ELWAVE

HYDRO22 - MONACO

afhy ASSOCIATION FRANCOPHONE D'HYDROGRAPHIE

IFHS

Subsea detection by *Octopulse* sensor
CEDAR™ TECHNOLOGY

ELWAVE

Biomimetics « electric sense »

15 employees (hiring !)

https://elwave.fr/carrieres/

33% women

- World ‘s first company to offer solutions based on « electric sense »
- Awardee of the most selective French and European grants (**EURONAVAL INNOVATION AWARD 2022…**)

3 applicative markets

- Industrial robotics
- Energy and offshore infrastructure
- Defense and security

HISTORY

2007 — IMT Atlantique (Bretagne-Pays de la Loire, École Mines-Télécom)
Academic research

2018 — ELWAVE inc.
Nantes, FRANCE

2019 — MINISTÈRE DE L'ENSEIGNEMENT SUPÉRIEUR, DE LA RECHERCHE ET DE L'INNOVATION (Liberté, Égalité, Fraternité)
Winner French innovation prize *i-LAB*
250k€

2020 — MIRICLE | Mine Risk Clearance for Europe
European Consortium led by Naval Group
300k€

SOFIMAC Innovation · Litto INVEST · CA Atlantique Vendée
1st fundraising
2M€

2021 — European Commission
Winner Blue Economy Grant 1,7M€

2022 — Octopulse CEDAR

2023
Commercial deployment with Early Adaptors

CONTRACTS

TechnipFMC · subsea 7 · TotalEnergies · SAIPEM · FUGRO · NAVAL GROUP · THALES · ...

Partners

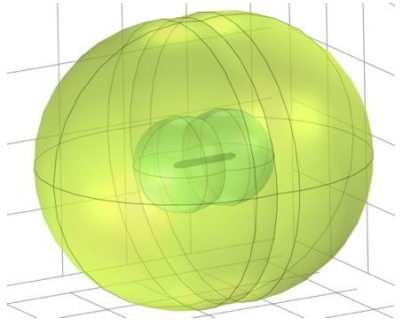
IMT Atlantique (Bretagne-Pays de la Loire, École Mines-Télécom) · ATLANPOLE Land of innovation · bpifrance · AIRBUS · EVOLEN Energy Made in France · GICAN

ENHANCED REAL-TIME 360° ELECTRIC IMAGE

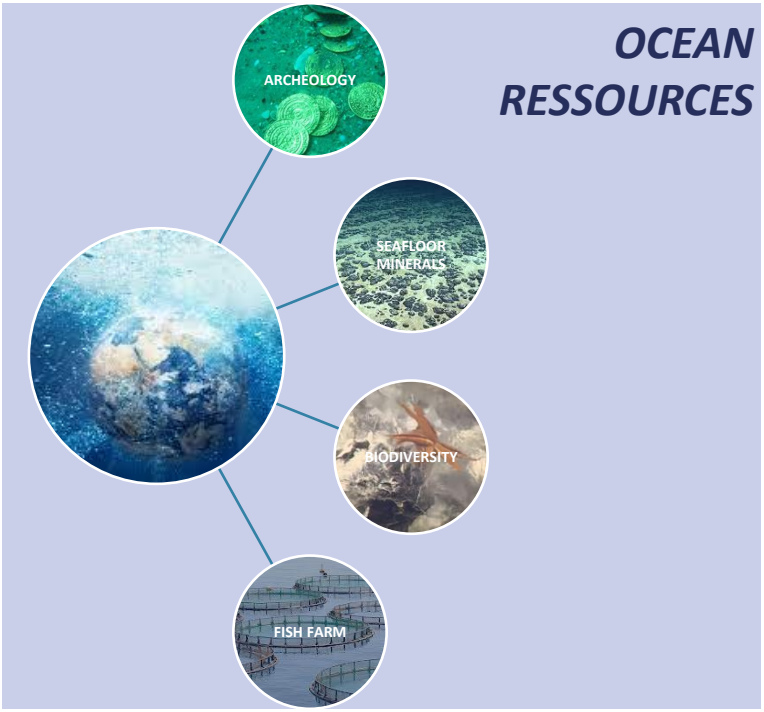
Active Electric Detection

- Emission of an alternative low frequency, low energy electric field
- Measurement of its variations
- AI & algorithms for detection, location and characterization

- **Real-time 360° perception** *(4pi steradian)*
- **Location and characterization** (size, shape, material, alive)
  of metallic and non-metallic objects
- **Efficient for buried objects** (cable, mine/UxO, pipeline)
- **Efficient in complex environments** (turbid water, cluttered environment, ...)
- **Integrable on any size of ROV and AUV**

