





CONFIDENTIAL

Enabling resident subsea operations through rechargeable battery energy storage



CONTACT DETAILS

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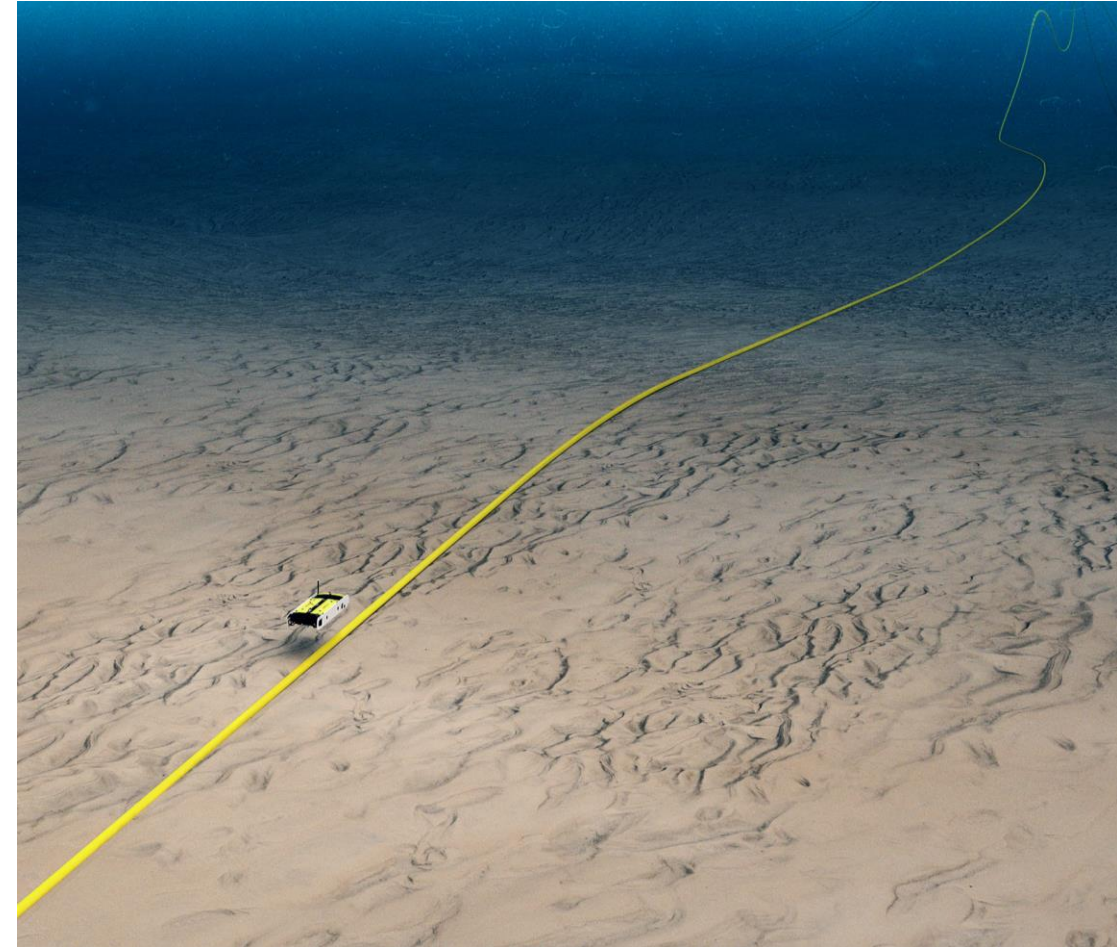
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Technology Development Background

- + Having identified challenges across the underwater landscape including:
 - + High costs associated with underwater environmental monitoring
 - + Challenges with resident AUV charging capability
 - + Increasing scrutiny of carbon emissions
 - + Challenging workability in adverse weather
 - + 'Incidents' in launch & recovery of AUV's

- + Verlume has utilised its expertise in intelligent energy management and energy storage to develop a rechargeable, compact battery storage solution to solve these industry problems.





