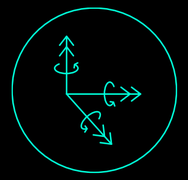

GWF
GEOSPATIAL WORLD FORUM
CLICK TO KNOW MORE


exail

Exail group
A vertical integration of technologies

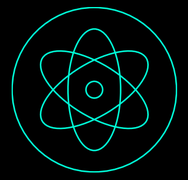


Inertial navigation

Subsea acoustic positioning and imagery

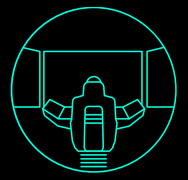
Autonomous vehicles, drones systems and AI

Ship equipment and protection



Photonics and quantum

On-board electronics and manufacturing & testing solutions for aeronautics



Training simulation

Mechatronics

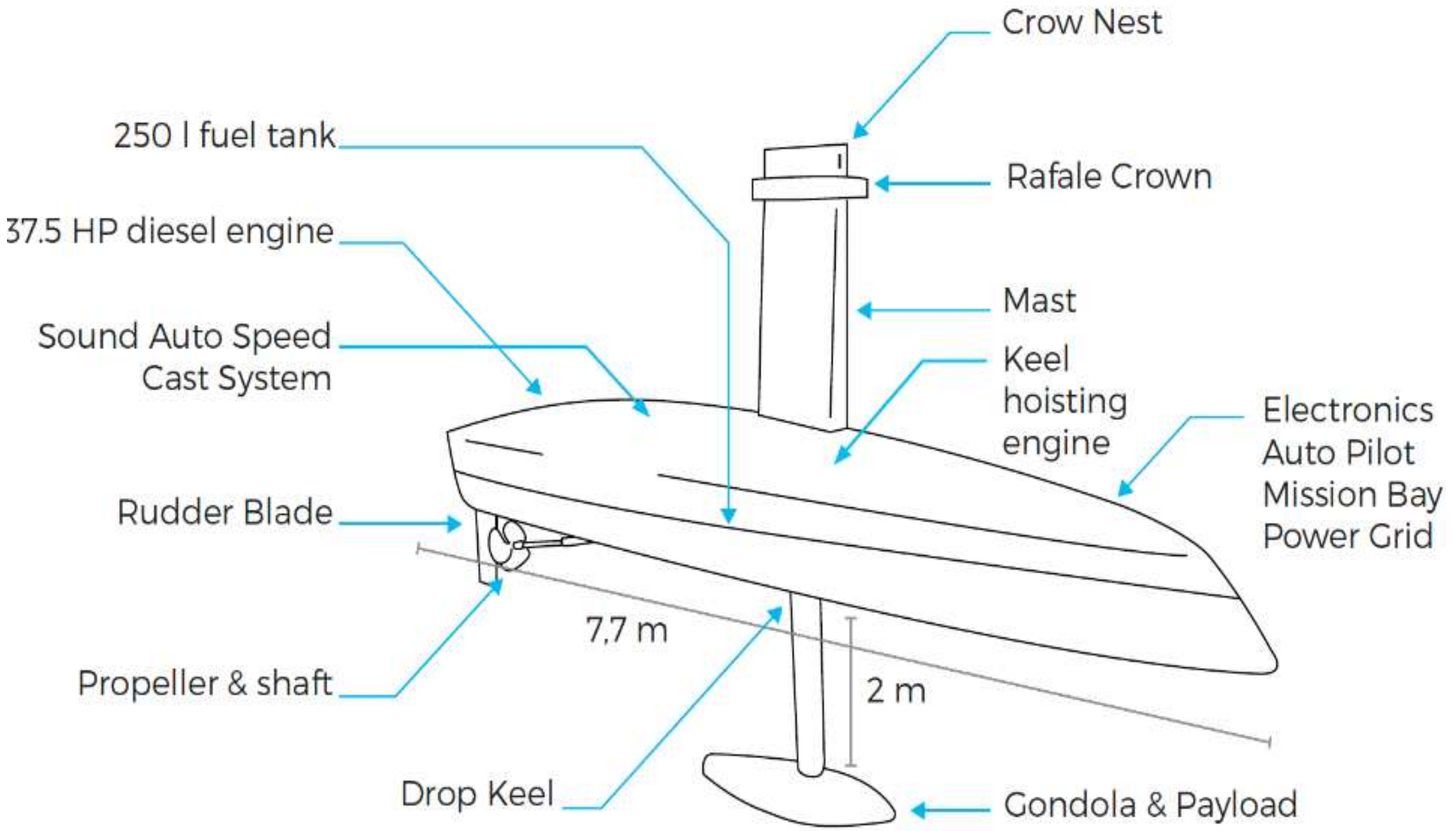
exail

