



# Unlocking the Depths

Advancing Marine Survey and Inspection with  
Autonomous Platforms at the  
Deutsche Bucht Offshore Wind Farm

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12.03.2024 at Oceanology International

# Subsea Europe Services in a Nutshell



Subsea Europe Services' mission is to **simplify marine data acquisition and analysis** by delivering integrated survey solutions and software applications that merge autonomous high-quality data collection with enriched analytical capabilities, adding **significant value for our customers**.

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- Established in January 2020
  - Logistics hub in Halstenbek, Germany
  - R&D Center in Rostock, Germany
  - Rental, Sales & Services for Hydrographic Survey Equipment
  - Development of integrated Survey and Inspection Systems
  - Survey as a Service
  - Inspection as a Service
  - Maritime Security as a Service







# The Maritime Data Challenge

Organizations in Offshore Energy, Shipping, Maritime Infrastructure and Environmental Monitoring have in common that they need **detailed information** from **large areas** over **many years** to fortify their business foundations and safeguard their assets.

This **data is vital** for optimizing operations, mitigating risks, and promoting sustainability and security within their respective domains.





**Conventional** methods of generating and analyzing marine data involving **crewed vessels** and **human data analysts**, are notably costly leaving the full potential of such data largely untapped.





# The O&M-Task



# The O&M-Task

Annual survey and inspection of  
25 % (100 %) of the

- Foundations of the Wind Turbine Generators
- Foundations of the Offshore Substations
- Inter-Array Cables
- Cathodic Protection
- Cable Protection Systems





# Challenges







# The Mothership Approach

# Mothership Ops vs. Conventional Vessel



Autonomous Survey System  
Operating from Mothership  
A few EUR per day\*

VS.



Large Survey Vessel  
Operating alone  
15k - 50k EUR per day





# Mothership Approach – Prerequisites

## Capable Technology

- Platform (USV) capable of handling higher sea-states in an OWP
- Sensor payload capable of handling small platforms with a lot of movement
- Communication devices capable of handling long distances between Mothership and USV

## “True Autonomy”

- Autonomy of Platform and Sensor Payload must have a high autonomy level
- Platform and Sensor Payload must be tightly coupled
- Data must flow from Platform to Cloud and back with very little latency

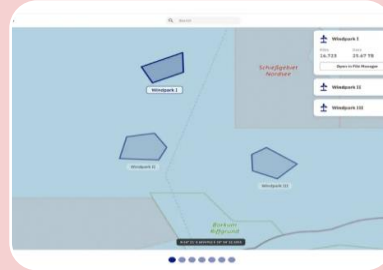
## Residence in OWP

- Survey and Inspection Systems must be resident in OWP to achieve maximum savings
- Residence can be achieved by using existing vessels, such as SOV and CTV
- Minimum-manning must be as low as possible



# True Autonomy

**True Autonomy** breaks down the silos between safe and efficient navigation, high-quality data acquisition and extraction of **high-value information**.



## Survey Autonomy Factor

Autonomy Factor 0.5:  
A ratio of 2 systems per  
1 operator targeted

## Survey Autonomy Level

Autonomy Level 4-5:  
Full automation of  
platform and payload >  
80% of survey time

## Project Workflow Automation

Automated planning,  
simulation, surveying,  
data processing and  
reporting

## Ping to Cloud

All data is transferred  
directly to the cloud,  
where it is stored and  
processed – from  
planning and processing  
to the final report



## Data as a Service

All historical data is  
indexed and searchable  
by time, location,  
project, and client,  
allowing for value-  
adding data products









# Survey Autonomy Level

	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
	No Automation	Driver Assistance	Partial Automation	Conditional automation	High Automation	Full Automation
 Car	Driver controls everything.	Most functions controlled by driver but some can be done automatically by the car.	At least 2 critical functions are automated (like cruise control & line centering), but the driver must be ready to take control.	Drivers still necessary, but not required to monitor the situation all the time.	Vehicle performs safety-critical driving functions for the entire trip, human override is still an option.	Vehicle performs all driving tasks under all conditions. No human attention or interaction required!
 Ship	Same a car	Same a car	Same a car	Same a car	Same a car	Same a car