Axon

Intelligent Energy Management System

CHARGE

Compact Rechargeable Energy Storage

AIRIES

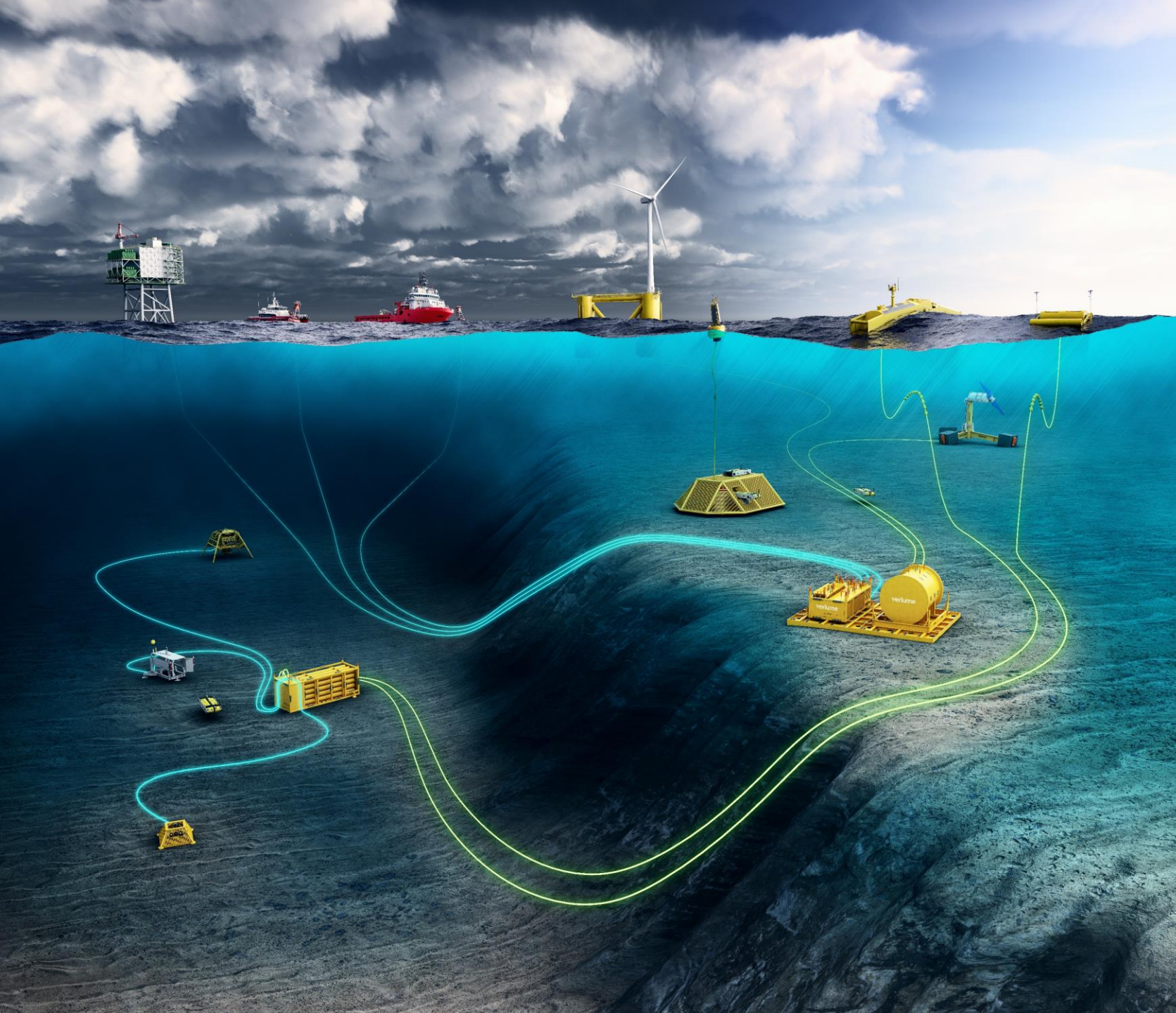
AUV Recharging Station incorporating CHARGE