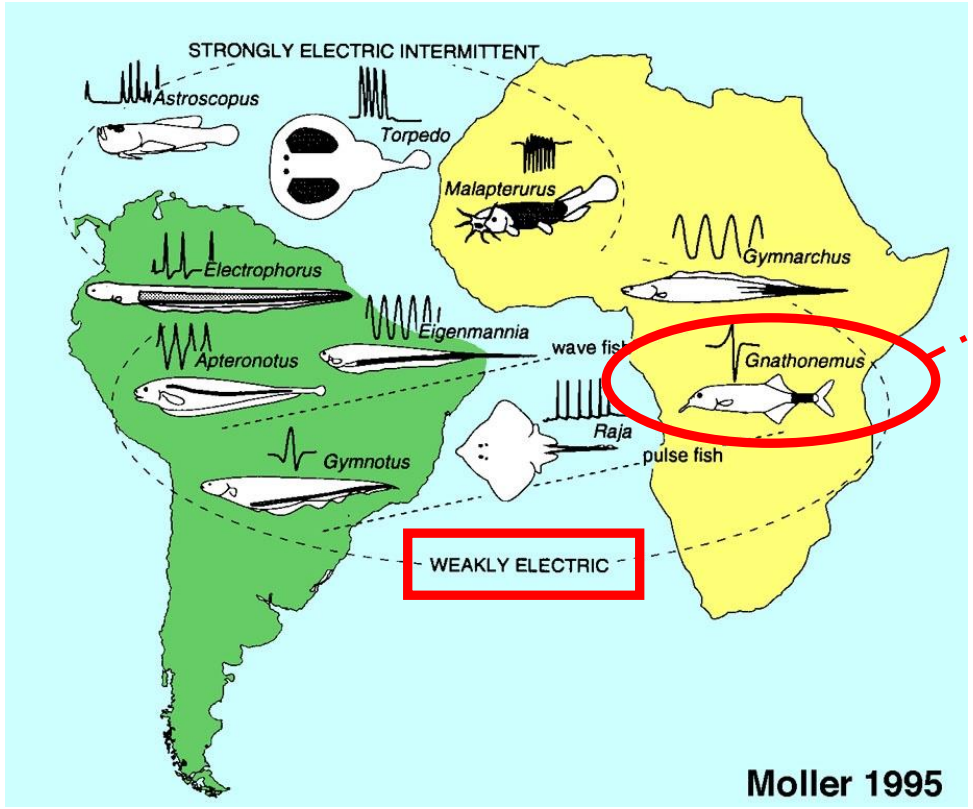


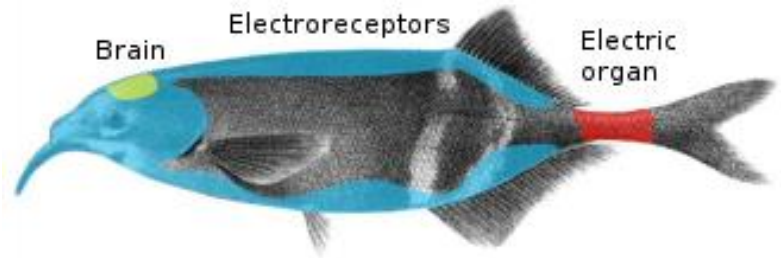
CEDAR TECHNOLOGY, SUBSEA APPLICATIONS



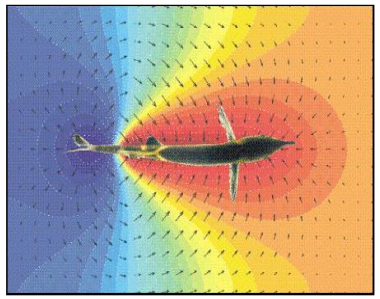
BIO-INSPIRED TECHNOLOGY

« Electric Sense » in Nature

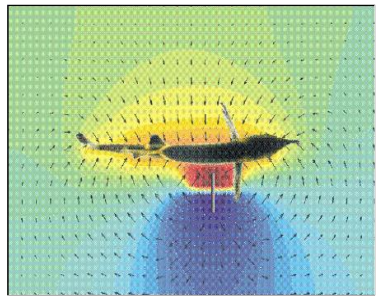




Electric fish
Gnathonemus Petersii



Electric field generated by the fish without any object close to it



Electric field perturbated by an object close to the fish

« ***Electric sense*** » is the perception mode of fishes living in muddy and very cluttered tropical water in which **vision and acoustics are inefficient**.

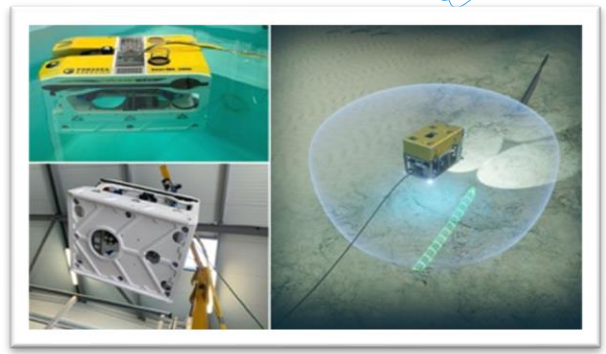
Detection method:

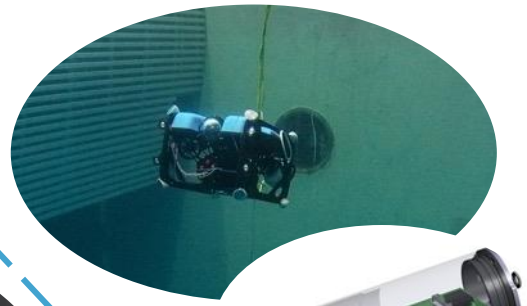
- Emission of a weakly alternative electric field
- Measure of its evolution
- **Real-time** data treatment for the **detection**, the **localization** and the **characterization** of object

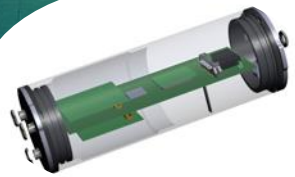
IMT University and Elwave collaboration

IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

ELWAVE







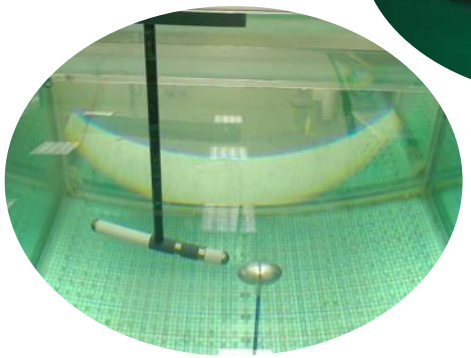
Commercial product *Octopulse*
(2022)

Octopulse
CEDAR

Industrial prototype
(2020)

Lab Prototype V2
(2017)

Lab Prototype V1
(2012)



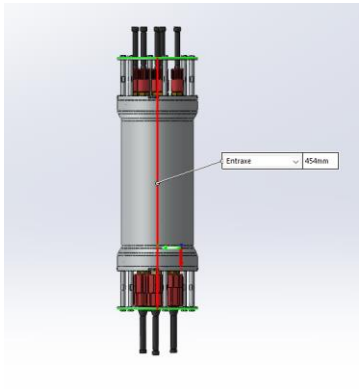
Electric probe
(2007)

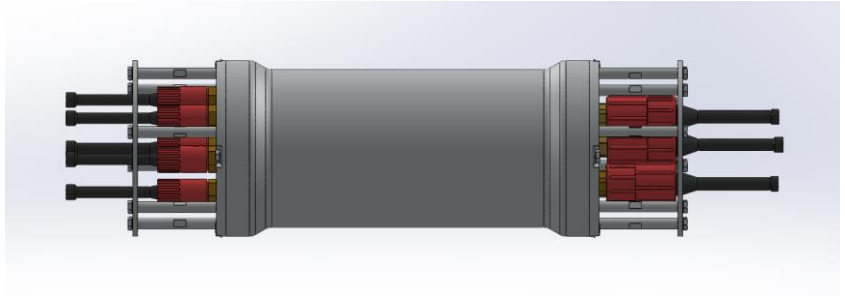
+ 15ans R&D

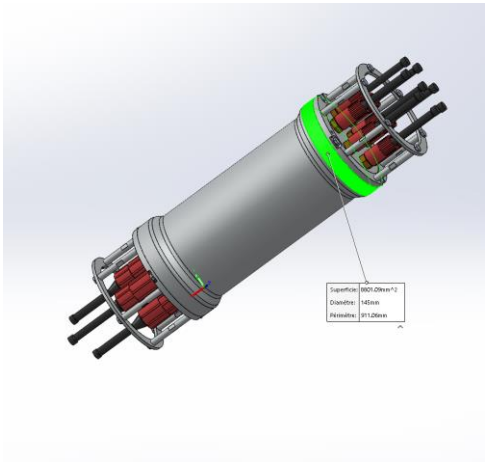
Sensor hardwares

Octopulse 300m – up to 8 electrodes – ≈50W

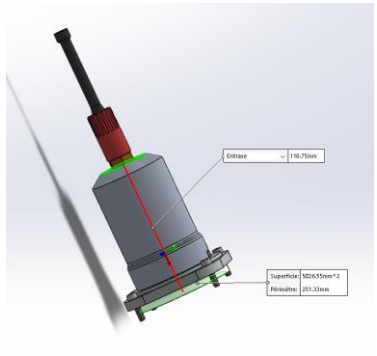
POD Length: 450mm - OD :145mm - Aluminium – Weight 6,5Kg / 1,3Kg (Air/Water)