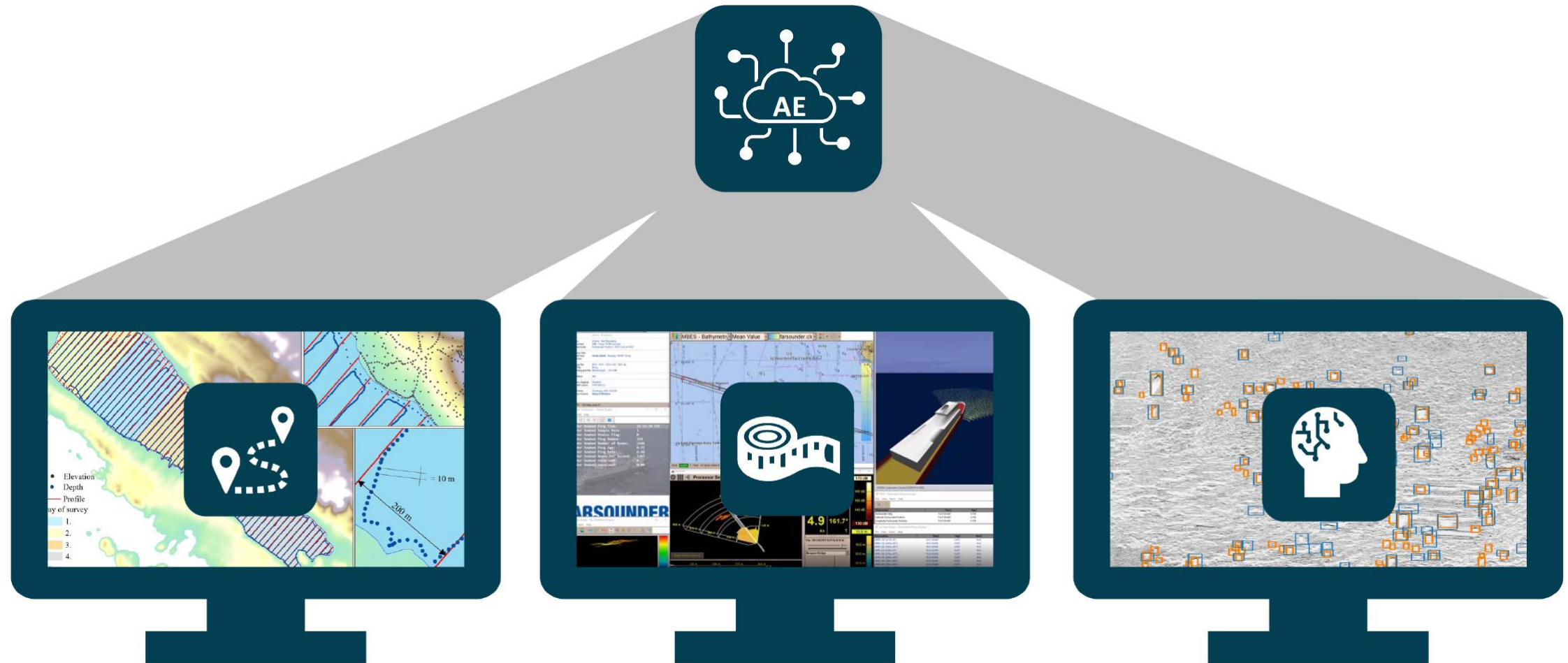
# Survey Autonomy Level

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<b>Car</b> 	Driver controls everything.	Most functions controlled by driver but some can be done automatically by the car.	At least 2 critical functions are automated (like cruise control & line centering), but the driver must be ready to take control.	Drivers still necessary, but not required to monitor the situation all the time.	Vehicle performs safety-critical driving functions for the entire trip, human override is still an option.	Vehicle performs all driving tasks under all conditions. No human attention or interaction required!
<b>Ship</b> 	Same a car	Same a car	Same a car	Same a car	Same a car	Same a car
<b>Sensor</b> 	Surveyor controls everything	Most functions controlled by surveyor but some can be done automatically by the sensor.	At least 2 critical functions are automated (like range and gate track), but the surveyor must be ready to take control	Sensor performs critical functions automated (range, gate, swath, power). Surveyor still necessary, but not required to monitor sensor all the time.	Sensor performs all functions automated, human override is still an option.	Sensor performs all survey tasks under all conditions. No human attention or interaction required!
<b>Survey System</b> 	Captain and Surveyor control everything.	Most functions controlled by captain and surveyor but some can be done automatically by ship and sensor (independently).	At least 2 critical functions are automated for both, ship and sensor (still independently).	Survey System (ship + sensor) are loosely coupled and perform critical functions as an coupled system.	Survey System (ship + sensor) are tightly coupled and perform all functions as an integrated system, human override is still an option.	Survey System (ship + sensor) are tightly coupled and perform all functions as an integrated system. No human attention or interaction required!