HALO

Deep Water Seabed Energy Storage

ORAH

Shallow Water Hi-Capacity Seabed Energy Storage



Modular battery storage solution



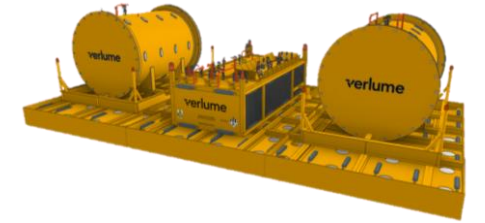
CHARGE
(35 - 55 kWh)



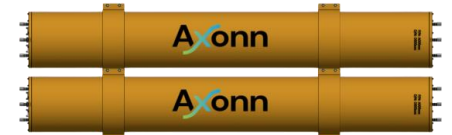
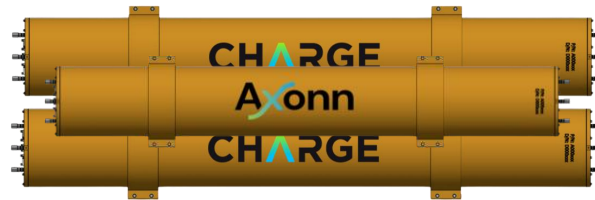
HALO
(60 - 240kWh)



ORAH
(240 - 500kWh)



ORAH
(1MWh+)

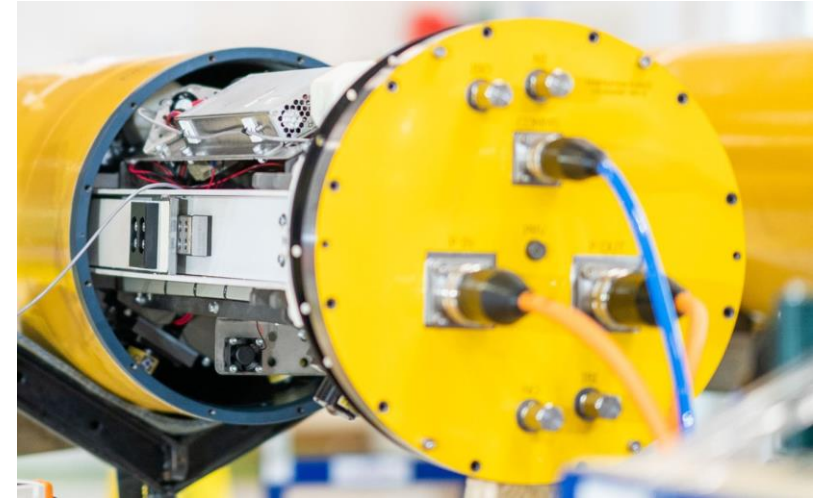




Charge is a compact battery unit, offering a high energy density solution, maximum deployment and application flexibility in the offshore environment.

TECHNICAL SPECIFICATION OVERVIEW

- + Multiples of 35kWh or 55 kWh depending on Pipe Length*
- + Battery Chemistry: Lithium-ion NMC
- + Output Voltage: 24VDC (48VDC optional)
- + Output Power: 100W (others on request)
- + Communications: Optional add on (client specific)
- + Interface Connector: Dual Seal Flange Bulkhead
- + Design Depth: 3,000m*
- + Dimensions: Diameter 0.5m, Length 2.2–3.5m
- + Weight (In Air): 1,000kg
- + Weight (In Water): 640kg
- + Housing Design: 1atm, N2 Purged, Dual Seal Barrier

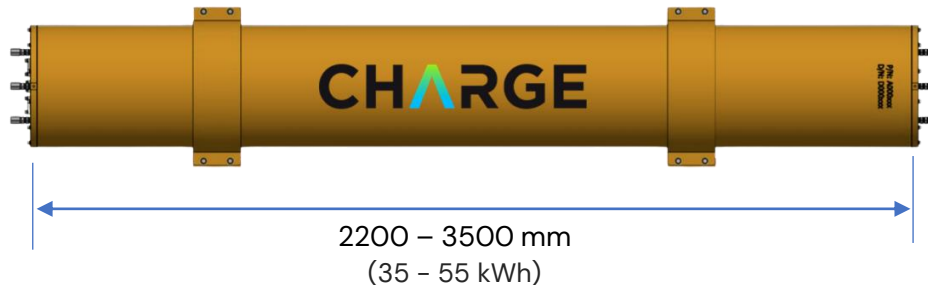




The system can be configured as standalone or as fully integrated within existing infrastructure such as environmental monitoring units.

