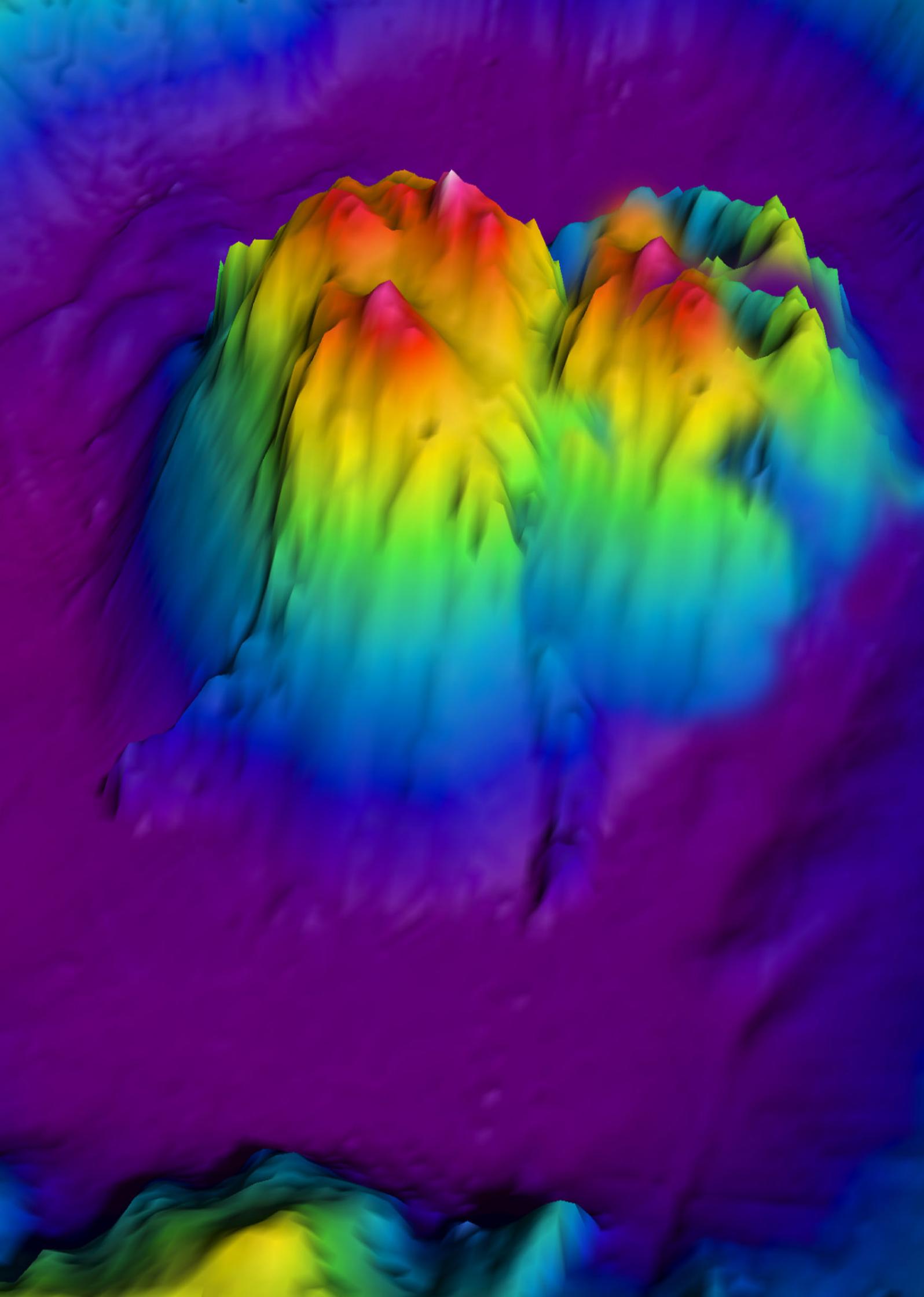
standards and broadening operational possibilities for these products.

Maritime Robotics headquarters is located in Norway's technology capital Trondheim, staffed by a highly competent team of engineers and personnel. For our global clients and partners, our staff will provide support services and assist in finding the right solution for your maritime operations.





...AND ON THE SURFACE



BATHYMETRIC DATA ACQUISITION

Bathymetry is usually performed by sailing a boat with a multibeam sonar in a rather repetitive lawn-mower pattern. The data acquisition should ideally be going on 24/7, but when using manned survey boats this possibility may be limited due to crew HSE regulations. We believe that this is an ideal job for a robotic boat that sails these repetitive patterns 24/7 with the result of saving both costs and reducing HSE risk for survey personnel. The cost-saving and HSE reducing motivations are especially significant in shallow-water surveying.