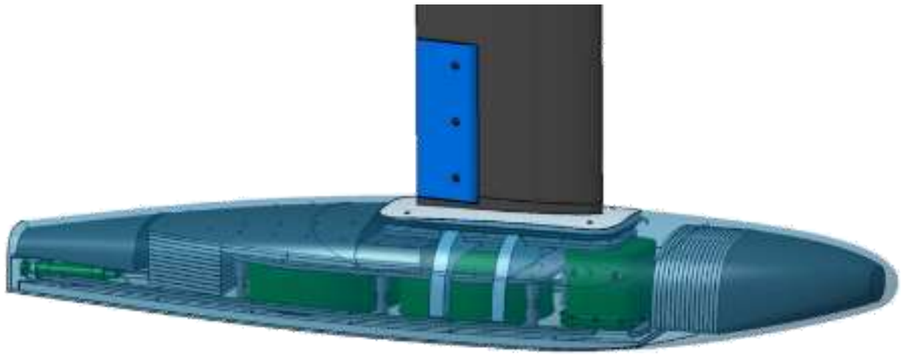
HOW AUTONOMOUS PLATFORMS ARE REVOLUTIONIZING HYDROSPATIAL EXPLORATION

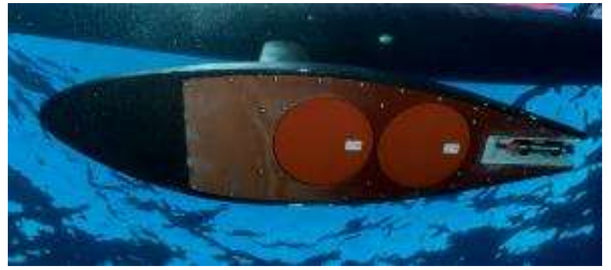
DRIFTX - MAY 2024

exail

DriX USV : A design to improve hydrospatial data gathering



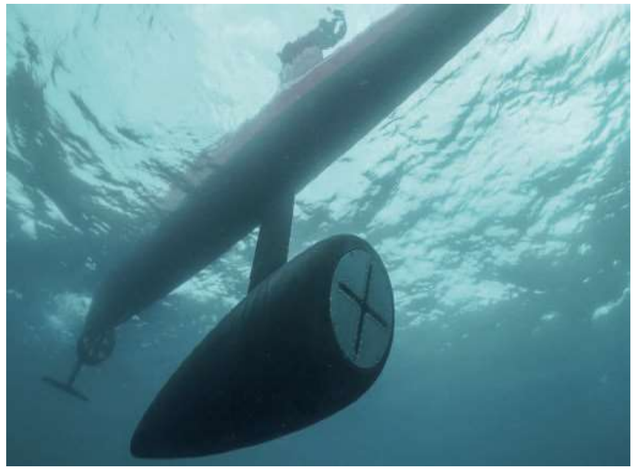


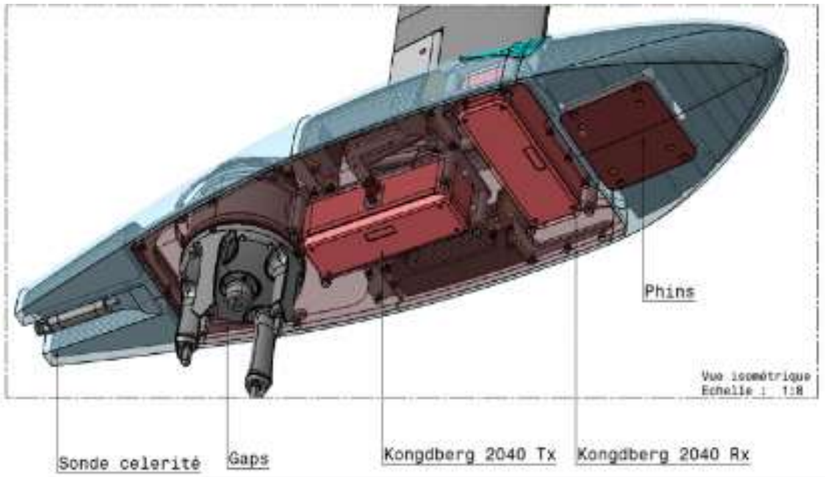


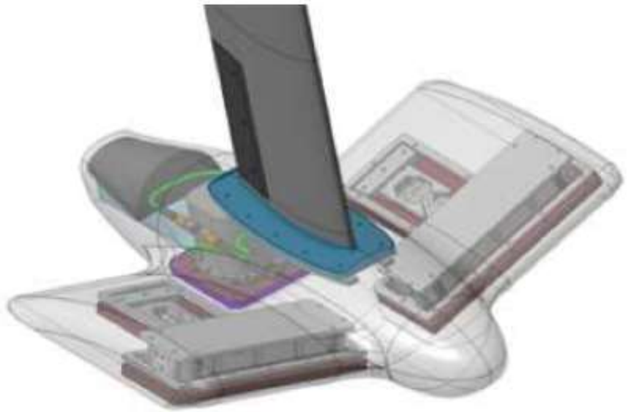
iXblue

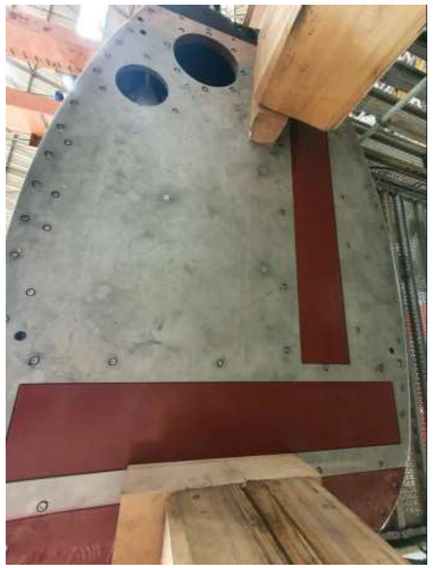
A universal platform

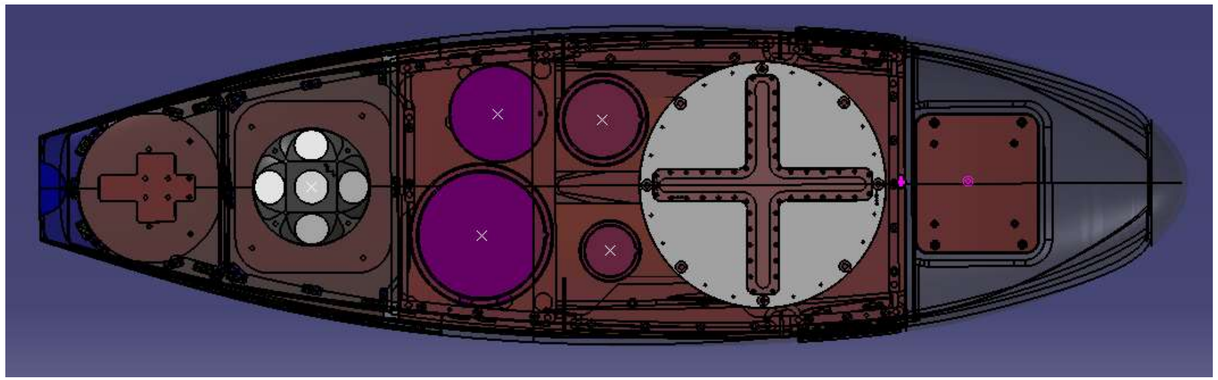
A gondola to house any type of relevant sensor – « Underwater awareness »