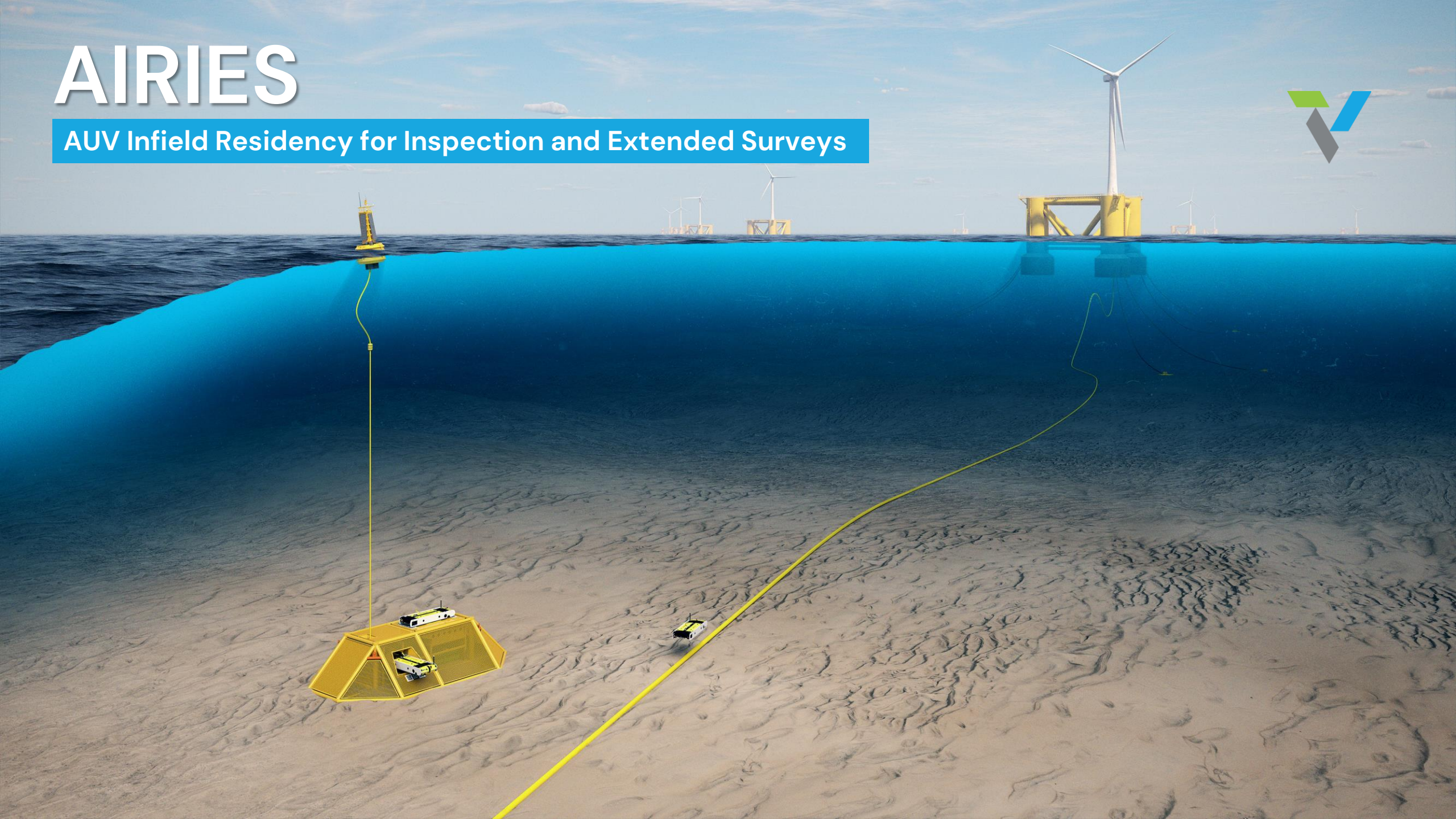
USE CASES

- + Monitoring equipment
- + Insulation resistance recovery
- + Underwater camera systems
- + Leak detection monitoring
- + ADCP life extension
- + Multi sensor power system
- + Scientific monitoring skids
- + Gas monitoring
- + Ocean observation
- + Acoustic arrays
- + Remote location power
- + AUV Recharging