# The Software (Autonomy Engine)



Autonomous Planner

Autonomous Operator

Autonomous Analyst



# The Hardware

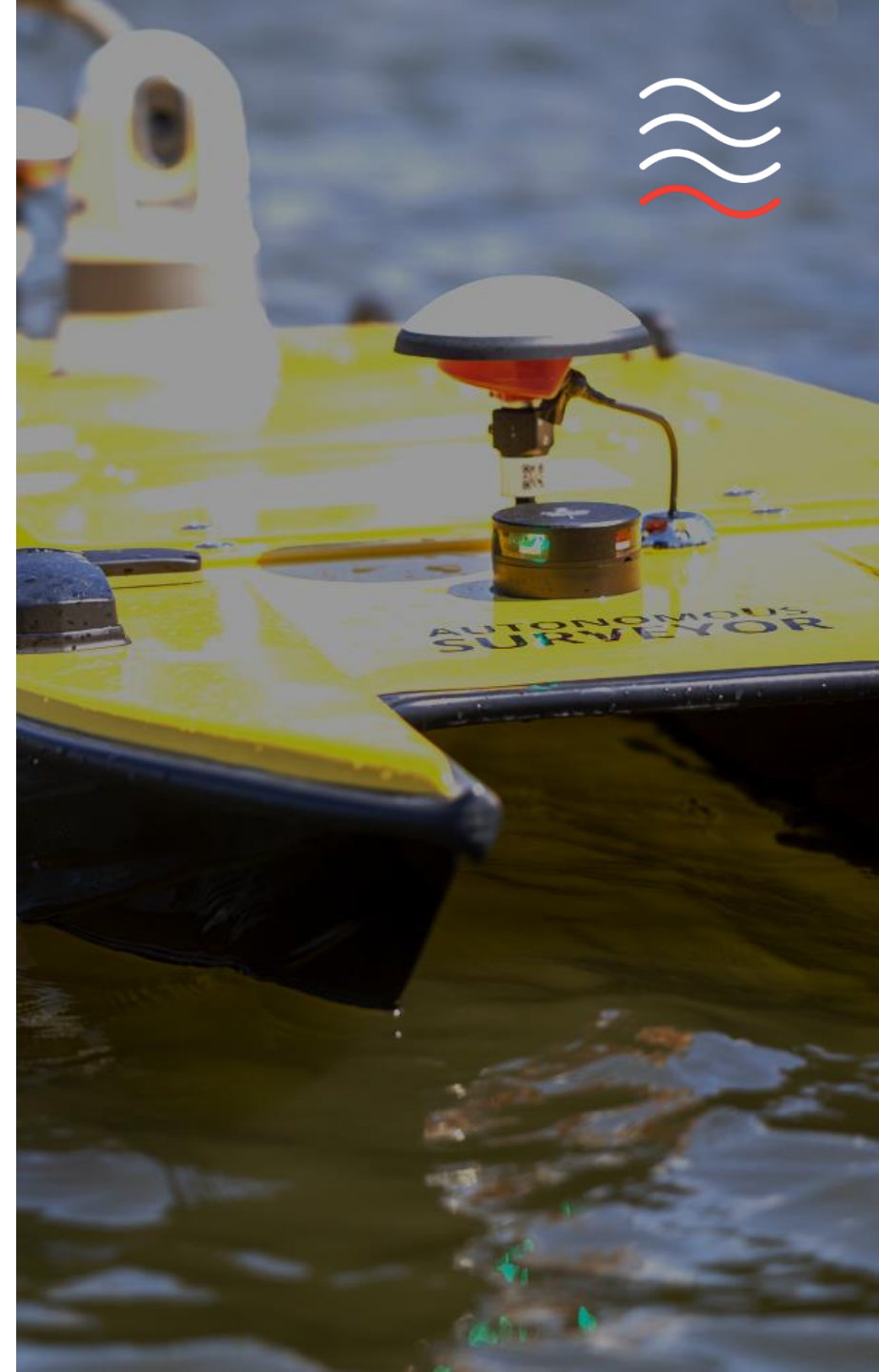


# USV – MANTAS T12

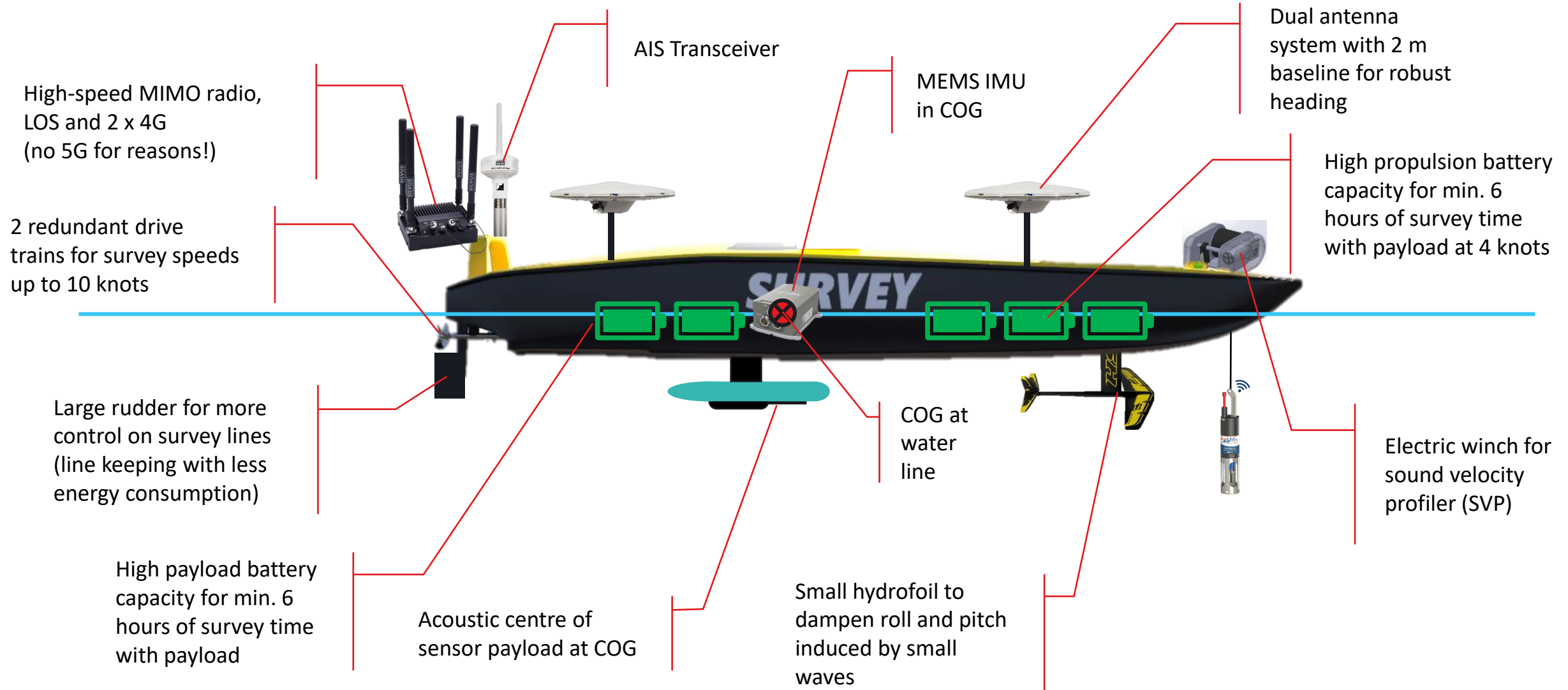
- 3.6-meter uncrewed surface vehicle of the "X-class" (originally for military use)
- Fully electric drive with replaceable batteries for up to 6 hours of surveying operation with 1 battery (12h or 24h with quick battery change)
- Extremely low CO2 footprint for surveying sensitive areas (offshore wind, renaturation, etc.)
- Sensor connection via own "Autonomy Engine"
- Suitable to be handled from any davit or deck crane from any vessel of opportunity (mothership), or deployed from shore
- Launch, recovery and operations until Hs 1.5 m