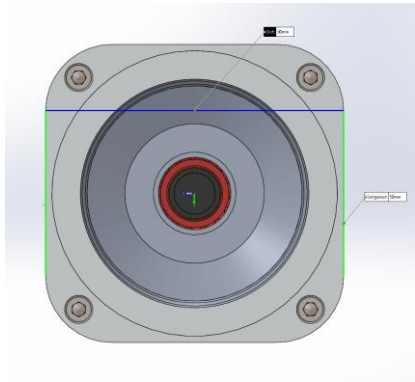


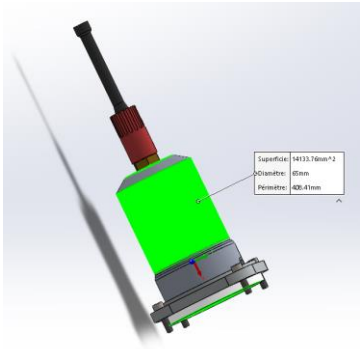




Electrode Length: 120mm - OD :90mm Aluminium - Weight 0,85Kg / 0,35Kg (Air/Water)

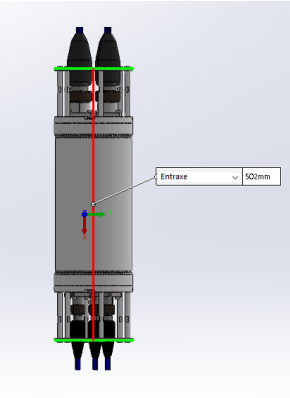




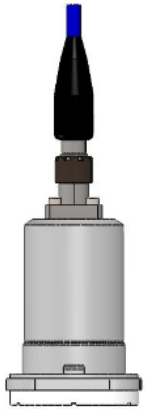


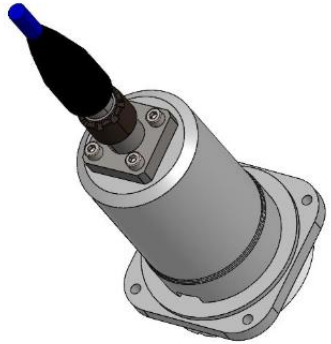
Octopulse 6000m – up to 2*8 electrodes – ≈60W

POD Length: 520mm - OD :145mm - Titanium – Weight 12Kg / 7Kg (Air/Water)



Electrode Length: 120mm - OD :90mm - Titanium - Weight 1,5Kg / 0,95Kg (Air/Water)





