

The Fugro logo is displayed in a large, white, stylized font. It is positioned in the upper left corner of the image, partially overlapping the yellow structure of an offshore platform and the sky. The background of the entire image is a composite scene showing an offshore oil platform, several red and white survey vessels, and wind turbines in the distance under a blue sky with clouds. The lower half of the image features a semi-transparent blue overlay with white text and a 3D visualization of a seabed survey. This visualization includes a yellow ROV (Remotely Operated Vehicle) with a camera and lights, a yellow cable being deployed from a vessel, and a 3D color-coded map of the seabed showing various geological features in shades of blue, green, and red. The text is centered within this blue overlay.

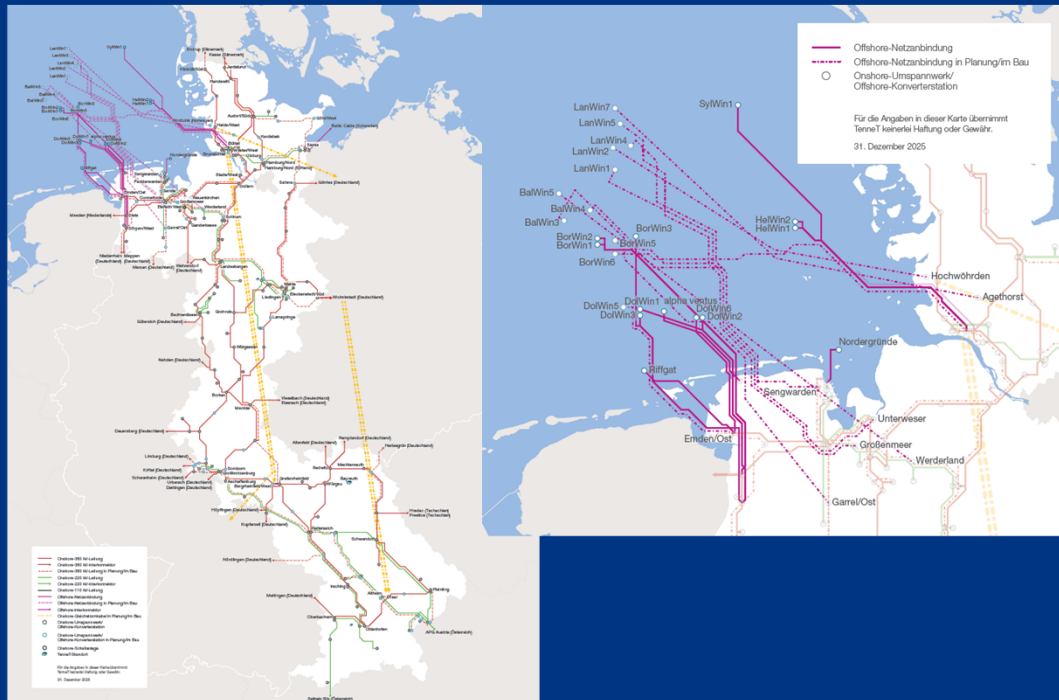
fugro

The Tennet logo is located in the upper right corner. It consists of a stylized circular icon with blue and green segments, followed by the word "tennet" in a blue, sans-serif font. The background of the entire image is a composite scene showing an offshore oil platform, several red and white survey vessels, and wind turbines in the distance under a blue sky with clouds. The lower half of the image features a semi-transparent blue overlay with white text and a 3D visualization of a seabed survey. This visualization includes a yellow ROV (Remotely Operated Vehicle) with a camera and lights, a yellow cable being deployed from a vessel, and a 3D color-coded map of the seabed showing various geological features in shades of blue, green, and red. The text is centered within this blue overlay.

tennet

**Effizienz durch USV-gestützte Plattform-
und Kabelinspektionen als neuer Standard
von lokalen Einsätzen zu großflächigen
Surveys**

Who we are



Onshore

14.700 km High Voltage
Transmission Lines

Offshore

4.300 km DC and AC Power Cables

12 Converter Platforms

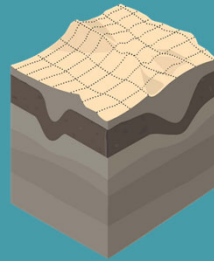


We unlock insights from Geo-data through our map, model and monitor solutions

We support our clients throughout the project lifecycle.

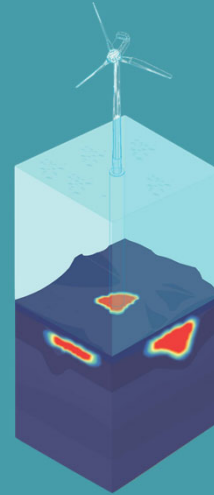
During the planning, construction and operation of their assets.

Both on land and within a marine environment.