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➤ **Commercial proof-of-concept for offshore wind farm "Deutsche Bucht" (Northland Power) in July 2023**



# USV – MANTAS T12



# Mothership as Force Multiplier





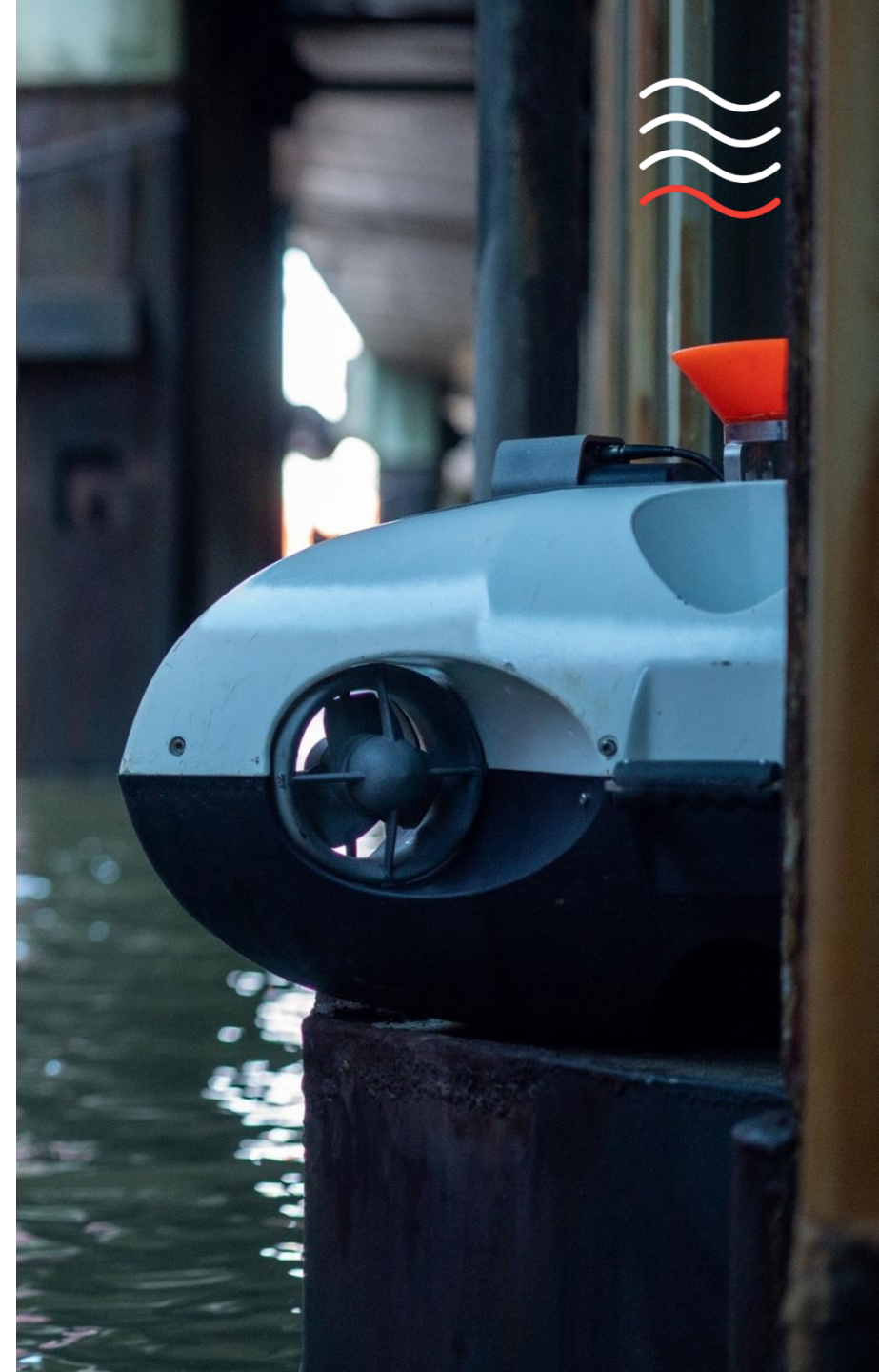
# BeeX – A.IKANBILIS

- Hovering Autonomous Underwater Vehicle (HAUV)
- For fully automated inspection of underwater structures
- Georeferenced, real-time reporting via a cloud-based platform