AIRIES

AUV Infield Residency for Inspection and Extended Surveys

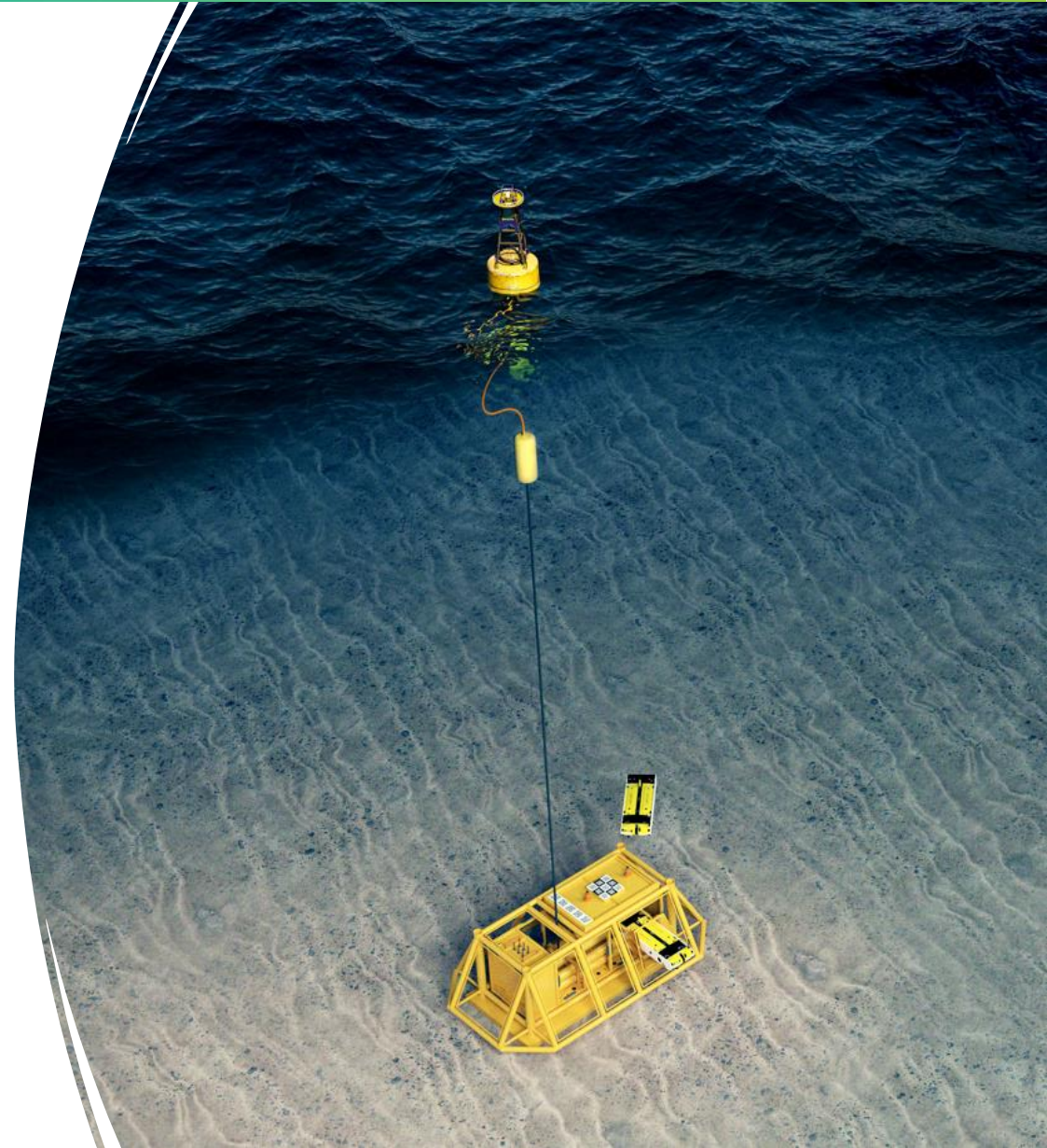


AIRIES – AUV Infield Residency for Inspection and Extended Surveys



Replacing Manned Vessel Inspection with Autonomous Systems

- + Standalone charging station with integrated communication.
- + Enables long-term underwater AUV residency.
- + Reduces inspection cost while improving data quality.