Map

Conduct technical studies and geographical surveys to map the (sub)surface



Model

Support construction with visualisation services and pinpoint positioning



Monitor

Scan, monitor and analyse structural integrity of assets and environments

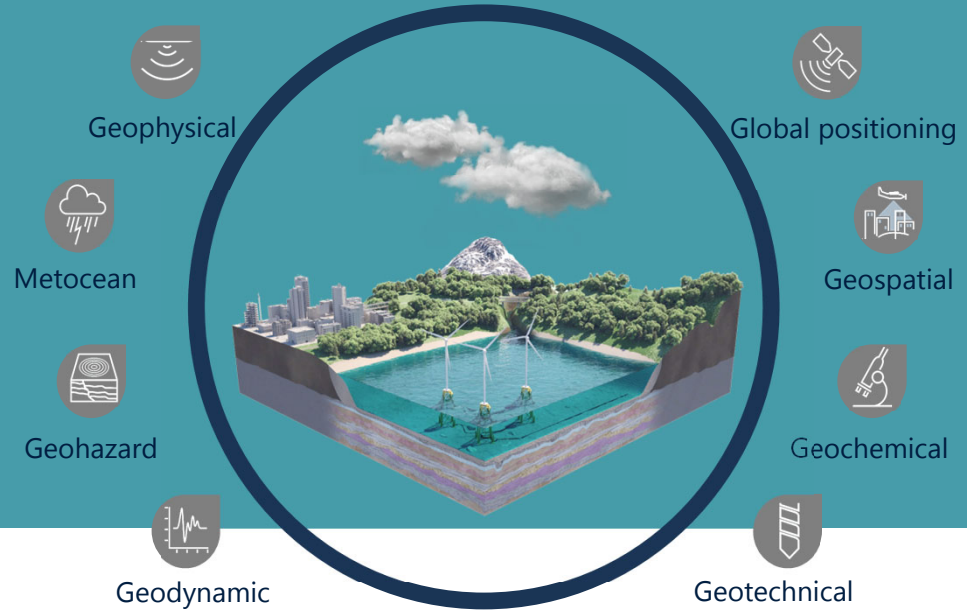


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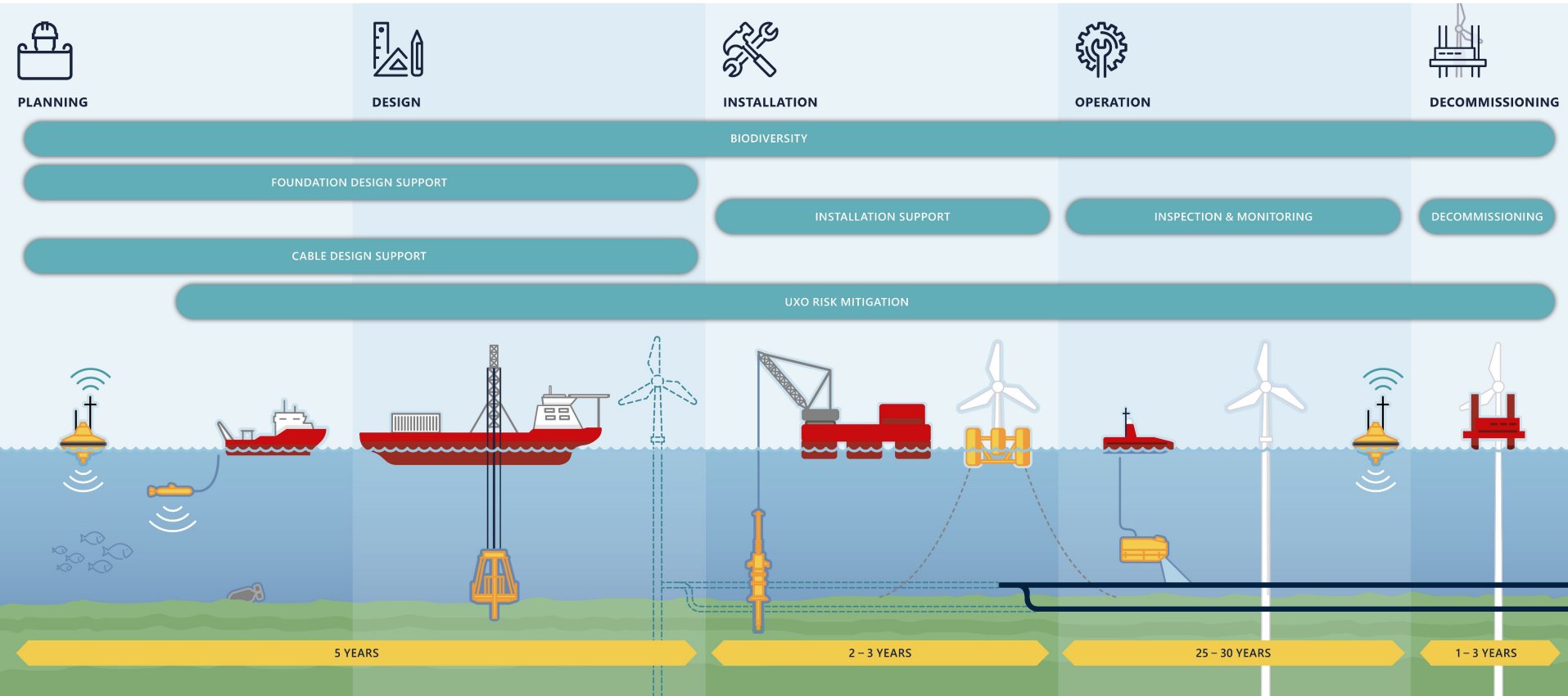
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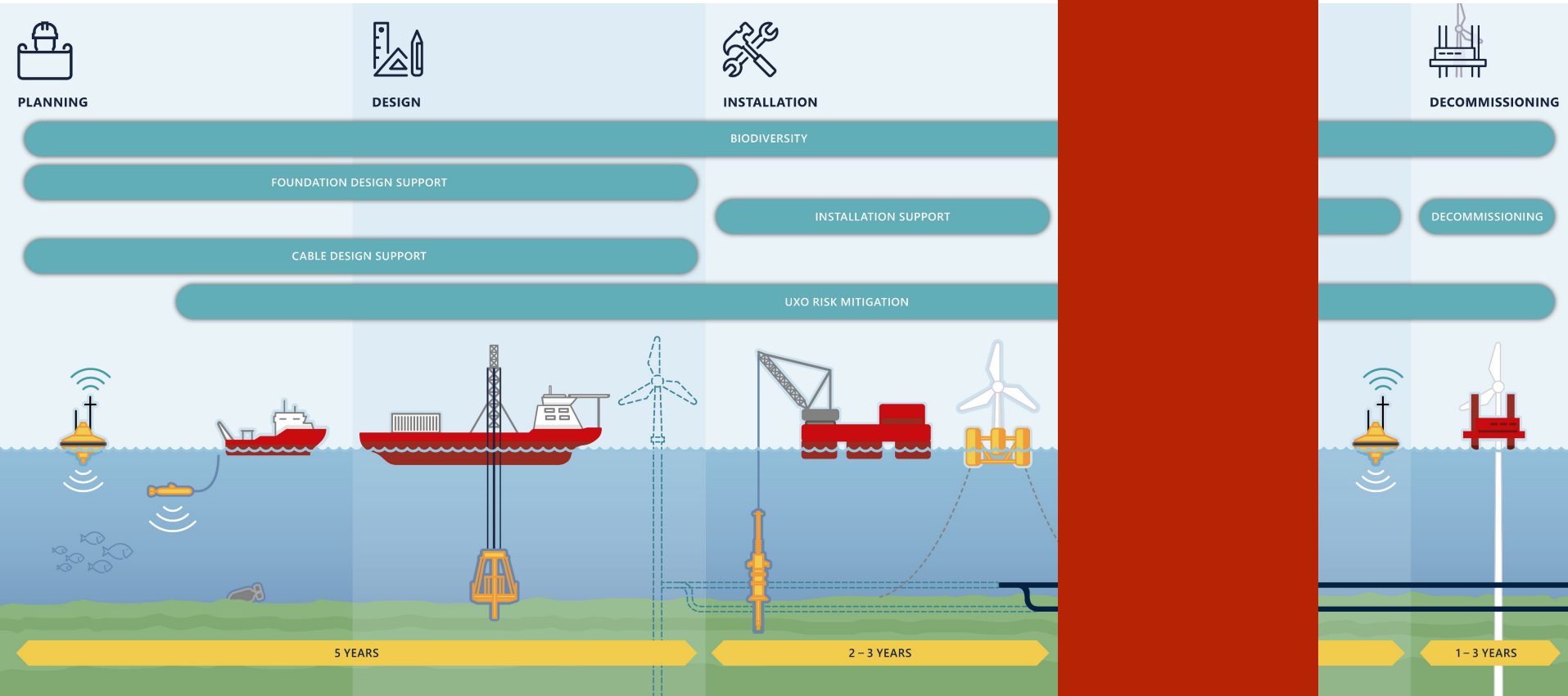
Both on land and within a marine
environment.



Geodata throughout the project lifecycle.



Geodata throughout the project lifecycle.