Maritime Robotics USV systems can be delivered on almost any hull that matches the user's mission profile, and by listening to the market we have chosen

2 standardized sizes for an integrated USV bathymetry system, in addition to the possibility of converting almost any vessel into an Unmanned Surface Vehicle with our USV Conversion System.

Size matters when it comes to sea-state capabilities and endurance, and for open-water and coastal missions the larger MARINER USV will be the obvious choice. Capable of open water operations, (coastal and offshore equipped with diesel engine, the MARINER USV offers a survey endurance of 2 days' continuous operation and a speed range of up to more than 30 knots for rapid transit legs. Slightly below 6 m overall length, it can still fit into a standard cargo-freight container, which makes the MARINER USV a mo-

bile and deployable system. A smaller vehicle can be more flexible and convenient when it comes to sheltered and calm waters. A small USV has obvious advantages, both during shipping and handling at the site of operation, making our new OTTER (of only 200cm length and 95kg weight) an obvious candidate for shorter duration surveys in lakes, canals, rivers, ponds and harbours. Compared to a bigger USV, the OTTER also has a lower price entry point.



SHELTERED WATERS

Our small OTTER is a highly deployable integrated turnkey system for bathymetry in sheltered waters such as small lakes, rivers, ponds and harbours.



OPEN WATERS

For open waters a larger USV would normally be preferred. The MARINER USV offers both the sea-state and the endurance you would need for 24/7 operations in open water areas.



DISCOVER A NEW WORLD

This Short Sunderland airplane sank in 1945, not far from Maritime Robotics headquarters.



THE OTTER

01



Vehicle Control Station

03



Bathymetric Mapping System

04



Custom Payloads

02



20 hours (2kts)



95 kg



WiFi, 4G and optional long range VHF radio link

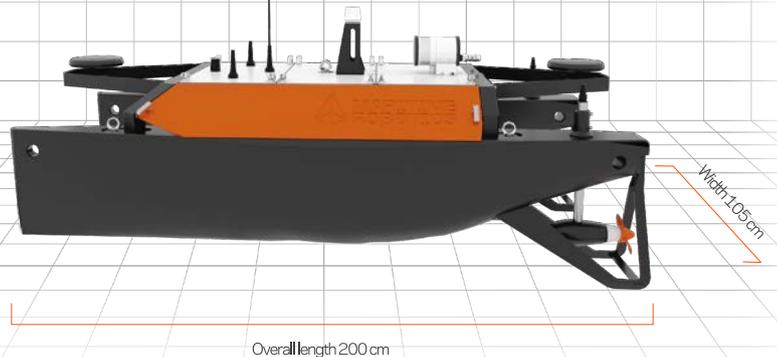


Dual electrical fixed thrusters



Max-speed without sonar: 6kts / with sonar: 4,5kts

Height 85 cm

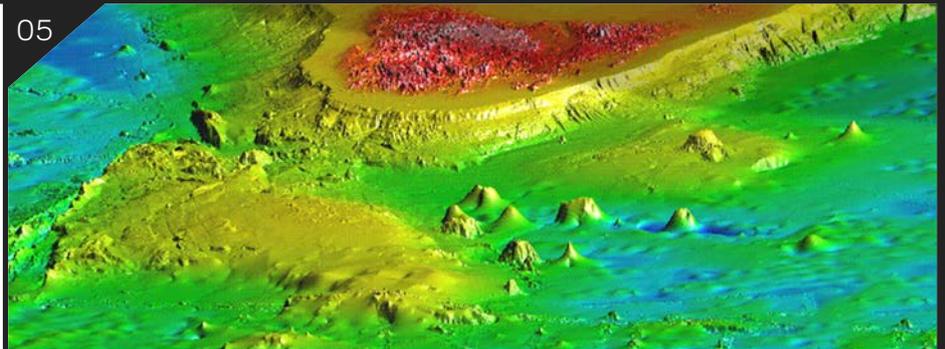


Overall length 200 cm

Width 105 cm

Specifications

05



Bathymetry

01 VEHICLE CONTROL STATION

Sensor and payload data can be monitored in the Vehicle Control Station. Multibeam data, swath width, coverage area, and quality parameters can be displayed in real-time on an intuitive user interface.

02 SPECIFICATIONS

20 hours endurance with 2kts, 95kg total weight, Wifi, 4G and optional long range radio link. Dimensions: 200cm x 105cm x 85cm. The OTTER can be dismantled into smaller components (hulls, mid-section, batteries and payload), so that one person can transport the OTTER to the site of interest.

03 BATHYMETRIC MAPPING SYSTEM

Ultra-compact singlebeam and multibeam sonar systems are available for integration for the OTTER. This makes the OTTER a turnkey bathymetric survey system for sheltered waters.