- + Sits on seabed: no more waiting on weather to inspect.
- + Reduce CO2 emissions associated with inspection.
- + Greenfield Surveys for new developments in Offshore Wind





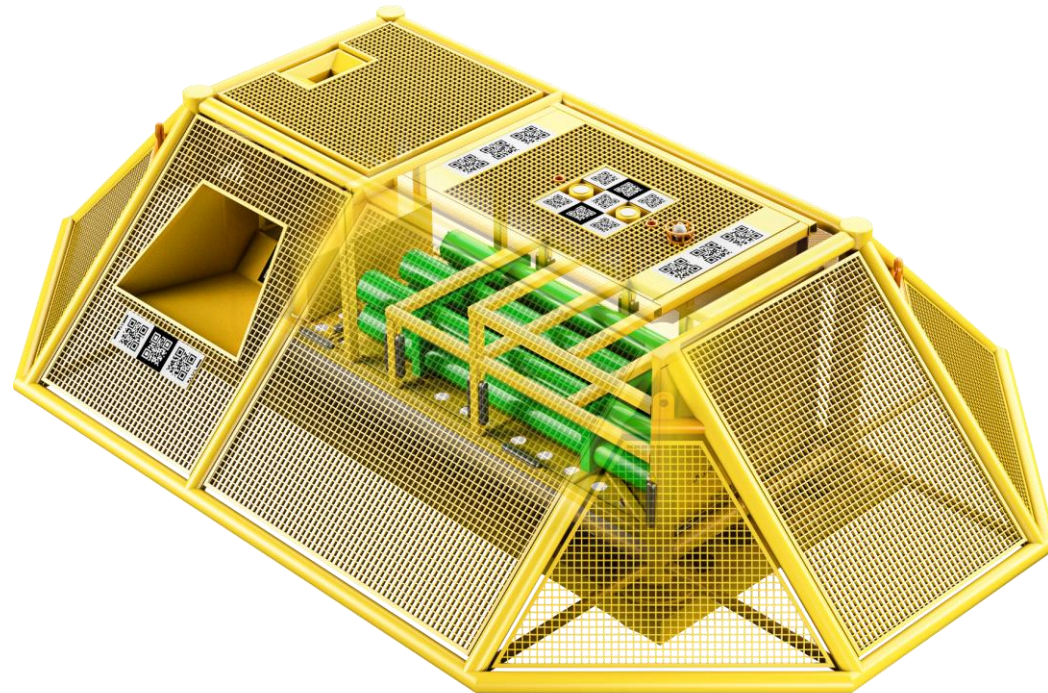
AIRIES – Sub-Components

- + New market solution combining 3 cutting edge products, enabling resident subsea operations.
- + Integrated operating software environment.