- Tethered and untethered operations
- Launch, recovery and operations from mothership, TP or Platform (OSS, Converter Station) until Hs 1.5 m
- Market access through consortium between SES and BeeX

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**BeeX is exhibiting at R10**

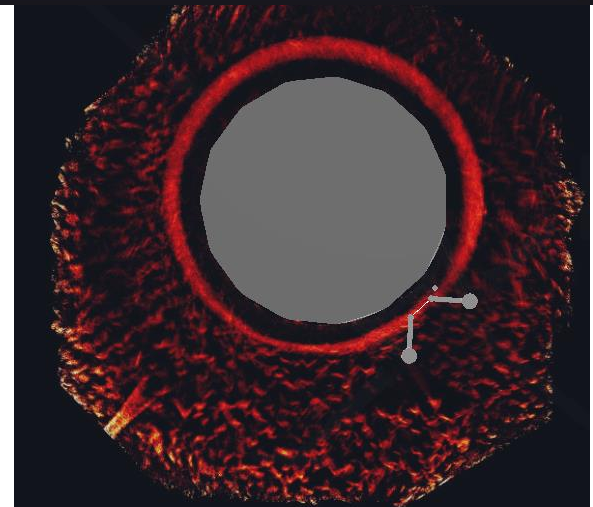
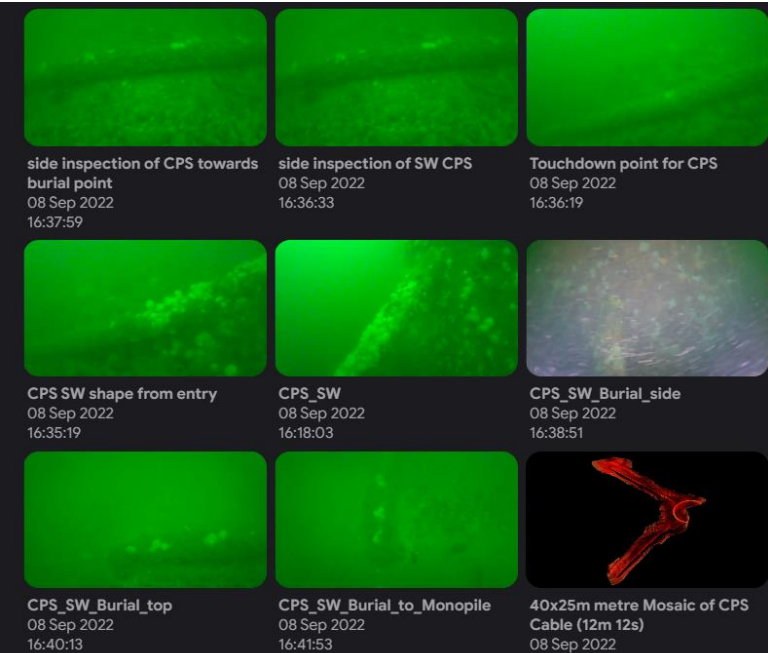
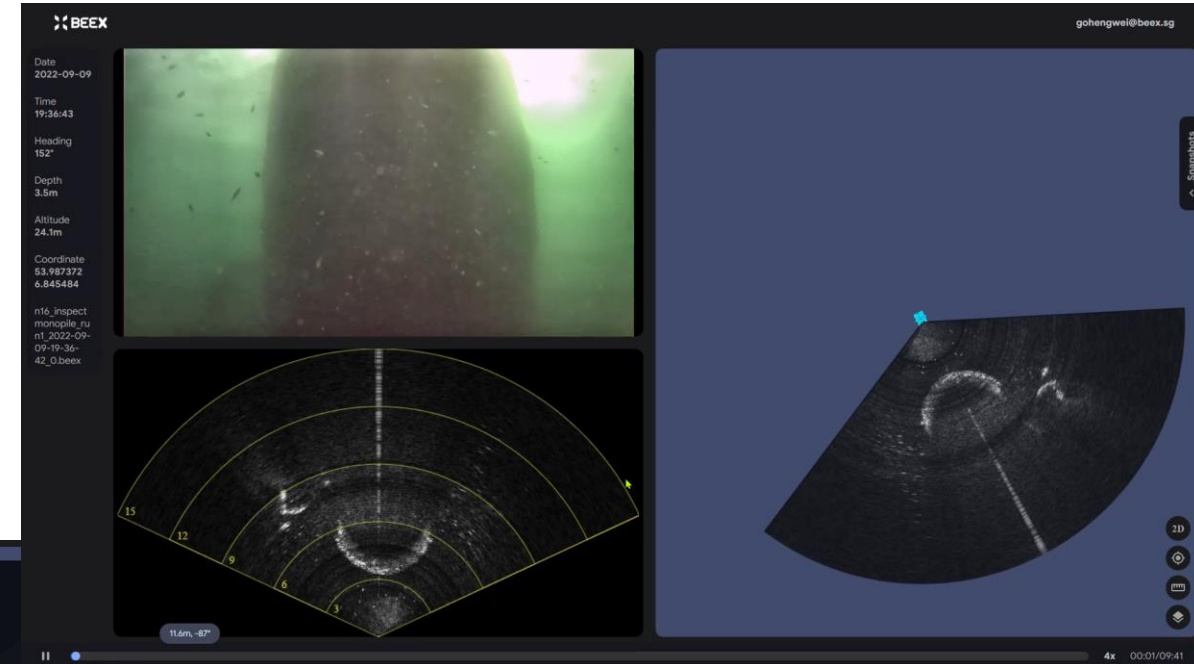
**Dockside Demos at Cabin 2, daily from 14:00 - 14:30**