Changing the offshore ecosystem



Safer



Faster



More sustainable



Future-fit workplace

USV types and capabilities

Fugro Blue USV fleet (Uncrewed Survey Vehicle)

Blue Shadow®

Hydrographic survey vessel



Dimensions and capacities

Length: ~ 9 m



Beam: ~ 2 m

Draft: ~ 2 m

Weight (ex payload): 4,600 kg incl. fuel

Environmental capacity in survey mode

Wave height $H_s = 2.4$ m

Autonomy Level 4

Communication systems and autonomy



UHF Line of Sight



Radio range
6/8 km



4G



Remote
control

Data acquisition

Accelerated hydrographic data
acquisition with parent vessel.
MBES on USV gondola

eROV No

AUV No

Blue Essence® and Blue Volta® eROV

Survey and inspection vessel



Dimensions and capacities

Length: ~ 12 m



Beam: ~ 2 m

Draft: ~ 2.5 m

Weight (ex payload): 12,500 kg incl. fuel

Environmental capacity in survey mode

Wave height $H_s = 2.0$ m

Autonomy Level 3

Communication systems and autonomy



UHF, over the horizon
Iridium and VSAT



Radio range
6/8 km



4G



Remote
control

Data acquisition

MBES on USV gondola
and eROV, SBP optional

eROV Water depth 450 m

AUV Hugin / LLAUV (optional)

Blue Eclipse® and Blue Amp® eROV

Survey, inspection and light intervention vessel



Dimensions and capacities

Length: ~ 18 m



Beam: ~ 3.5 m

Draft: ~ 2.5 m

Weight (ex payload): 45,000kg incl. fuel

Environmental capacity in survey mode

Wave height $H_s = 3.0$ m

Autonomy Level 4

Communication systems and autonomy



UHF, over the horizon
Iridium and VSAT



Radio range
6/8 km



4G



Remote
control

Data acquisition

Dual MBES, SSS, HD Cameras
and optional UXO ID&C

eROV Water depth 500 m

AUV Hugin / LLAUV (optional)

Fugro Blue Essence®

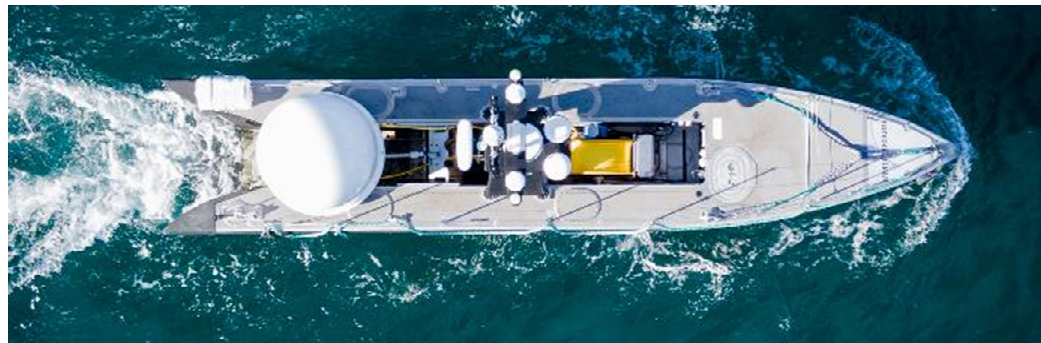
12m Uncrewed Surface Vessel

General

- Transit Speed max 6 knots
- Survey Speed 2-4 knots
- Endurance
 - 7-10 Days

Principle Particulars

- Length: 11.75 m
- Beam: 2.2 m
- Draft 2.3 m
- Weight: 14.5 t
- ROV deployment: 1.75m Hs
- MBES/SBP survey: 1.3m Hs
- Transit: 2.0m Hs



Fugro Blue Volta®

eROV for USV Operations

General

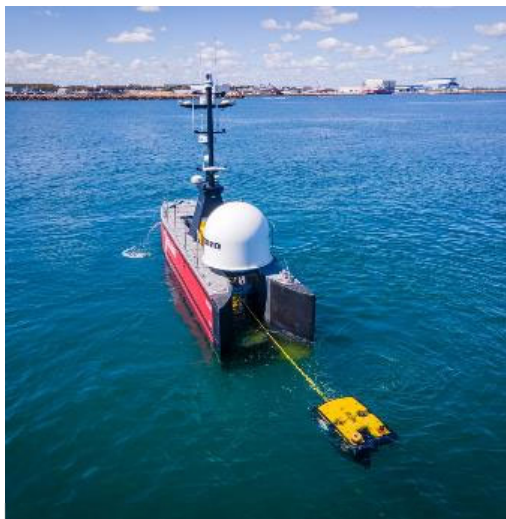
- Depth rated to 300 MSW
- Speed 1-2 knots

Pipeline Inspection

- Multibeam + Laser Point Clouds
- 9-point list and free span
- UHD Georeferenced Imagery
- CP and Field Gradient
- Depth of Burial