Software Modules

UXO 2D SOFTWARE MODULE

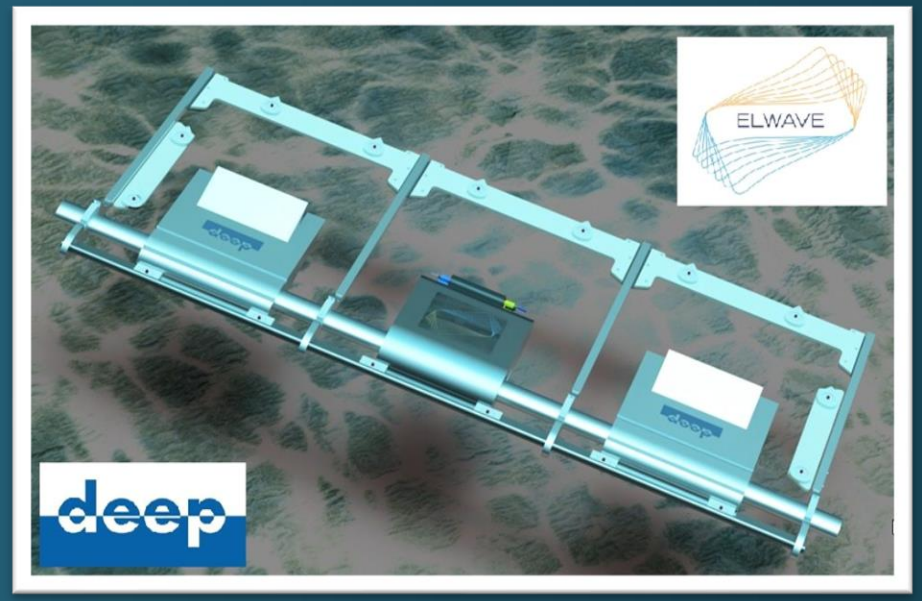
BURIED UXO

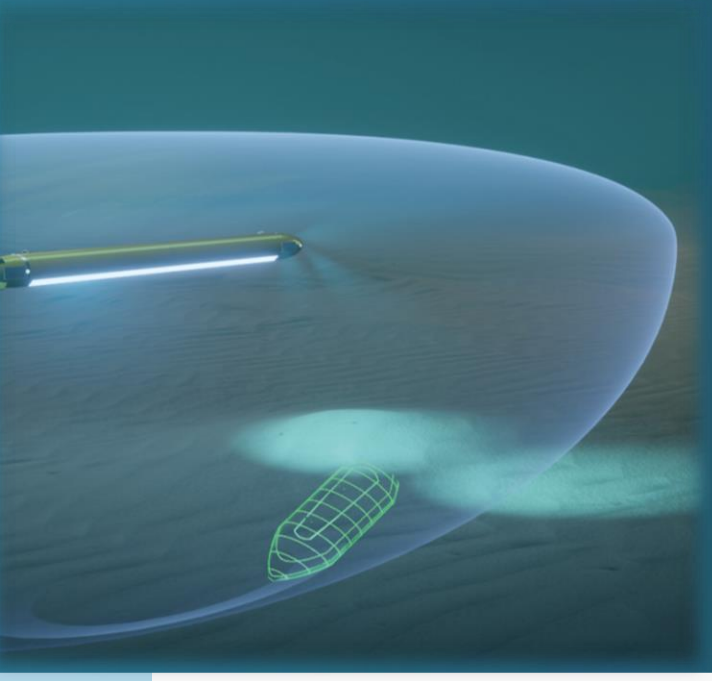
BURIED MINES

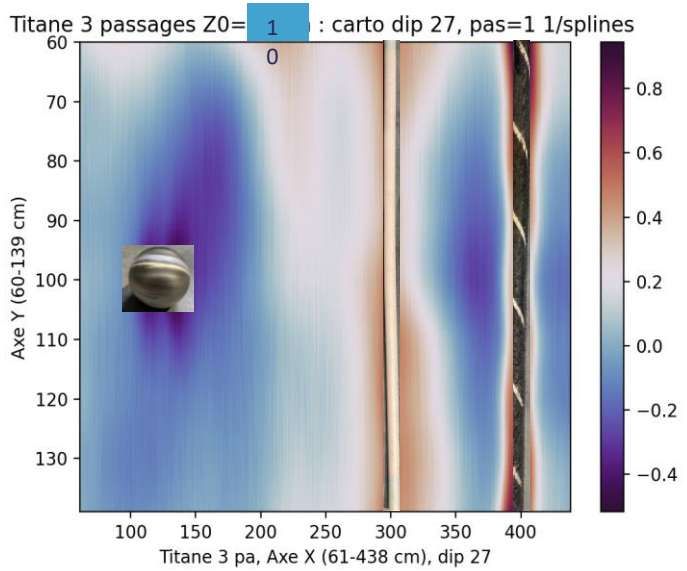
MARINE ARCHOLOGY

SEABED MINERAL RESSOURCES

WRECK & DEBRIS



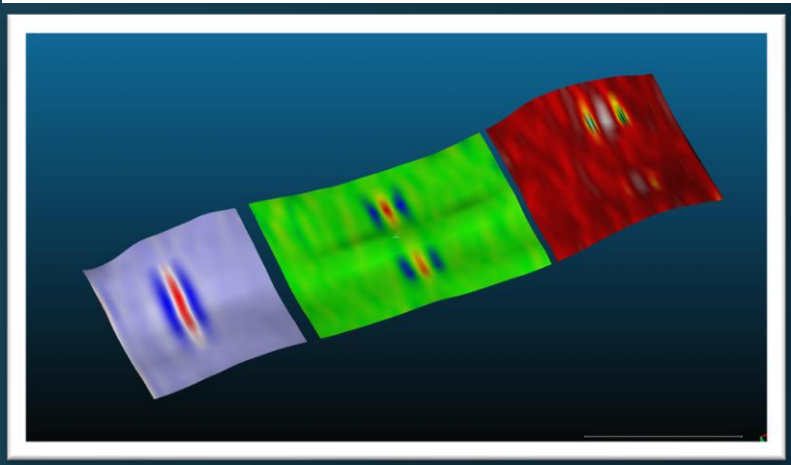




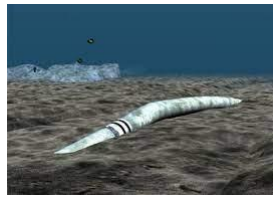
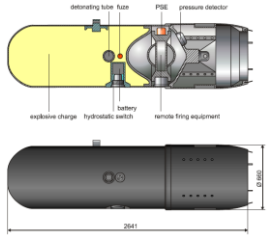
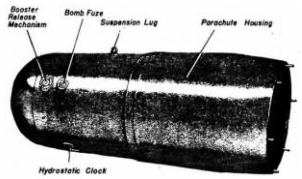
Buried conductive sphere and non-conductive communication cables

DATA OUTPUT

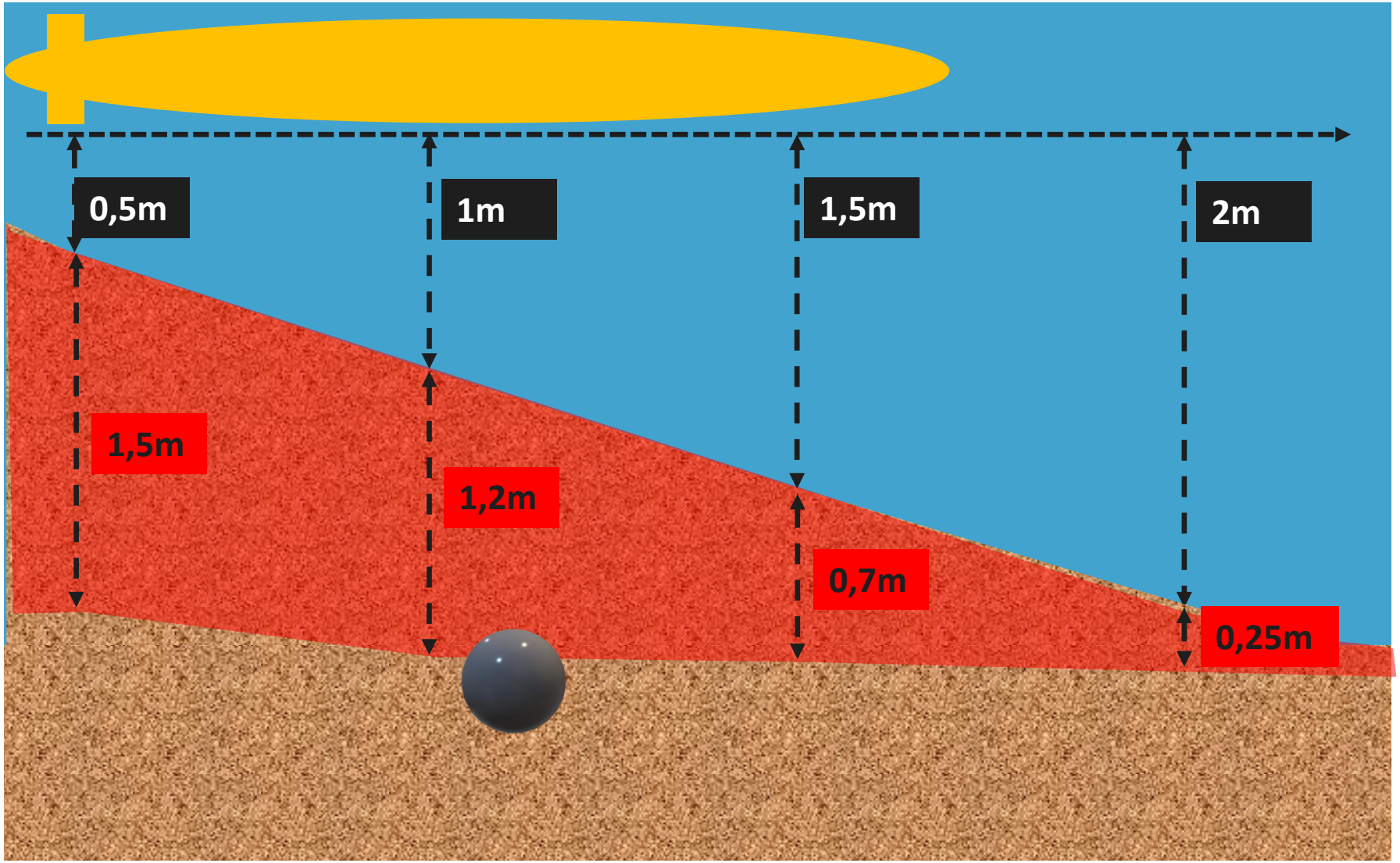
- ✓ **POINTS CLOUD (X,Y,Z,seabed resistivity)** to export to 3rd party mapping software
- ✓ **UXO 3D SOFTWARE MODULE** will also provide a text file with individual buried object additional information (time, coordinates, DOB, shape, size,material conductivity).