04 CUSTOM SENSOR INTEGRATION

Sensors such as ADCP, CTD, fluorometers, hyperspectral imager and other environmental sensors is easily and cost-efficient integrated.

05 BATHYMETRY

Repetitive tasks like bathymetry are an ideal task for an automated robotic system. The OTTER performs these tasks without the expense or extensive resources involved in traditional surveys.



THE MARINER

01



MARINER USV

03



Vehicle Control Station

02

 50 hours (5kts)

 1700 kg

 10nm typical radio range (VHF/UHF/C-band)

 Global range with SatCom/Mobile data

 35kts max speed

 Echosounder, sonar, acoustic positioning

 METOC, CTD, ADCP

 EO/IR cameras

 Radar, lidar

 Bow thruster

Height 200cm

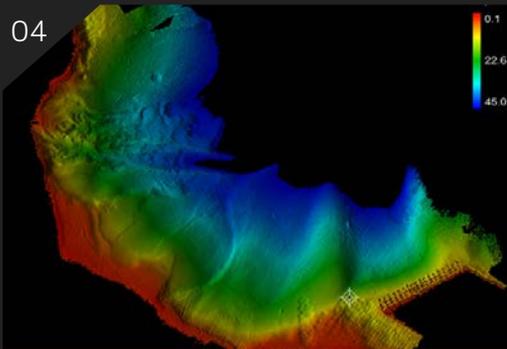


Overall length 585cm

Width 205cm

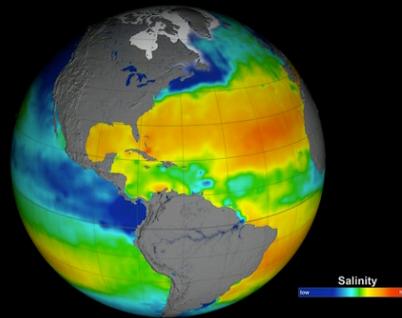
Specifications

04



Bathymetry

05



Environmental Monitoring

06



Hydroacoustic Communication

01 MARINER UNMANNED SURFACE VEHICLE (USV)

The MARINER USV is a cost-efficient system for maritime data acquisition that has been proven in both offshore and coastal scenarios.

02 SPECIFICATIONS

Versatile for both faster speed patrolling and slower speed surveying, a large variety of payload and sensors can be integrated on the MARINER. The MARINER can be easily shipped worldwide in a standard 20feet container.

03 VEHICLE CONTROL STATION (VCS)

The USV operator interacts with the MARINER through the Vehicle Control Station usually located on-shore or on a mother-vessel. The intuitive graphical user interface with sea-map, AIS, video and radar overlay can also be augmented with AIS and radar-based collision

04 BATHYMETRY

Unmanned Surface Vehicles offers a great advantage in repetitive and tedious missions. Bathymetry is an application where we now see a great potential for a seabed-mapping USV.

05 ENVIRONMENTAL MONITORING

Knowledge and data from our oceans are crucial for a sustainable future. Unmanned Surface Vehicles can carry oceanographic sensors in ways that has usually been too expensive or risky.

06 HYDROACOUSTIC COMMUNICATION

Robots helping other robots is the next frontier, and we are starting to see that underwater Remotely Operated Vehicles (ROV) and Autonomous Underwater Vehicle (AUV) operations can be made possible due to the very cost-efficient capability of having a USV as a communication relay and support platform on the sea-surface.



Maritime Robotics' new *Vehicle Control Station room*



USV CONVERSION SYSTEM

Some users want the option of using their survey boat in an unmanned mode, while still having the option of manned use. Other users see a potential in using Unmanned Surface Vehicles, but are not yet ready to take the cost of investing in a custom USV platform. For those users the Maritime Robotics USV Conversion System offers a unique opportunity to take advantage of the possibilities for unmanned surface operations.

The USV Conversion System includes the same Vehicle Control Station, Communication and On-Board-Systems as the more integrated MARINER USV system, but can also be highly customized for your special need and requirements.

For bathymetric survey we often see that many users have invested in customized smaller manned survey boats. These users can now transform their boat into unmanned operations and thus achieving the HSE and cost-saving features of unmanned operation.



THE CONVERSION SYSTEM

The onboard Conversion System consists of the Main Control Unit (MCU) and the Low-Level Control Unit (LCU). The system has a compact size that allows a flexible integration.



CONVERSION OF MILITARY BOATS

We have also converted military patrol boats to unmanned operations.



CONVERTED FUGRO Alumaster

Fugro has chosen Maritime Robotics Conversion System to give their Alumaster survey vessel capabilities.