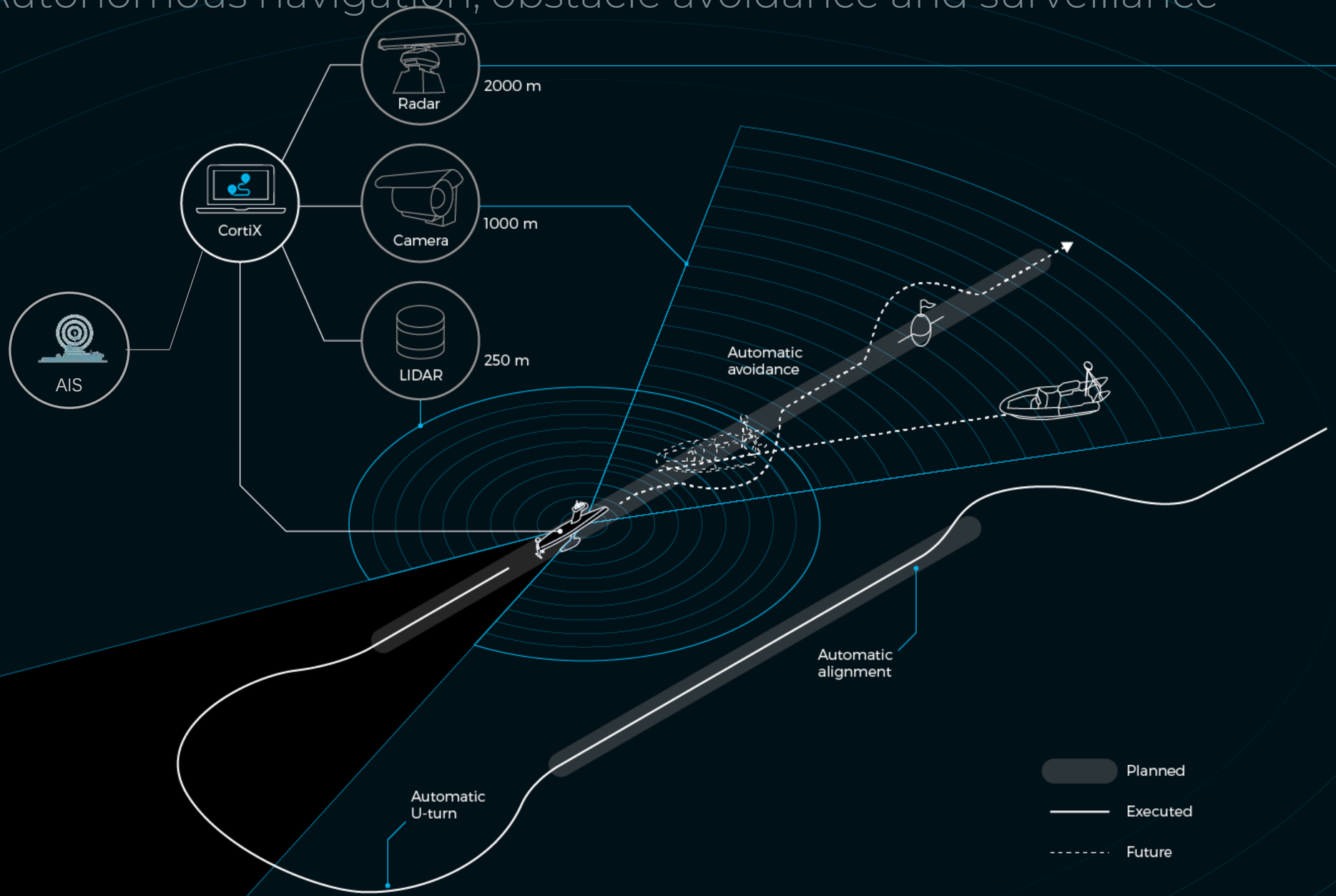


- Multiple brands of SBES / MBES
- Side Scan Sonar
- Sub bottom profiler
- USBL

- Acoustic modem
- Hydrophone
- ADCP
- CTD, SVS,

Environmental awareness

Autonomous navigation, obstacle avoidance and surveillance



iXblue

Autonomous Navigation in Restricted Waters

Dec 8, 2022 - Autonomous entry and collision avoidance in Mina Salman, Barhein.
(Speed 10 knots, video speed x20). CPA setting 100 yards

Introducing Hydrospatial

Definitions *adopted by the Hydrospatial Movement Club*

Hydrospatial *(adjective)*
Relating to hydrospatial sciences or denoting data, information and knowledge that is associated with a particular location and time of the earth's waters and their contiguous zones.

hydrospatial sciences
(plural-only noun (plurale tantum)
All sciences dealing with the study of the earth's waters and their contiguous zones.

Figure 1. Some of the Blue of our Blue Planet domain activities. Sources of images: Paola Echeverry, member of the Hydrospatial Movement Club, South American node.

Return of experience hydrospatial data collection

Autonomous remote – EEZ and Archeological survey Canada/France

North Atlantic – 650km² survey

- Archaeological survey
- EEZ bathymetric survey
- Sedimentologic model

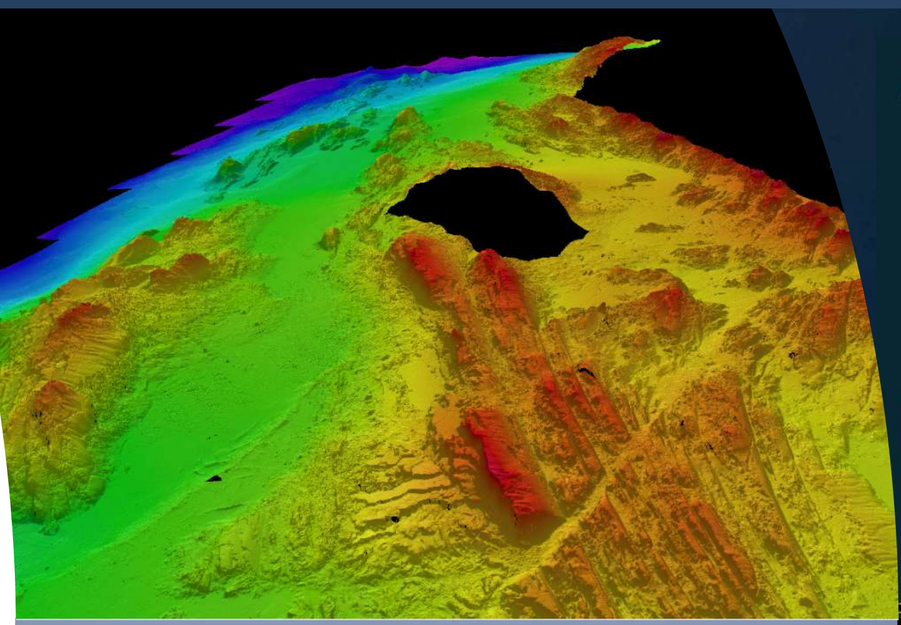
Harsh Weather :