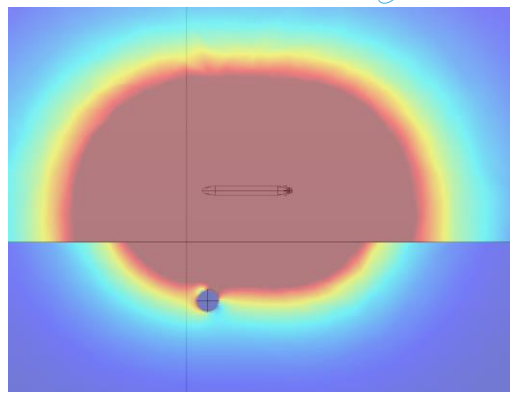


BURIED OBJECTS :Typical Detection capabilities

	20mm Fiber Optic cable (non-conductive)	24” Buried pipeline (non-conductive)	Buried LMB (conductive & non ferro magnetic)	Buried LMA (conductive & ferro magnetic)	Buried Manta (non-conductive & non ferro magnetic)
					
Dipole length (vehicle dimension)	**4m**	**1,5m**	**1,5m**	**4m**	**4m**
Vehicle altitude	1m	3m	3m	7m	3m
Target Depth of Burial	0,5m	2m	2m	0,5m	0,5m

Typical detection from a 4m long AUV



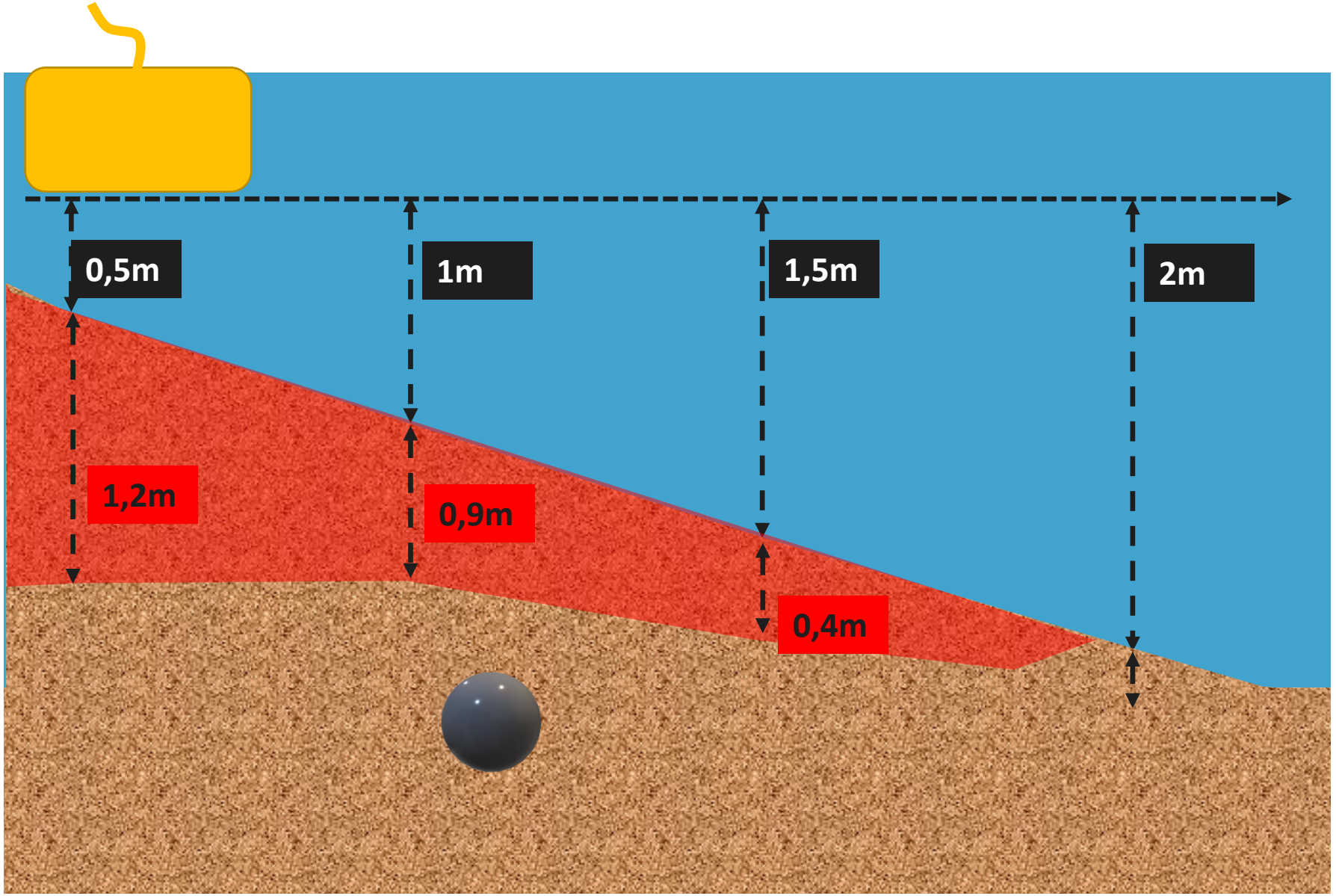


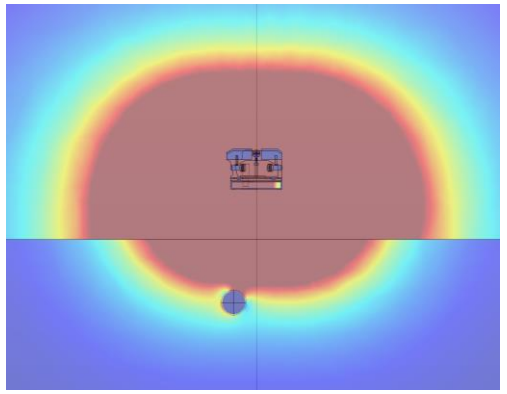
Detection coverage of a Ø0,5m sphere or volume equivalent **insulated** buried object