# Offshore Wind Farm – Monopile Inspection



- Fully autonomous monopile inspection
- and CP assessment
- 3D surveys and 2D mosaic for scour protection
- Cloud-based automated reporting and geo-referenced analysis







# Benefits

 **SUBSEA EUROPE  
SERVICES**  
SIMPLIFY MARINE DATA ACQUISITION

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# Less CO2 – Less Staff – Less OPEX



Task for offshore wind farm operators:  
Survey + Inspection  
25 % per year



Survey Vessel



ROV Support Vessel



Work-Class ROV



(shared) Mother ship

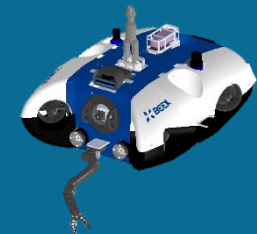


**99% less CO2**  
**80% reduction in staff**  
**50% reduced OPEX**

USV



HAUV





# The Proof of Concept

Combined survey and inspection at the OWP “Deutsche Bucht” in July 2023



# OWP Deutsche Bucht – July 2023



World's first combined survey and inspection of an OWP from a mother ship

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- ✓ The systems were "resident" in the OWP for 14 days
- ✓ The systems did not interfere with the regular operations
- ✓ Customer and all companies involved are satisfied with the operations and the results have been accepted by the authorities



# Next Steps



- Grow the fleet of ASV and HAUV using the “Autonomy Engine”
- Expand number of MBES and SSS integrated in the “Autonomous Operator”
- Launch of autonomous feature identification capabilities as part of the “Autonomous analyst”





# Subsea Europe Services

SIMPLIFY MARINE DATA ACQUISITION AND ANALYSIS