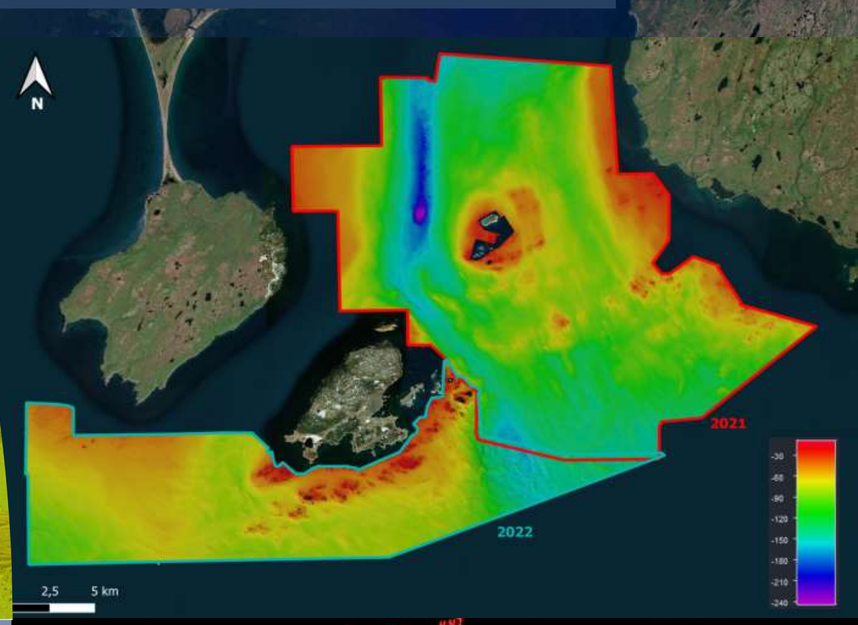
- Av. SeaState 4
- Wind up to 45kts
- Tidal current up to 2.5 kts
- Extremely Bad visibility

Supervised Over THE HORIZON

- GPRS network
- Satellite communication solution

Data: > 6.0 Terabit





Autonomous remote – EEZ and Archeological survey Canada/France

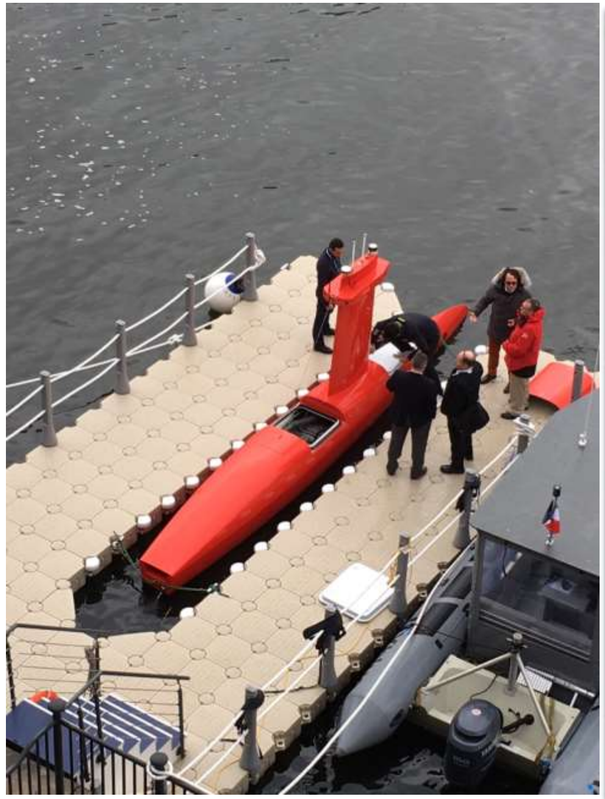
Benefits of DriX USV vs Vessels	DRIX (OTH Ops)	Opportunity Vessel
Archaeological search	**9000 line km – 650km²** **Water depth 5 to 270m**	
Survey Platform		
Duration of Operation	**60 Days** 10% Weather downtime	**80 Days** 30% Weather Downtime
CO^2 Equ **1l = 2.6kg equ CO^2**	**6.5 To CO^2** 98% savings	**338 To CO^2**
Man-hours Risk Exposure	**180h** 99% Savings	**15500 h**

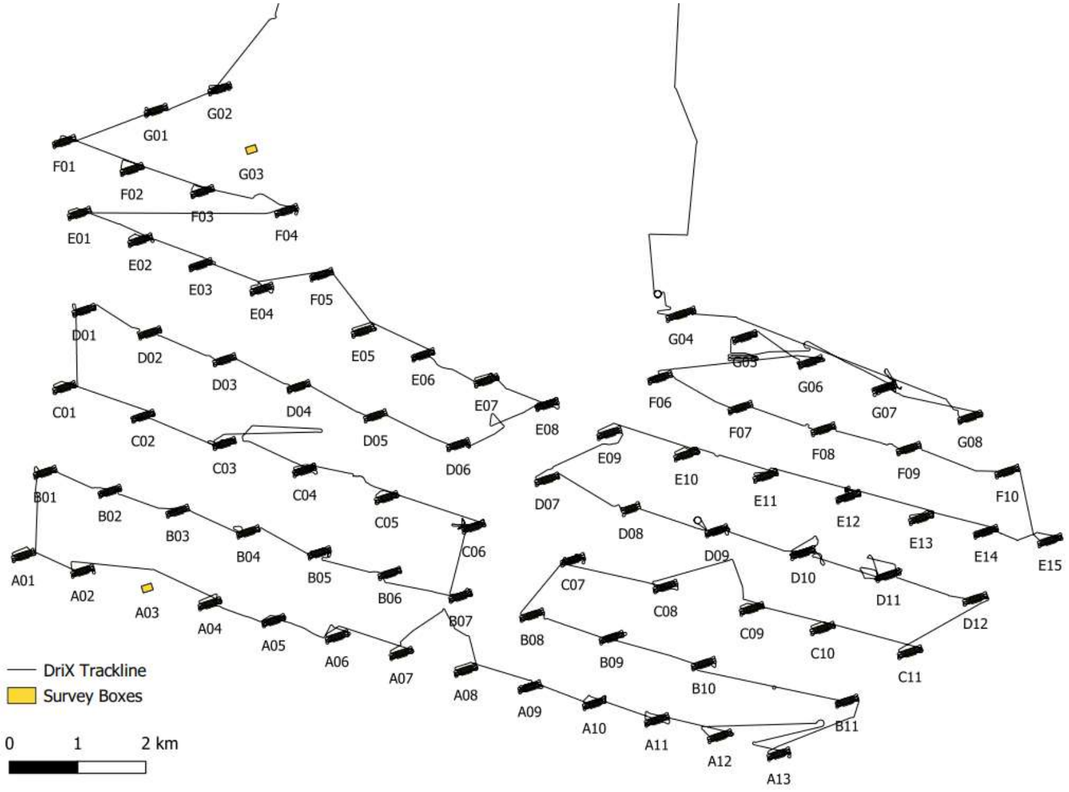
Marine Civil Engineering (MCE) / offshore windfarm development