2m — AUV altitude above seabed

0,7m — Sphere max depth of burial

Typical detection from a 1m long ROV



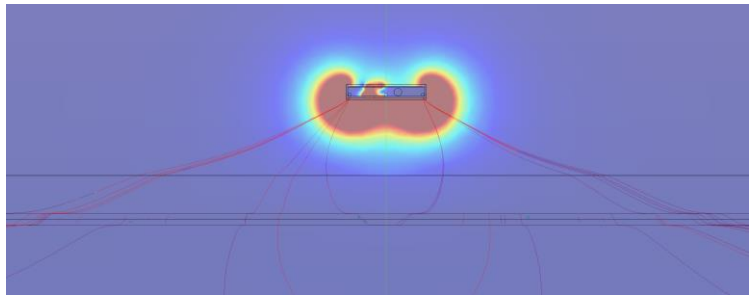


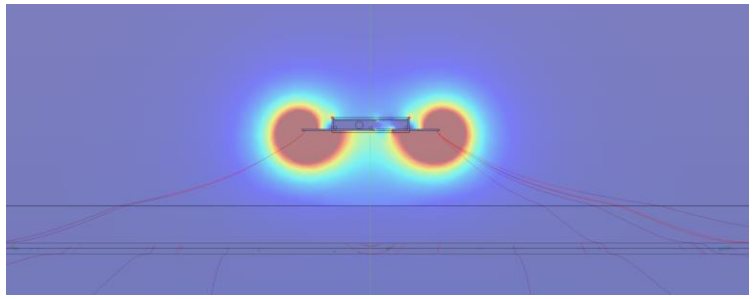
Detection coverage of a Ø0,5m sphere or volume equivalent **insulated** buried object