FORMATION CONTROL

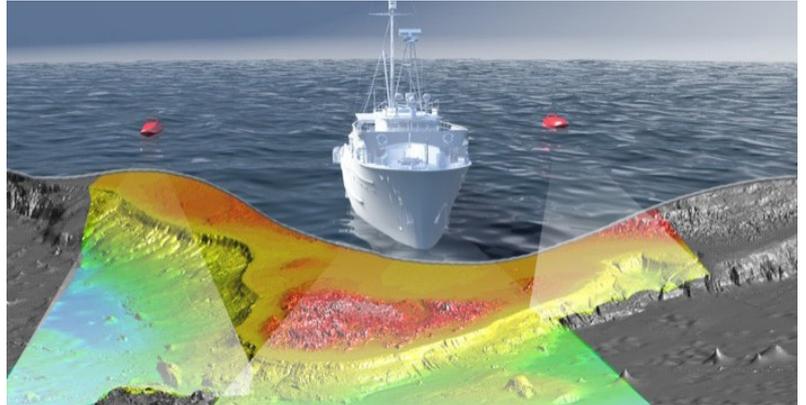
In the year 2008 Maritime Robotics and the Norwegian University of Technology and Science (NTNU) demoed what we still claim was “the world’s first full-scale demo of unmanned formation controlled boats”. At that time, we clearly saw a potential, but did not yet have a clear view of all the possibilities this technology could open up for. Since then, our internationally patented Formation Control System has been developed into a ready-to-go product for users who want to spread out sensor carrying boats over a larger water area, giving the possibility of controlling your fleet of multiple vessels like it was one single unit.

For multibeam bathymetry we have also improved the Formation Control System to use the information about the seabed footprint of the multibeam as a direct guidance input for the formation. The surveyor can then decide the required multibeam overlap that he wants, and then the Formation Control System takes care of the rest.

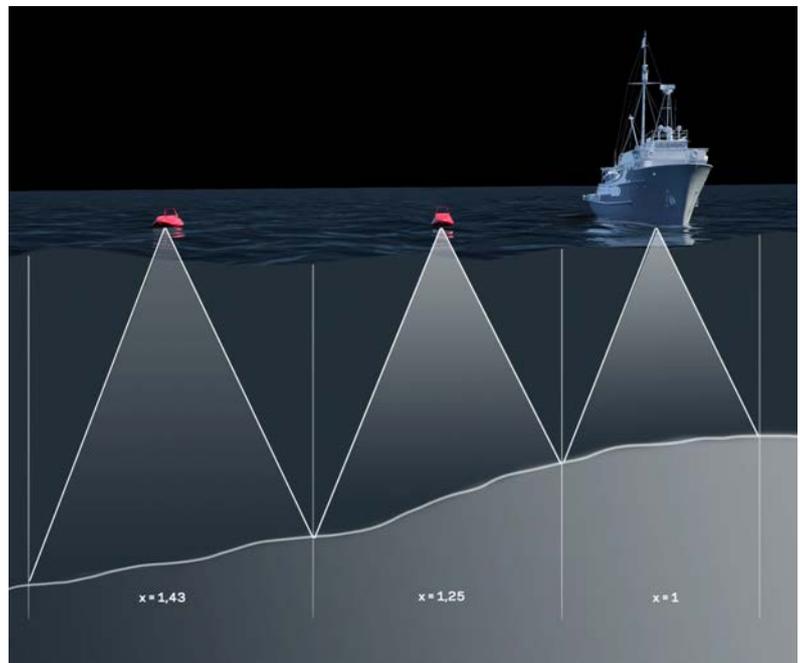
Our innovative Formation Control System has been accepted with a US patent no.9151858 B2, EP patent no. 2198355 B1 and NO patent no. 327433.



The Formation Control System in use for shallow water bathymetry. The leader vessel typically sails over the shallowest part close to shore, and the unmanned “slaves” then dynamically adapt their path for maximum efficiency.



Any existing bathymetry survey ship can be equipped with the Formation Control System, leading to great improvements in data collection per time unit.



Maritime Robotics Formation Control System automatically adjusts the relative distance between the sensor carrying boats so that optimal coverage and no gaps in the dataset occurs.





Unmanned Surface Vehicle

MARTIN



UNMANNED SYSTEMS

COST EFFICIENT AND RISK-REDUCING MARITIME DATA ACQUISITION

A LEADER IN UNMANNED SOLUTIONS

Maritime Robotics is a leading provider of innovative unmanned solutions for maritime operations and data acquisition. The company develops and delivers Unmanned Surface Vehicle Systems (USV), Moored Balloon Systems (MBS) as well as Unmanned Aircraft Systems (UAS). Our main markets are geophysical surveying, oil & gas, environmental monitoring, and the defence/security market. With technology developed in close collaboration with civilian, governmental and military partners, Maritime Robotics focuses on delivering high-quality system solutions and products that are cost-efficient, reduce HSE risk exposure and are highly deployable, in any conditions.



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