Offshore wind turbine

Objectives

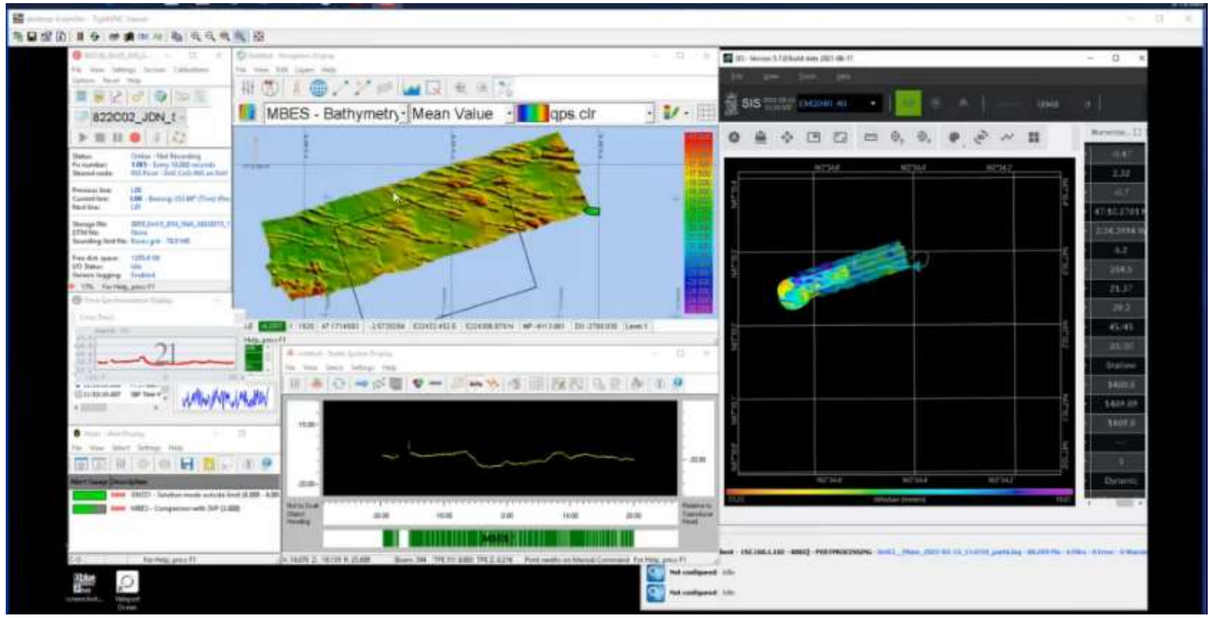
- 80 WTG - 200mx100m boxes to survey with MBES only
- Scouring and seabed inspection survey around wind turbine foundations.
- Over the horizon operation conducted in Saint-Nazaire (Fr) from La Ciotat (Fr) 800km away.



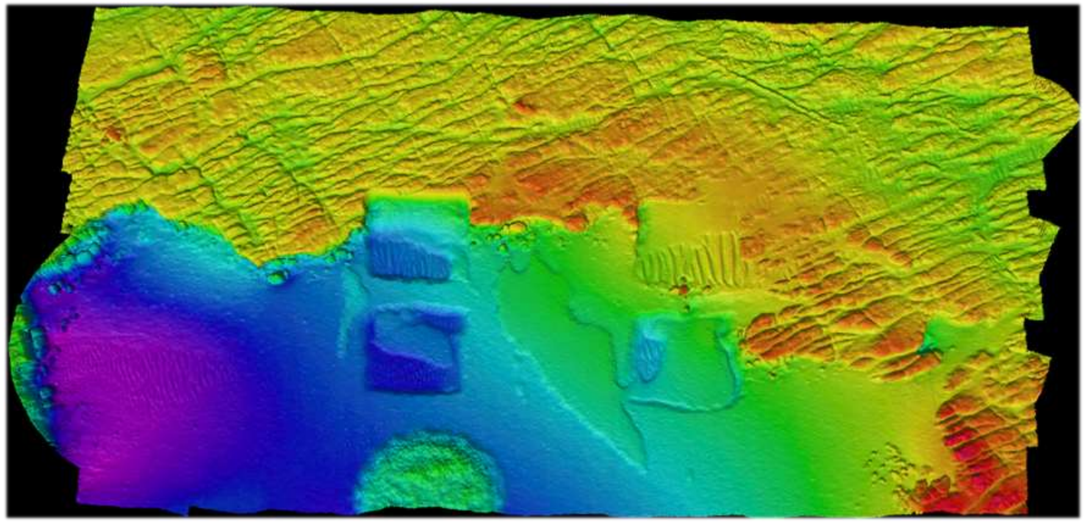


Civil engineering offshore windfarm development

- 35 hours operation incl. transit from port to port
- 425 km line km – 80 Turbines visited
- Seastate 3 to 4
- Autonomous behaviour based on sensors
- And… outstanding seabed mapping