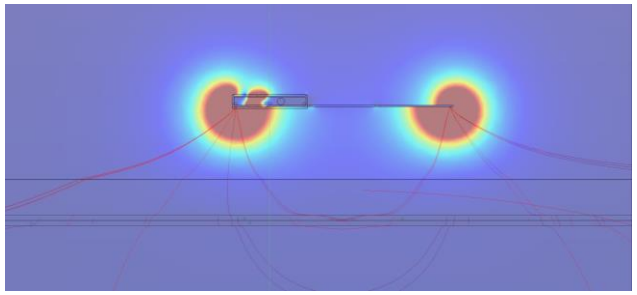
2m — ROV altitude above seabed

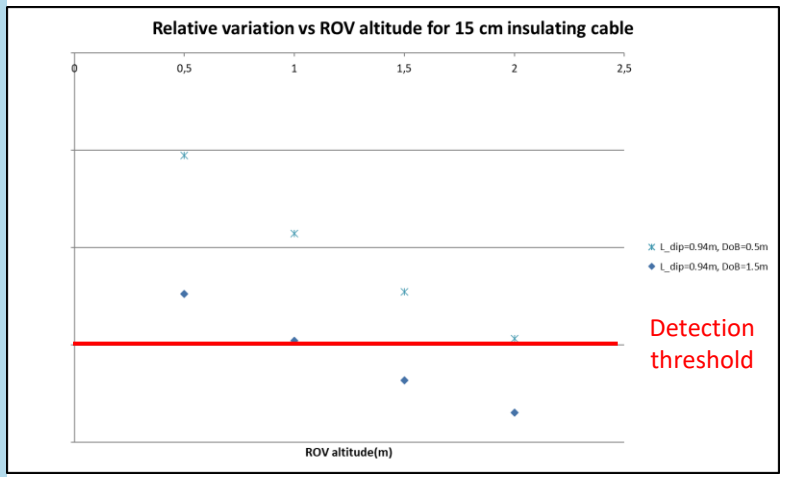
0,4m — Sphere max depth of burial

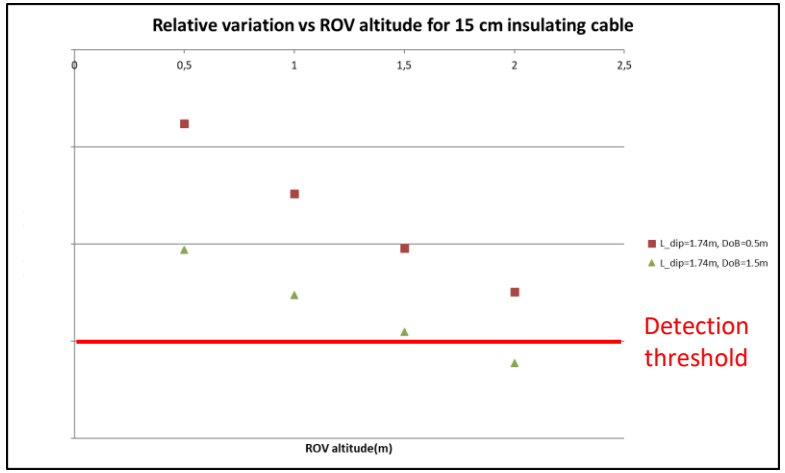
Detection capabilities – 15cm cable

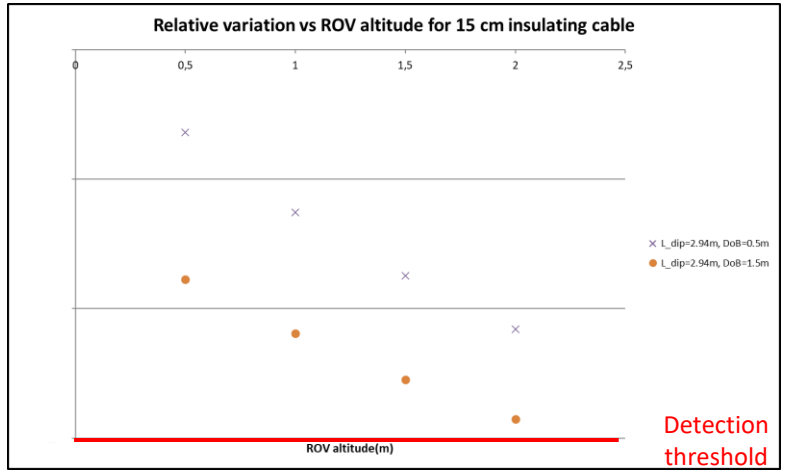












1m Skid

✓ *0,5m DoB cable : up to 2m altitude*

✓ *1,5m DoB cable : up to 1m altitude*

1,75m Skid

✓ *0,5m DoB cable : up to 2,3m altitude*

✓ *1,5m DoB cable : up to 1,6m altitude*

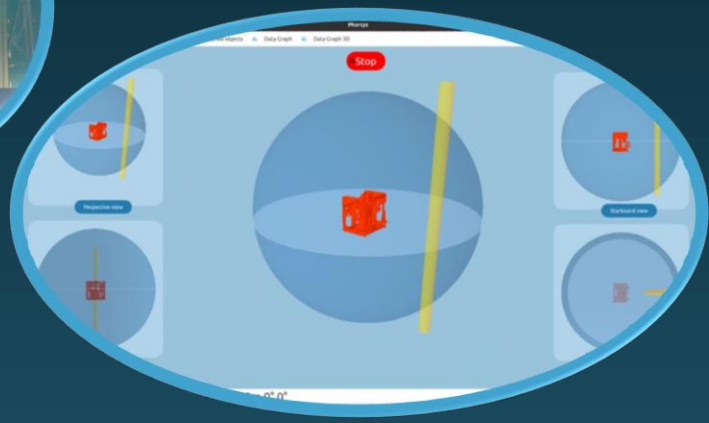
3m Skid

✓ *0,5m DoB cable : up to 2,7m altitude*

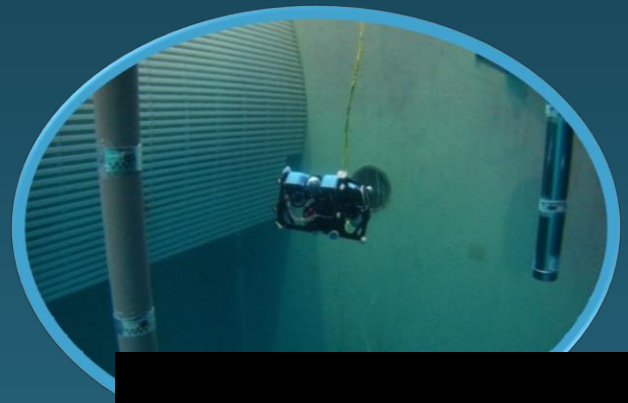
✓ *1,5m DoB cable : up to 2,2m altitude*

Further capabilites…

SAFETY SHIELD SOFTWARE MODULE



With its unique ability to detect and characterize (size, shape, electrical nature) any insulating and conductive objects in water, ELWAVE technology is a breakthrough solution for real time underwater perception with a ***detection range up up to 5 times the length of the vehicle***