Asset Inspection

- Cleaning
- CP and Field Gradient



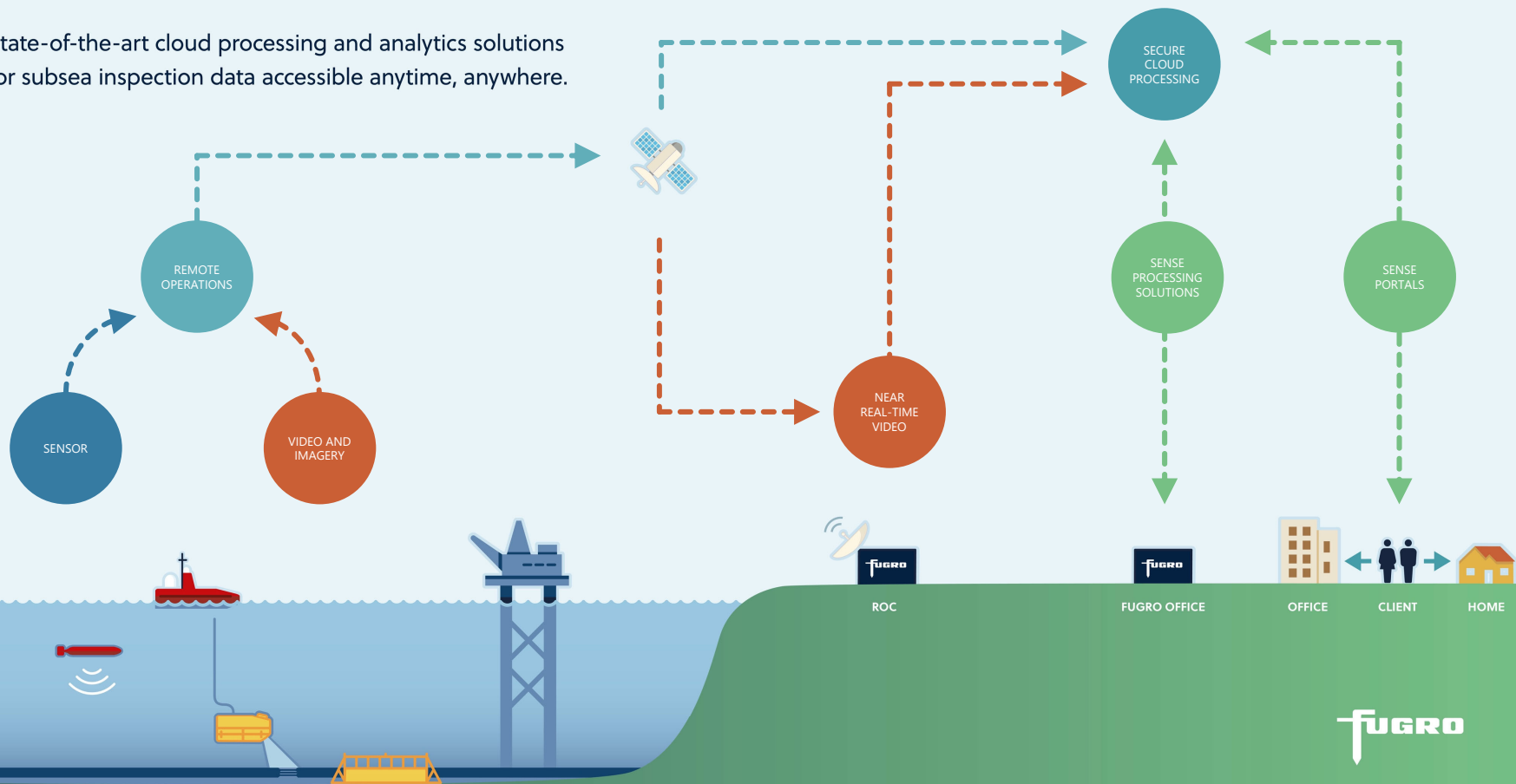
FUGRO



Operational Model

Sense Suite

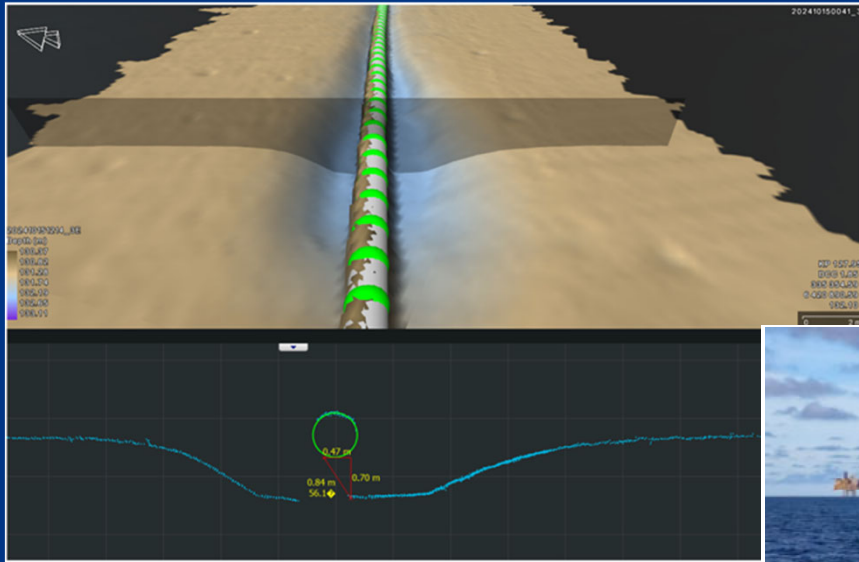
State-of-the-art cloud processing and analytics solutions for subsea inspection data accessible anytime, anywhere.



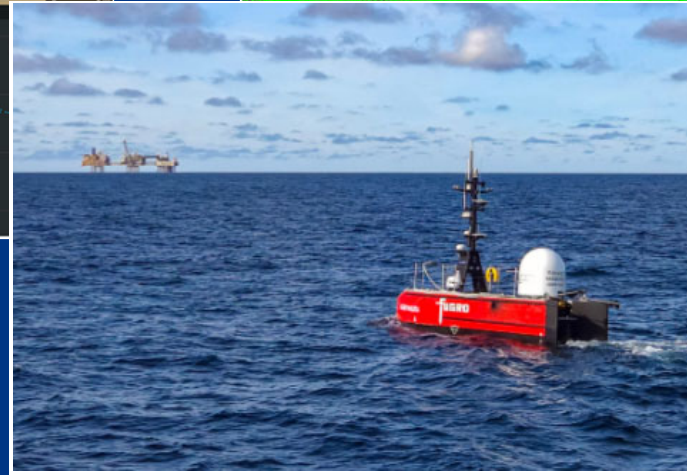
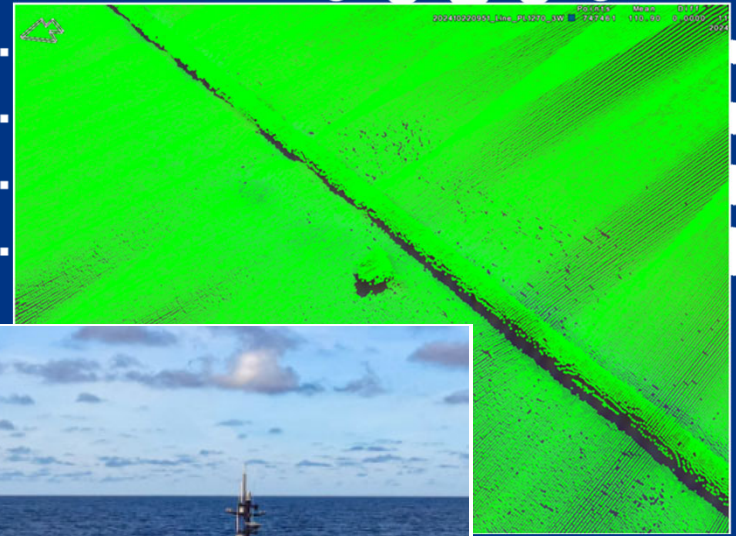
Global network of remote operations centres



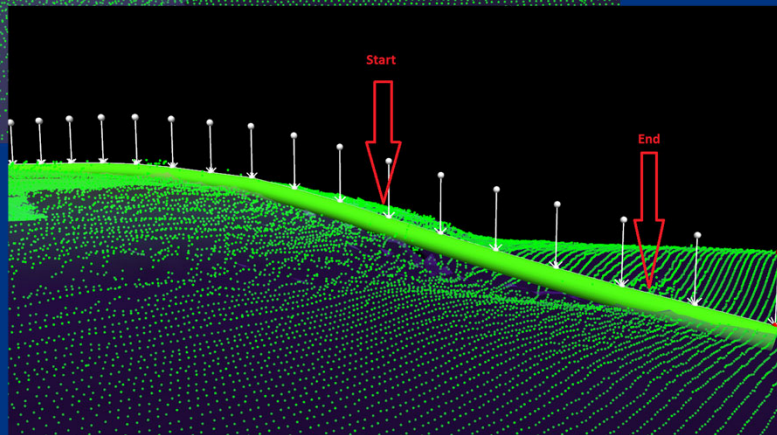
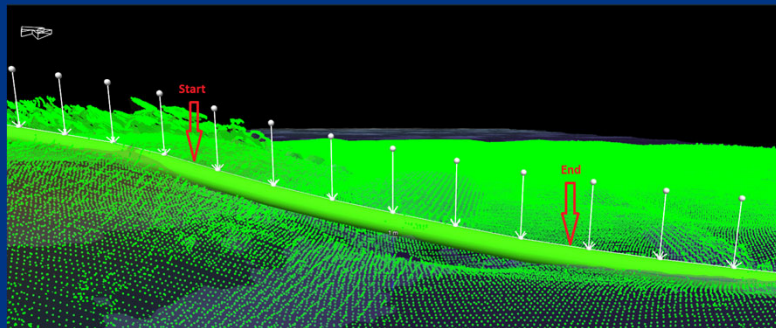
Use Cases