Autoline navigation + obstacble avoidance ON



Marine Civil Engineering (MCE) / offshore windfarm development

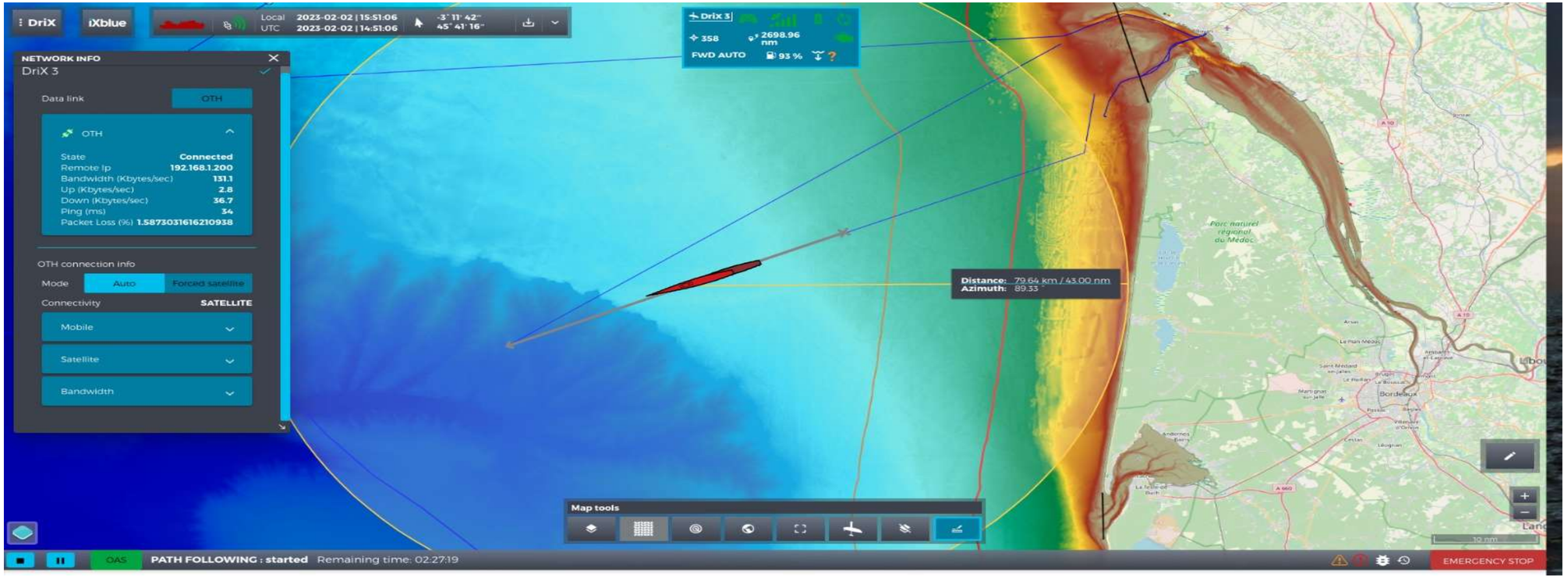
Benefits of DriX USV vs Vessels	DRIX (OTH Ops)	Opportunity Vessel
	80 Wind Turbines Foundation survey	
Survey Platform		
Duration of Operation	**35 hours** No Weather downtime	**6 Days** 30% Weather Downtime
CO^2 Equ **1l = 2.6kg equ CO^2**	**0.2 To CO^2** 99% savings	**23.4 To CO^2**
Man-hours Risk Exposure	**8h** 99% Savings	**1050 h**

Oceanic Environmental Monitoring

EEZ meteoceanographic, Sea Mammal and Fish interaction assessment

Objectives

- February in the Bay of Biscay
- 1 month to realize 2500LineKm observation – up to 150Nm from the shore
- Waiting on daylight at sea
- Gondola including: Environnemental Sonar (EK80), Hydrophone, ADCP,CTD, Met-station
- Full Over the horizon operation conducted from La Ciotat (Fr) – 700km away, 2 pax in field

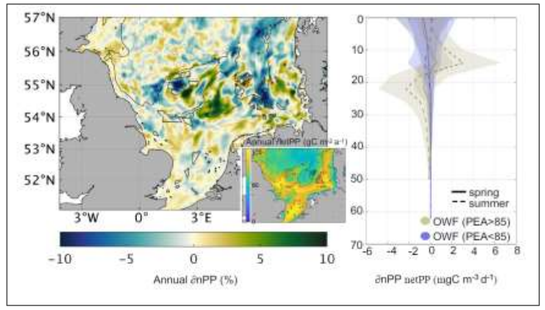


Oceanic Environmental Monitoring

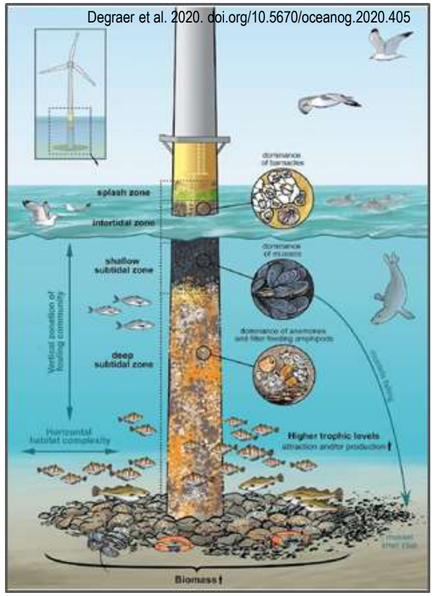
- **Scale of OSW Impacts:**
  - Spatial: Beyond the footprint of development
  - Temporal: Pre-construction to decommissioning, i.e., >30 years
  - Cumulative:: Spatial and temporal effects in aggregate

- In the context of existing ecosystem changes: warming waters, acidification, population shifts

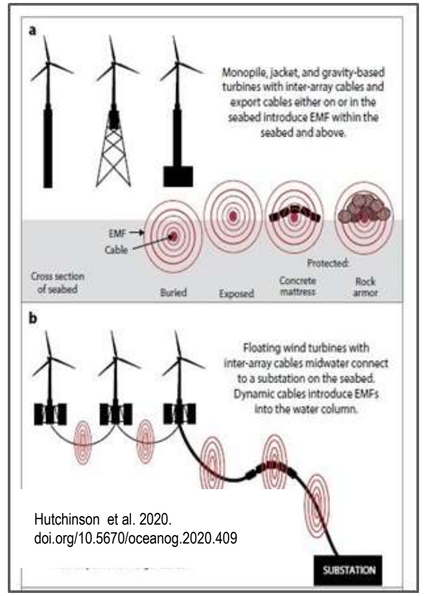
- Impact producing factors include:
  - **Noise** (Mooney et al. 2020)
  - **EMF** (Hutchinson et al. 2020a)
  - **Reef Effects** (Degraer et al. 2020)
  - **Benthic and Pelagic Habitat** Modification (Hutchinson et al. 2020b)
  - **Invasive Species** (Coolen et al. 2020)
  - **Entanglement** (Barnette et al. 2017. /doi.org/10.7289/V5/TM-NMFS-SER-5)
  - **Displaced Fishing Effort** (Scheld et al. 2022)
  - **Contaminants** (Kirchgeorg et al. 2018. doi.org/10.1016/j.marpolbul.2018.08.058)
  - **Hydrodynamic and wind wake** induced effects (NAS, 2023; Christianson 2022)