REAL-TIME

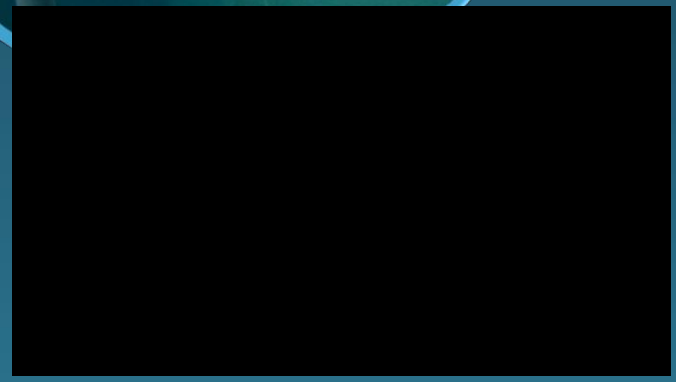
OMNIDIRECTIONAL

CONDUCTIVE & INSULATING OBJECT

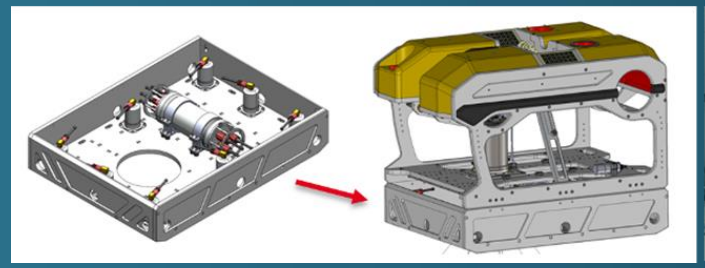
TURBID WATER

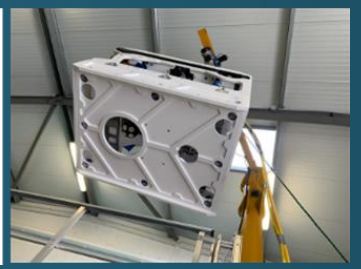
CLOSE APROACH

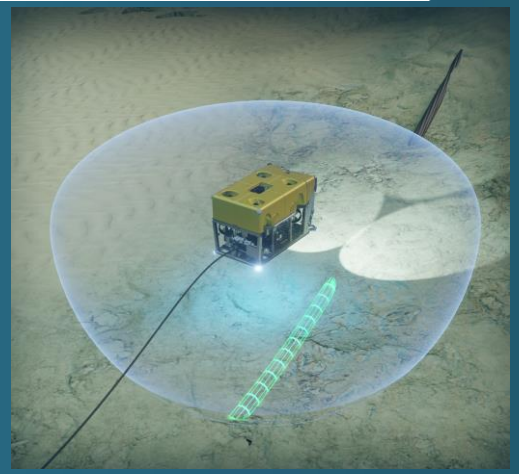
OBSTACLE AVOIDANCE



BURIED PIPELINE/CABLE TRACKING SOFTWARE MODULE





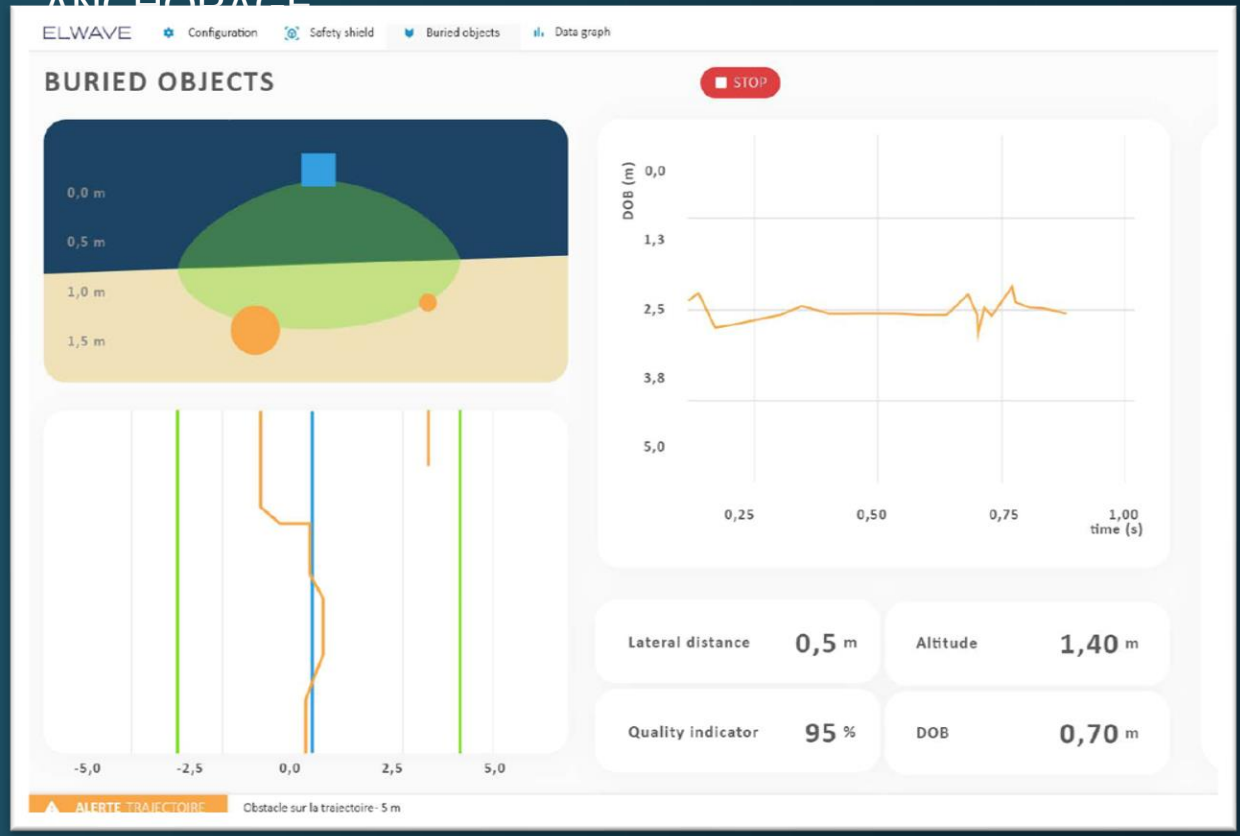


BURIED COMMUNICATION CABLES

BURIED ACTIVE & POWER CABLES

BURIED PIPELINES

BURIED MOORING LINES & ANCHORAGE



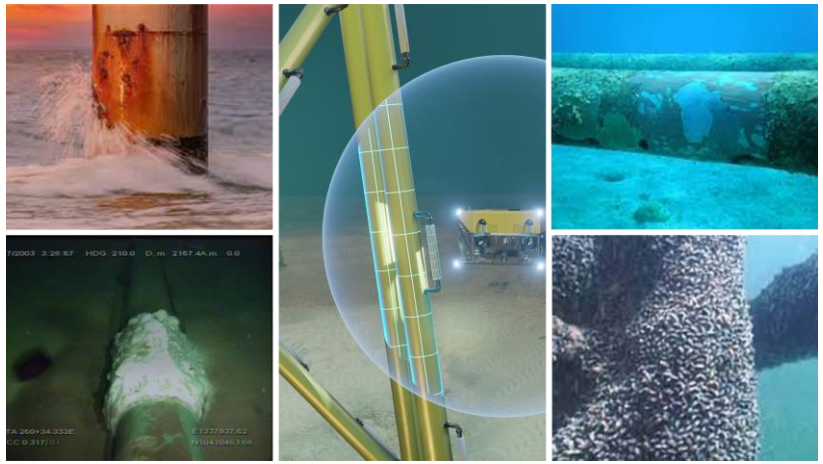
DATA OUTPUT

- ✓ **Industry standard protocol** to export real-time Depth of Burial survey information to 3rd party survey software
- ✓ Real time lateral offset information can feed the subsea vehicle **auto-tracking mode**

Further Software Modules to come…

Contactless

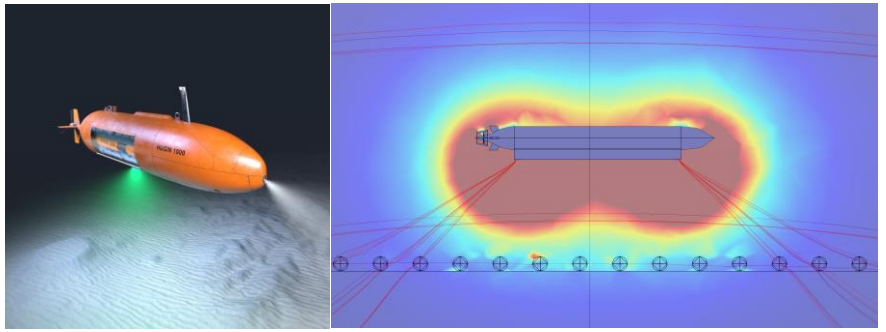
Subsea Structure Inspection



- ✓ Biofouling weight estimation
- ✓ Pipeline coating crack detection
- ✓ Corrosion and Microbiology Influence corrosion detection
- ✓ Contactless cathodic protection monitoring

Contactless

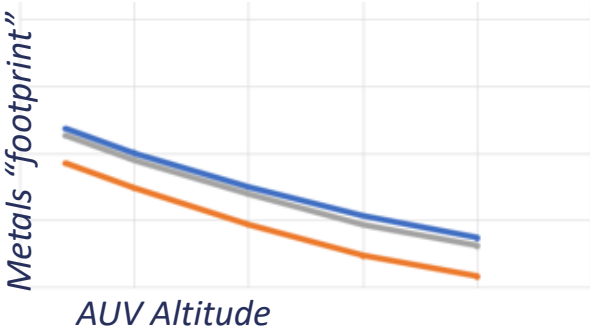
Seabed Minerals Identification



Massive sulphides minerals

Manganese

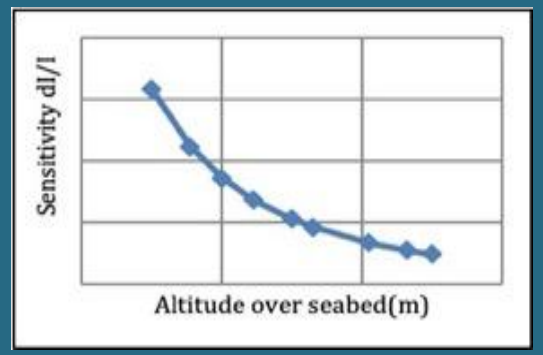
Quartz



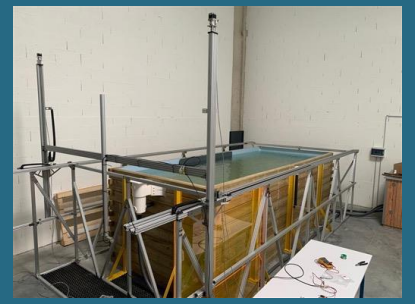
EARLY ADOPTER’s PARTNERSHIP

EVALUATION PROCESS *(representativity ≥95%)*

Numerical simulation



Offshore Sea trials & preliminary preparation in pools on scale model



Evaluation process (numerical simulation + scaled model in pools) as an **highly efficient, cost effective, risk mitigation** way before integration and T&E on real vehicle.

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2022

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