Quelle: Fugro



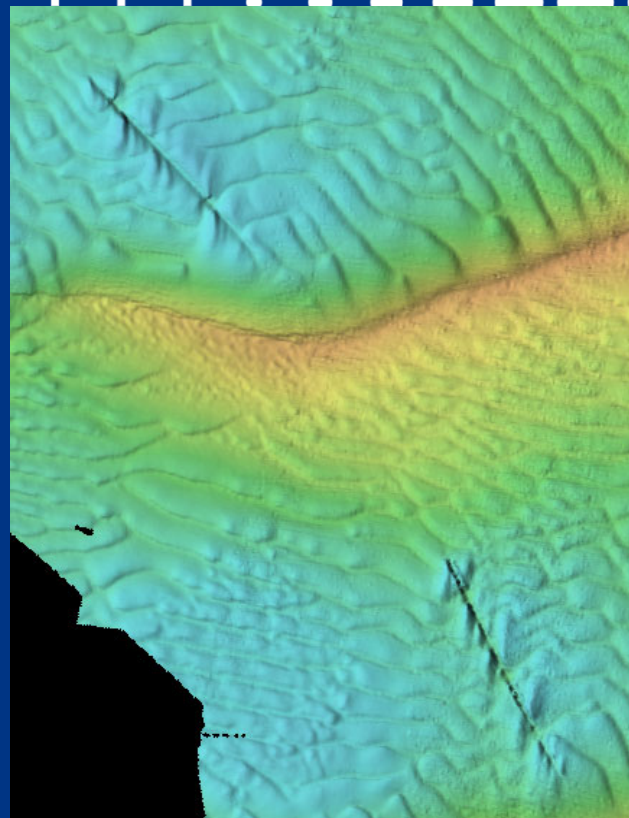
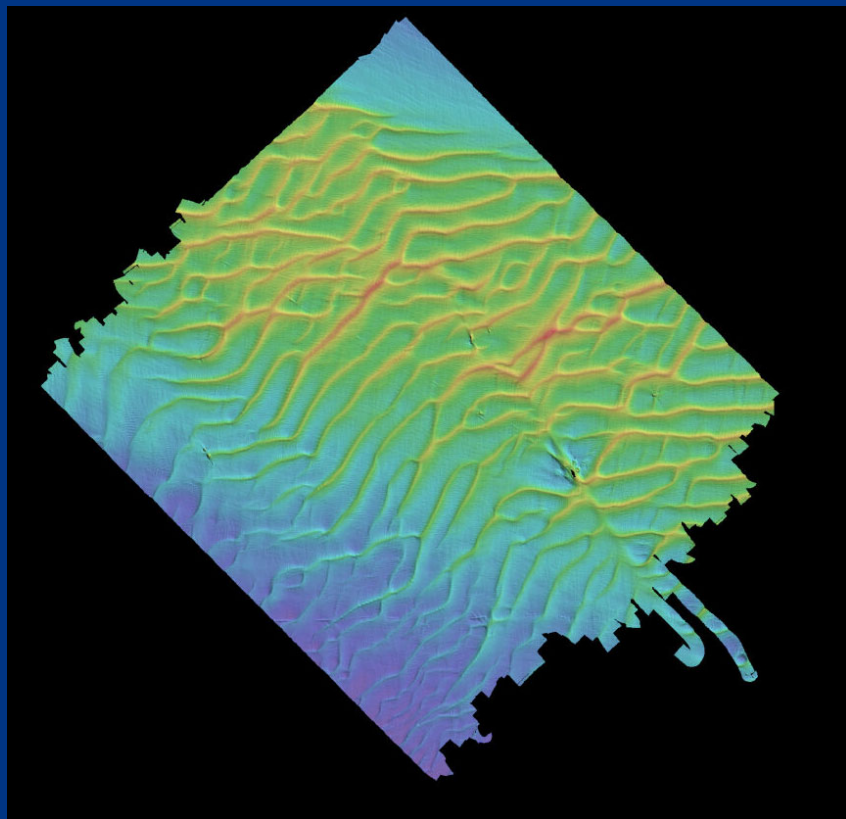
Linear Inspections / Surveys