Communication Buoy



Seabed Charging Station, integrated Charge



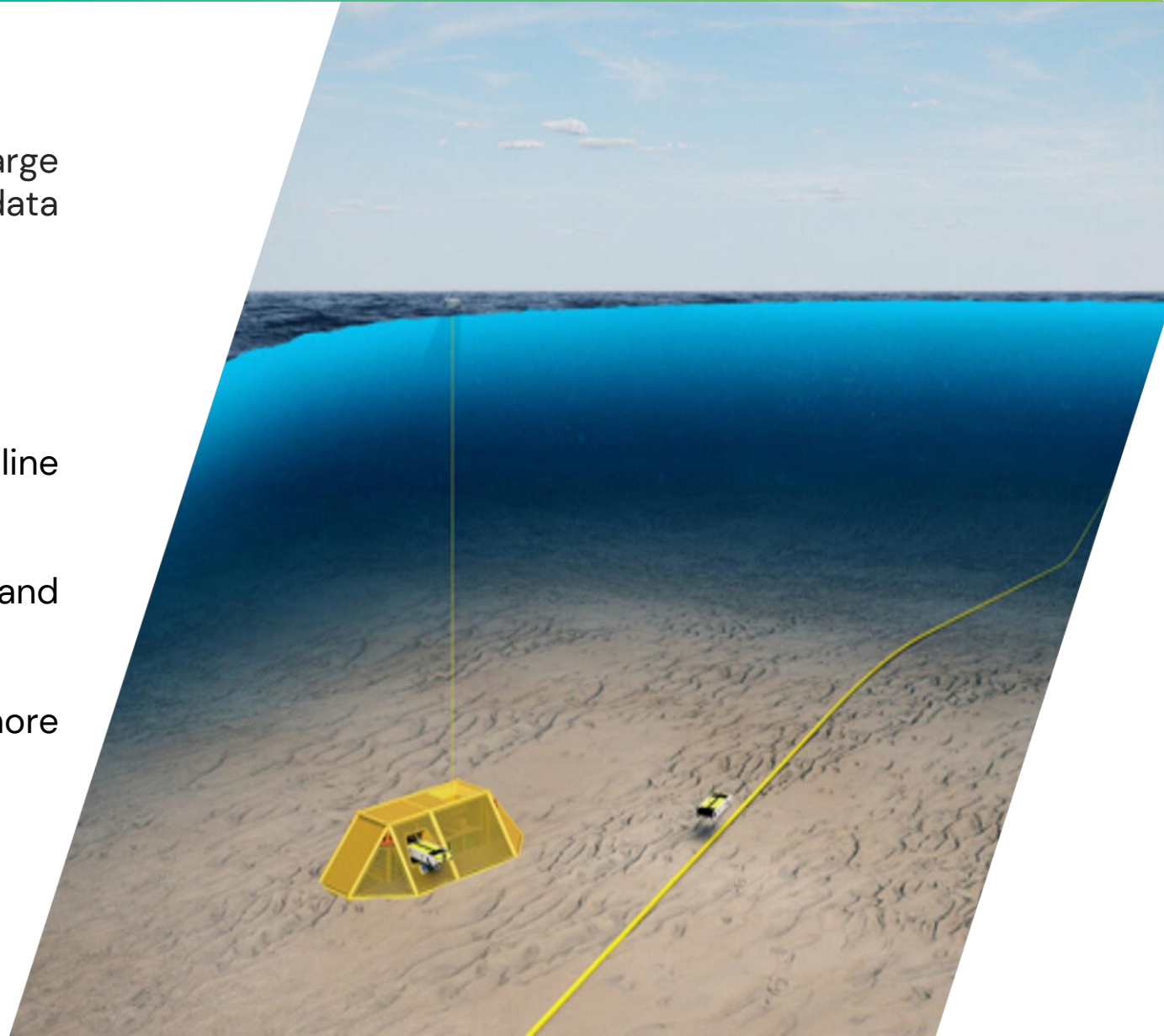
AUV – SAAB Sabertooth





AIRIES – Use Cases Across the Underwater Sector

- + The **AIRIES** system allows AUVs to dock, recharge batteries, upload data and receive new mission data without the need for offshore intervention.
- + Use Cases Across the Underwater Sector:
 - + **Oil and Gas Inspection** – leak detection/pipeline security.
 - + **Offshore wind** – pre-construction, during and maintenance after construction.
 - + **Defence** – monitoring applications, secure offshore communications, energy security.