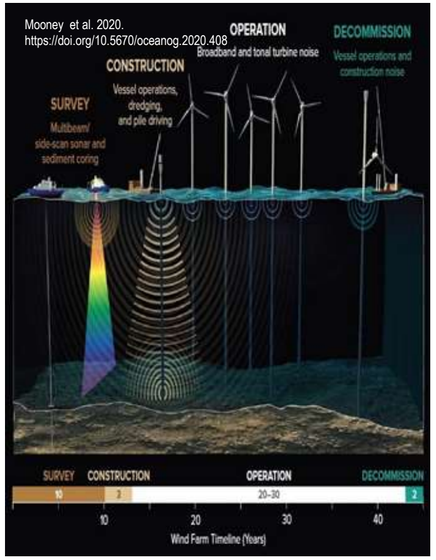
Daewel et al. *2022*. Offshore wind farms are projected to impact
primary production and bottom water deoxygenation in the North Sea. Communications https://doi.org/10.1038/s43247-022-00625-0



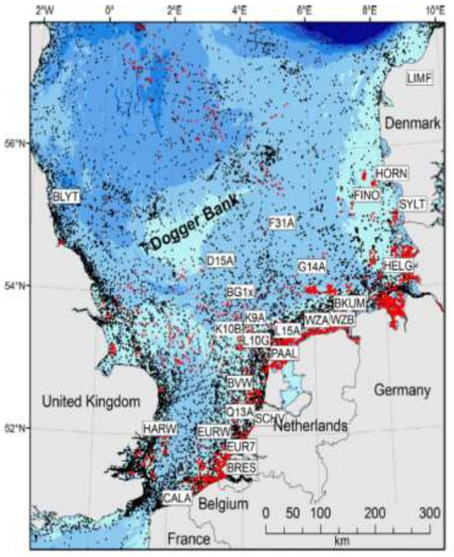
Degraer et al. 2020. doi.org/10.5670/oceanog.2020.405



Hutchinson et al. 2020.
doi.org/10.5670/oceanog.2020.409

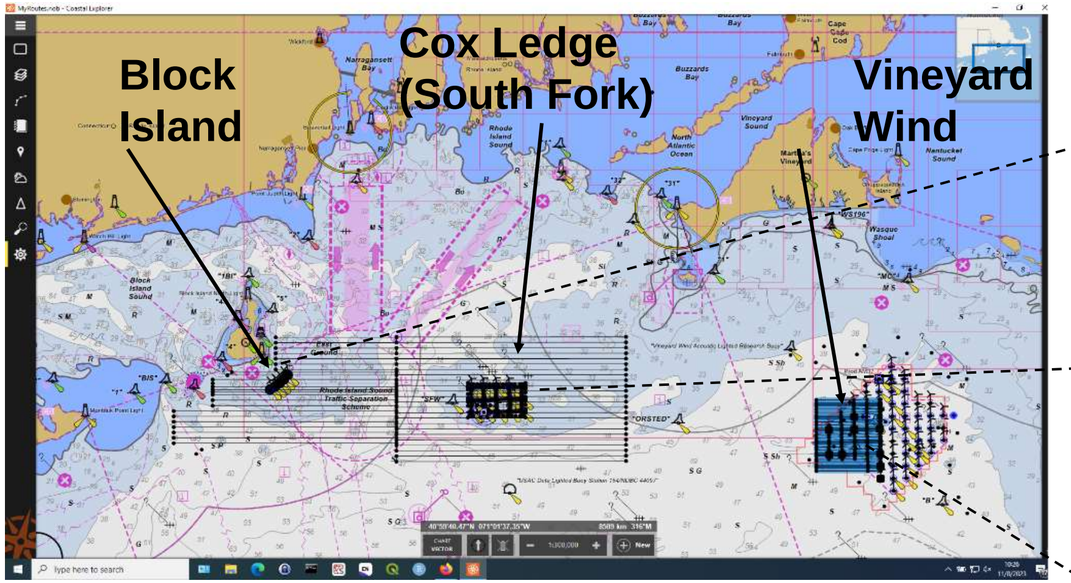


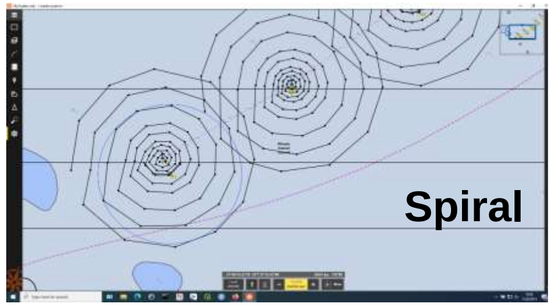
Mooney et al. 2020.
https://doi.org/10.5670/oceanog.2020.408

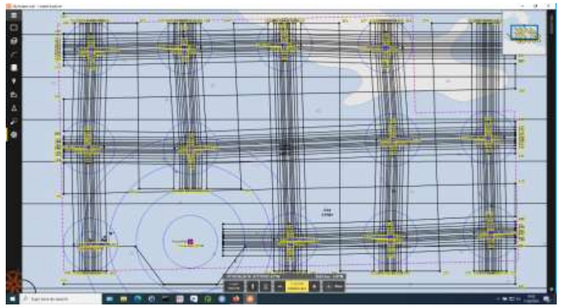


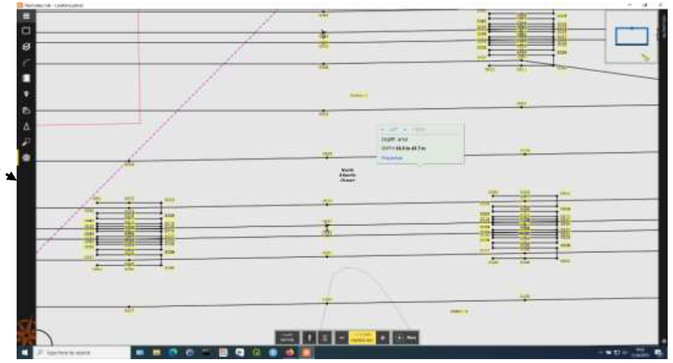
Oceanic Environmental Monitoring

Overall sampling strategies and survey designs to evaluate broad-scale and turbine-scale sampling