Quelle: Fugro

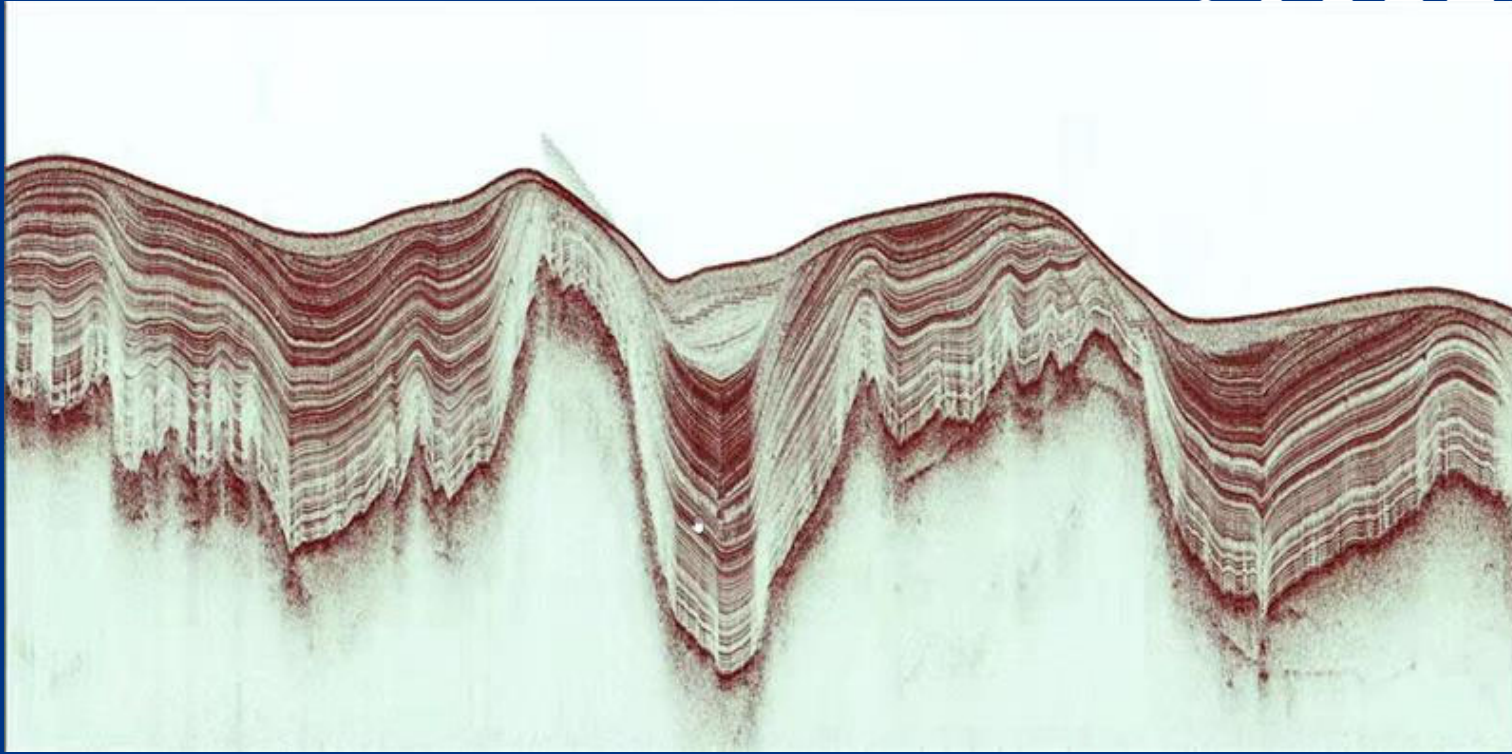


Case Study – Cable inspection



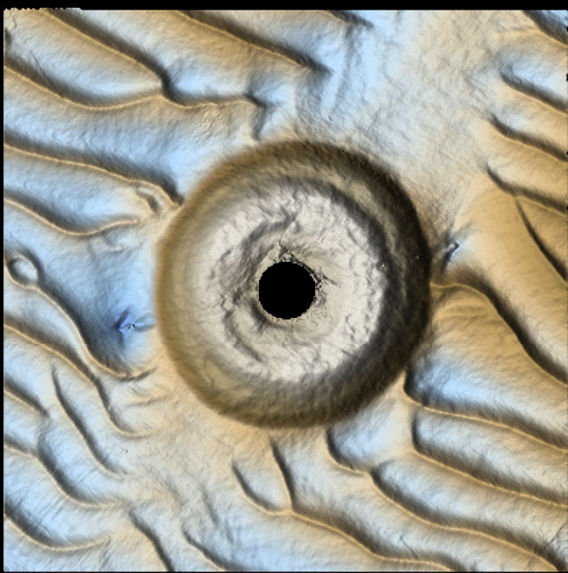
Quelle: Fugro

Seabed Mapping

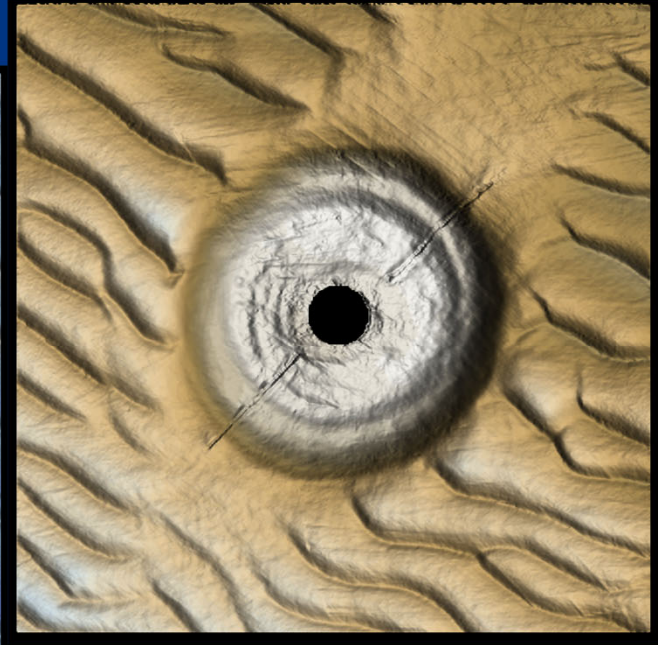
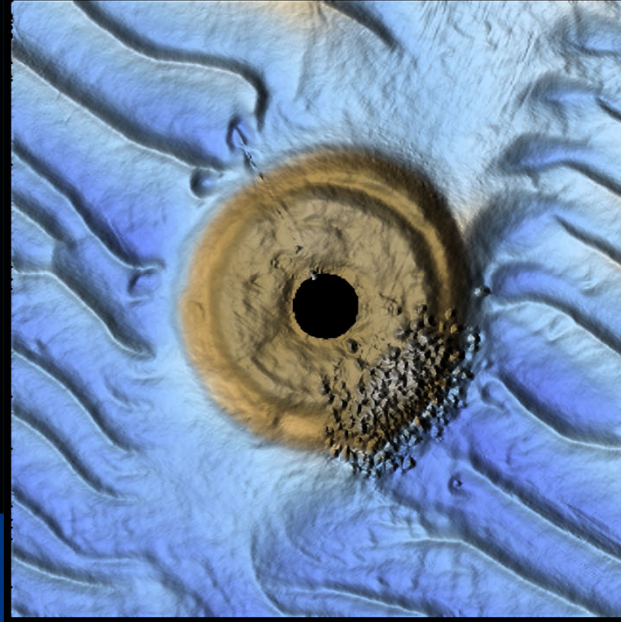