Renewables for Subsea Power – AUV Testing

- + AIRIES system development follows successful AUV docking/charging testing as part of Renewables for Subsea Power.
- + Renewables for Subsea Power: First-of-its-kind commercial full-scale system to provide renewable power and communications offshore.
- + Combined system deployed, connected and operational as of February 2023 and ending its deployment in spring 2024.
- + **AUV dock mounted onto Halo system** (see photo).
- + Autonomous vehicle provided by Transmark Subsea: ARV-i and ARV-i dock.
- + To-date **50 autonomous docks and undocks** have been carried out, following initial tethered trials.







Next Step for AIRIES

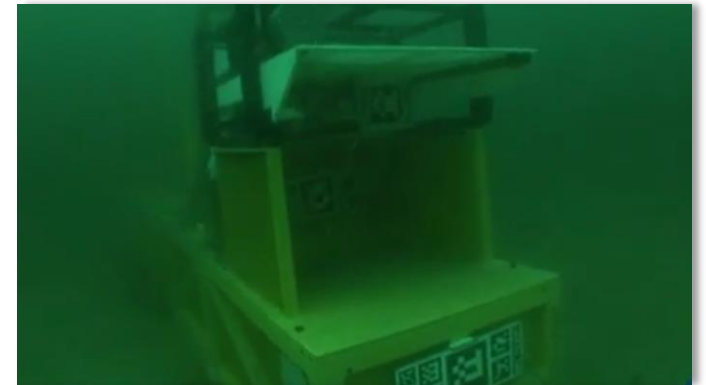
+ Charge Product:

- + Fundamental technological basis of AIRIES.
- + Product already developed and commercial orders secured.



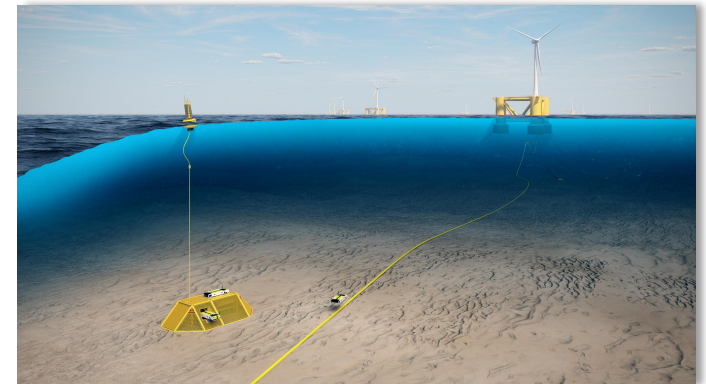
+ RSP AUV Testing

- + Docking/charging testing to continue until Q1 2024.
- + Recovery and inspection of system in Q2 2024.



+ AIRIES System Deployment

- + Project developing this system to be deployed Q3/Q4 2024 with industry partners.





Next Step for AIRIES

+ Project Funding:

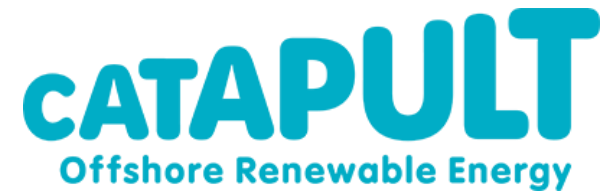
- + Funding from ETZ to build battery systems
- + Funding from Offshore Wind Growth Partnership (OWGP) for the Communication Buoy build and software development
- + OWGP funding also used to set up communication via 4G/Tampnet/Starlink networks

+ AIRIES Testing

- + Testing taking place at ORE Catapult in Blyth Q3/Q4 2024
- + Invitational event for interested parties

+ AIRIES System Trials

- + Full system trial summer 2025 in “real life” scenario at wind farm location



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