Gradient spacing (25-500m)

Survey Objectives:

- Evaluate a USV for fish and plankton surveys in offshore wind areas
- Map spatial distributions of fish and plankton in and around offshore wind areas
- Map spatiotemporal distributions of fish and plankton at turbine structures
- Evaluate the utility of the data for fisheries management and ecosystem services

Oceanic Environmental Monitoring

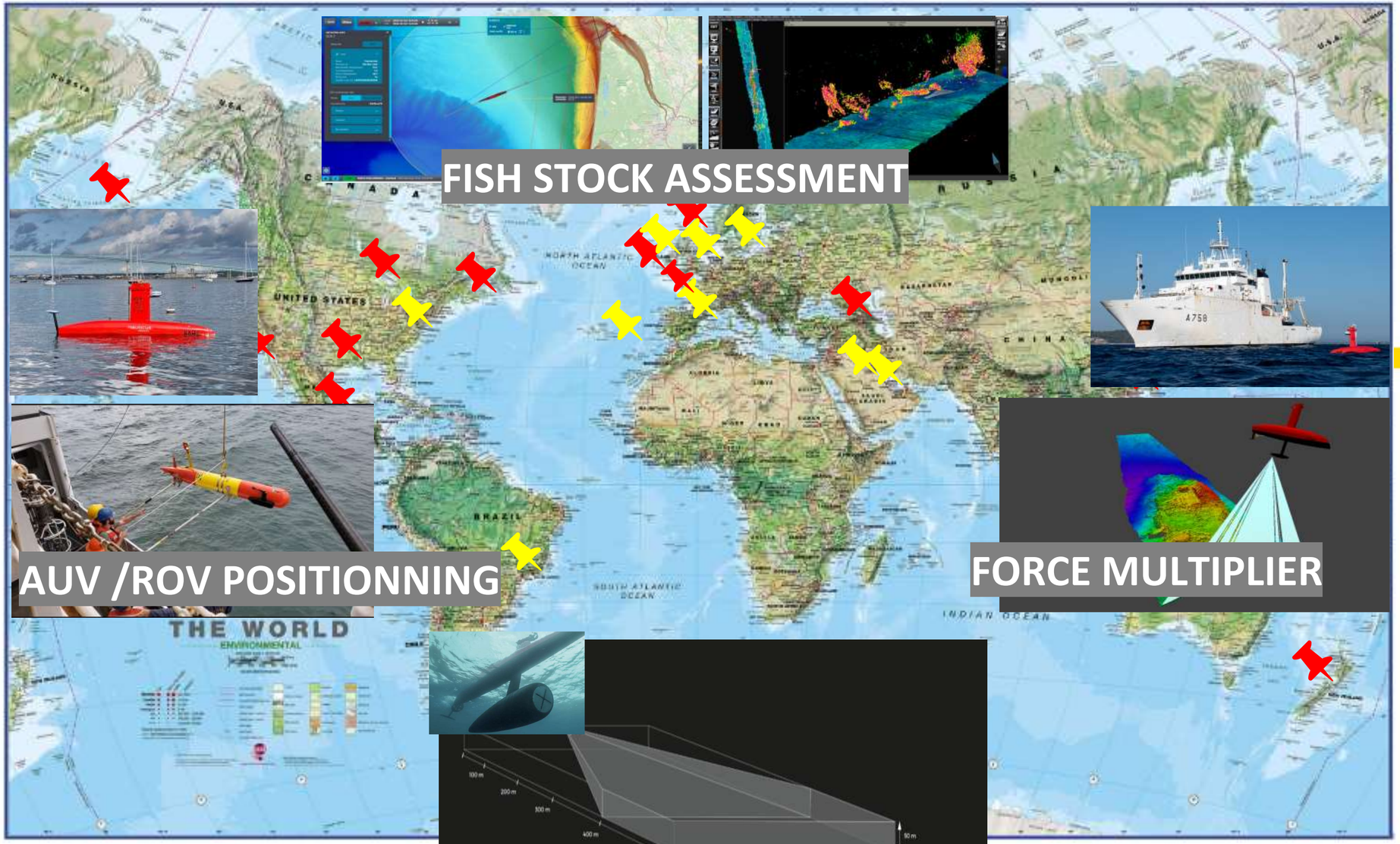
Benefits of DriX USV vs Vessels	DRIX (OTH Ops)	Opportunity Vessel
	2500 line km offshore	
Survey Platform		 
Duration of Operation	**12 Days** 4 days Weather downtime	**12 Days** 2 days Weather downtime
CO^2 Equ **1l = 2.6kg equ CO^2**	**2.1 To CO^2** 95% to 98% savings	**44.2 To CO^2 - 143 To CO^2**
Man-hours Risk Exposure	**24h** 99% savings	**4032 h**

“Finding and adapting new ways of collecting data in areas where our survey vessels and aircraft can no longer go is crucial to maintaining our data streams which are fundamental to effectively manage marine resources for food and conservation”

Andrew Lipsky, NOAA Offshore Wind Ecology Branch.

Main references – Multipurpse applications

Previous operation
Present positions of DriXs



KEY DIFFERENTIATORS VS A CONVENTIONAL SURVEY VESSEL

CONVENTIONAL SURVEY VESSEL	DriX – REMOTE HYDROGRAPHY
VESSEL: 50-100 m Crew: 30 - 50 personnes Energy: 4 - 10 Tons diesel / day CO2: 90 kg/Nm	USV: 8 m 2 to 3 people monitoring remotly Energy: 50 litres diesel /day CO2: 1.5 kg/Nm
Investment: 5 to few 10s of M€	Investment: 1.5 to 2.5 M€
Cost of Ownership: >1 M€/year	Cost of Ownership: 30 to 50 k€/year
Expensive logistic support Crew Safety at sea	Concept of operation Autonomy Acceptance

THANK YOU FOR YOUR ATTENTION

GWF
GEOSPATIAL WORLD FORUM

EXAIL
EXPANDING YOUR CAPABILITIES

DAVID.VINCENTELLI@EXAIL.COM

HTTPS://WWW.IXBLUE.COM/PRODUCTS/DRIX

exail