Quelle: Fugro

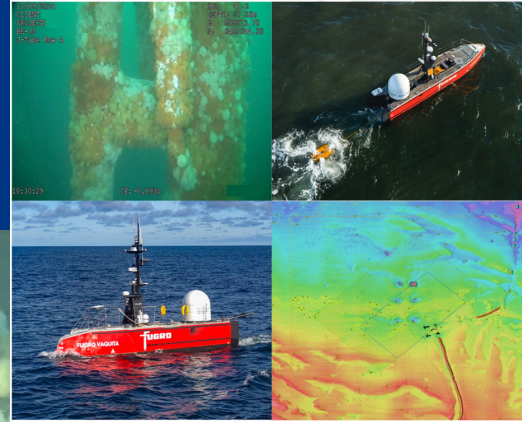
Case Study – Site Survey SBP



Quelle: Fugro



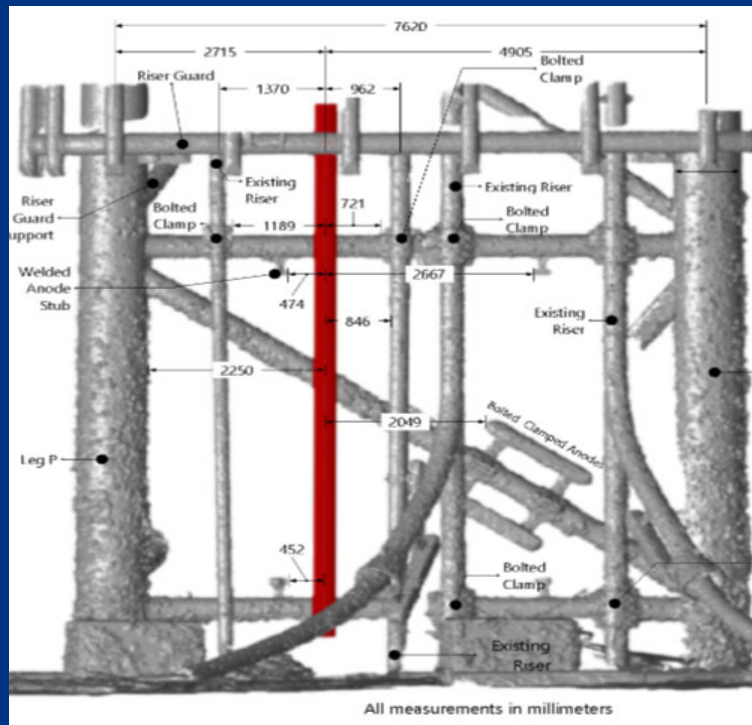
Data Examples – Scour Mapping



Quelle: Fugro

ROV Inspections
CP
FMD
GVI / CVI

Structural Inspections



Quelle: Fugro

Case Study – Photogrammetry

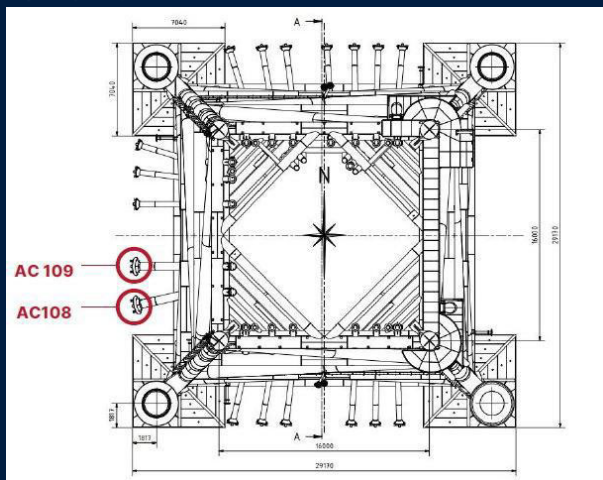


Success on Trianel Windpark Borkum

Scope

Visual Inspection: from bellmouth (platform side) to burial point. This inspection is solely video footage, without physical intervention.

Multibeam Survey: an MBES survey will be limited to entry of the J-Tube (platform side) to the burial point.



Target Approach

Dutch Port Authority

Dutch 12nm Zone

Dutch EEZ

Border Crossing to German EEZ

German EEZ

Approach and enter into Trianel Windfarm

Scope Execution

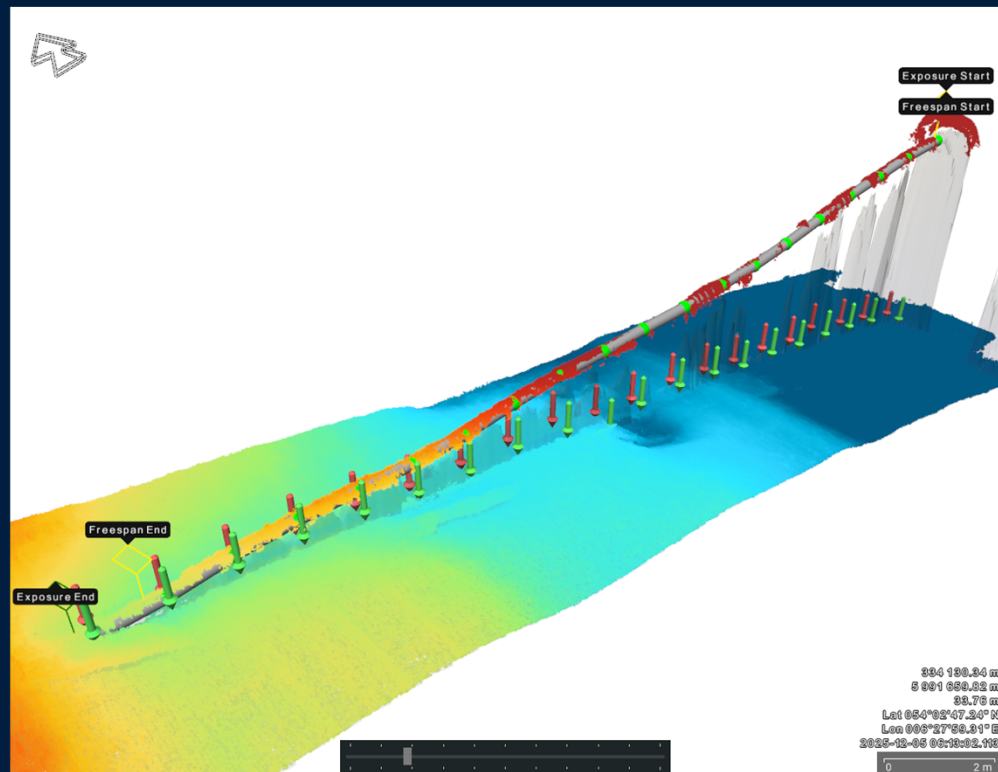
German 12nm Zone

Eems-Dollart Treaty Area

Emden Port Authority



Data Collection



Video / Stills Inspection

AC 108
Burial

AC108 Installation bands
secure south side

GVI

AC108 leaning
towards north side
of bellmouth, view
on north side

AC109 South Side
at Bellmouth



Outlook

Status quo

- Six 12m **Blue Essence® USVs** operational globally since 2022
- One 18m **Blue Eclipse® USV** operational in Europe
- Fleet of 5 **Blue Prism® USVs** to be delivered globally in 2026
- **Cat0** certified by **UK MCA** under **Lloyds Register** class society
- Successful survey and ROV inspection projects in **UK, Netherlands, Norway, Denmark, Germany, Brazil, UAE** and **Australia**



Operations Starting 2022

Total 1000+ days of USV project operations



Personnel

1+ million offshore personnel-hours saved



Environment

8200 Te of MGO saved
28,400 Te of CO2 emission stopped

Certifying & Flagging



Fugro USV's:

- No need for Guard vessel
- Can work without restrictions as any other manned vessel



Lloyd's Register:

- Fugro's USV Certifying Authority
- Survey Fugro USVs through build, fit-out & sea trials.
- Issue WBC Ed.3 certification on behalf of MCA.
- Also Certify the USVs against their own LR UMS Code.



UK Ship Register

Flagging:

- Fugro USVs in EUAF currently flagged UK.
- Overseas operations permitted but we must liaise with the Coastal State.



Permitting for automated sailing in German territorial waters

Permitting process

- Application to WSV to 'Carry out survey work with unmanned vehicles in the area of the German EEZ of the North Sea'.
- The USV was permitted to be used exclusively for the purpose specified (TenneT Germany SoW)
- Permit approved by BSH:

BSH - Postfach 30 12 20 - 20305 Hamburg

Fugro N.V.
Prismastraat 3,
2631 RT Nootdorp

The Netherlands

§ 132 Bundesberggesetz
Genehmigung von Inspektionsarbeiten (Multibeam Echosounder und Kamera) am von TenneT betriebenen Kabel und der J-Tube im Bereich des deutschen Festlandsockels der Nordsee an der Plattform des Trianel Windparks Borkum 1 mit dem USV „Fugro Orca“ (Rufzeichen: MIUV8) und den Begleitfahrzeugen „Ary“ (Rufzeichen: T7AY4), „Tonjin“ (Rufzeichen: T7AL5) und „Alcedo“ (Rufzeichen: HP2244)



BUNDESAMT FÜR
SEESCHIFFFAHRT
UND
HYDROGRAPHIE

Dienstszitz Hamburg

Datum
01.12.2025
Durchwahl
+ 49 (0) 40 3190 - 63306
Geschäftszeichen
(bitte bei Antwort angeben)
5213/N318_25/O3306/
Forschungshandlungen

What next: Future Permitting process for Fugro USV's in German waters?



Fugro Blue Prism®

General

- Transit Speed Max 12 knots
- Survey Speed 2-6 knots
- Endurance 23 Days

Principle Particulars

- Length: 17 m
- Beam: 4 m
- Draft: 1.8 m
- Geophysical survey: 1.5m Hs
- Transit: 2.5m Hs
- MBES, SBES, MVP, SBP, SSS, MAG and optional other sensors





Thank you



Blue Eclipse®

18m Uncrewed Surface Vessel

General

- Transit Speed 7-8 knots
- Survey Speed 2-6 knots
- Endurance
 - 21 Days

Principle Particulars

- Length: 18 m
- Beam: 3.5 m
- Draft: 3 m
- Weight: 44 t
- ROV deployment: 2.5m Hs
- MBES/SBP survey: 1.5m Hs
- Transit: 3.0m Hs



Blue Amp®

eROV for USV Operations

General

- 500m dive depth (from USV)
- 2.0m x 1.0m x 1.2m
- 650kg in air (without tooling skid)
- 250kgf forward thrust,
- 200kgf, horizontal thrust
- 100 kgf vertical thrust
- Speed 2+ knots

Pipeline Inspection (Single Pass)

- Dual head MBES
- Fast inspection operations
- CP and Field Gradient
- Depth of Burial
- Camera booms

Asset Inspection (Additional tooling skid)

- 100kg payload
- Brush/Flapper cleaning
- CP and Field Gradient
- Flooded member detection



Remote Operations Centres

24/7 operations.

Personnel

- USV Master – STCW 500T
- USV Operator – Officer of Watch
- Surveyor – Utilised across MCS and MAI projects.
- ROV Supervisors
- ROV Pilots
- Inspection Engineers
- Geophysical Operators

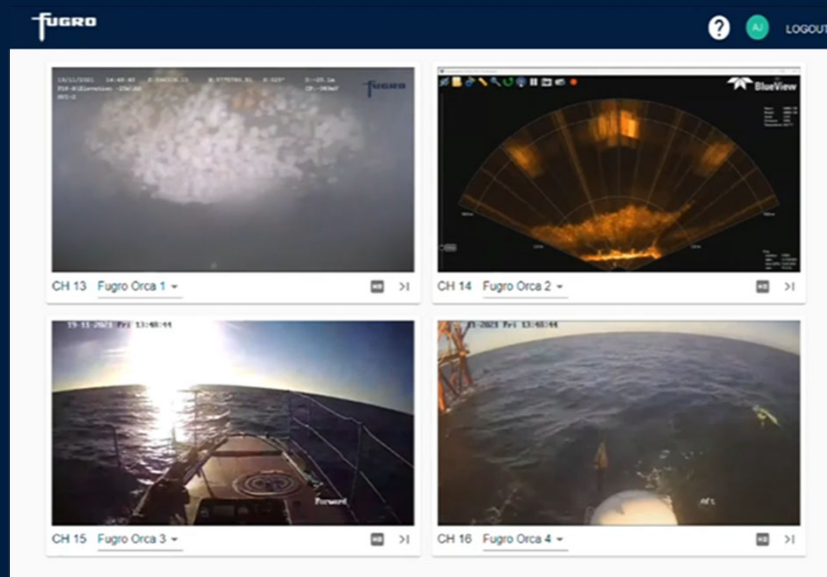


Sense.Live

Live Streaming of offshore operations

Sense.Live is Fugro's cloud-based Remote Operations live content delivery network

- Cloud-based video content delivery
- Ability to securely share multiple live video streams from offshore to office
- User-friendly web portal
- Audio, video, and data streams can be securely streamed to any internet-enabled device.



Site Support

12hr onsite technical support.

Personnel

- Site Manager – With engineering background
- ROV Technician
- Marine Engineer or ETO
- Geophysical/Survey Engineer
- Small boat handling ticket
- Team of 2-3 dependant of skillsets and training



Connectivity

Europe

- Primary – Dual Low orbit Starlink connections.
 - Secondary – Dual dedicated 5mb uplink and 1mb downlink
 - Tertiary – Iridium
 - 4G/5G for in port access
-
- Connection is actively monitored in the ROC for stable bandwidth

System will autonomously switch from Primary to secondary based on latency statistics.



Loss of connectivity

- Top Status Bar:**

 - Control Mode: **Standalone** (Other modes: Network, Standalone)
 - Time: 13:42 UTC
 - Position: 52° 17' 36.6N, 003° 49' 06.0E
 - Speed: 0.0 knots
 - Wind Angle: 280.0 degrees
 - Wind Speed: 3.89 knots
 - Wave Speed: 49.87 knots
 - Port Drive Power: 0.0 kW
 - Starboard Drive Power: 0.0 kW
 - Gen Set 1: 0.0 kW
 - Gen Set 2: 0.0 kW
 - Gen Set 3: 0.0 kW
 - Gen Set 4: 0.0 kW
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 - Gen Set 100: 0.0 kW

Central 3D Model:

 - Tugboat: **TUGRO ORCA**
 - Color: Red hull, white superstructure
 - Position: 52° 17' 36.6N, 003° 49' 06.0E
 - Speed: 0.0 knots
 - Wind Angle: 280.0 degrees
 - Wind Speed: 3.89 knots
 - Wave Speed: 49.87 knots
 - Port Drive Power: 0.0 kW
 - Starboard Drive Power: 0.0 kW
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 - Gen Set 94: 0.0 kW
 - Gen Set 95: 0.0 kW
 - Gen Set 96: 0.0 kW
 - Gen Set 97: 0.0 kW
 - Gen Set 98: 0.0 kW
 - Gen Set 99: 0.0 kW
 - Gen Set 100: 0.0 kW

Left Sidebar:

 - ENGINE MONITORING:**
 - Port Engine: 1000 RPM, 100% Load, 100% Fuel Flow
 - Starboard Engine: 1000 RPM, 100% Load, 100% Fuel Flow
 - PRODUCTION:**
 - Port Thrust: 100% (1000 kW)
 - Starboard Thrust: 100% (1000 kW)
 - STATUS:**
 - Port Engine:

GSAPI User interface and control software

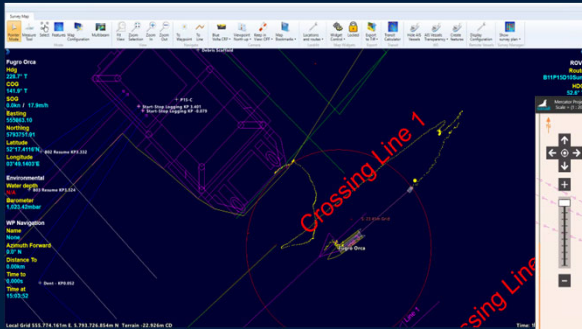
Navigation Safety

Visual awareness

- Actively managed cameras for 360 situational awareness
- Thermal imaging FLIR camera

ECDIS and Navigation

- Class approved ECDIS system
- Integrated survey and navigation stations



Navigational Safety

System diagnostics

- Digital engine room facilitating active monitoring of Voltages, Currents, Temperatures.



RADAR & VHF

- Type approved radar and VHF

