

# Operations for the ALBATROSS line in the Ligurian Western site EMSO

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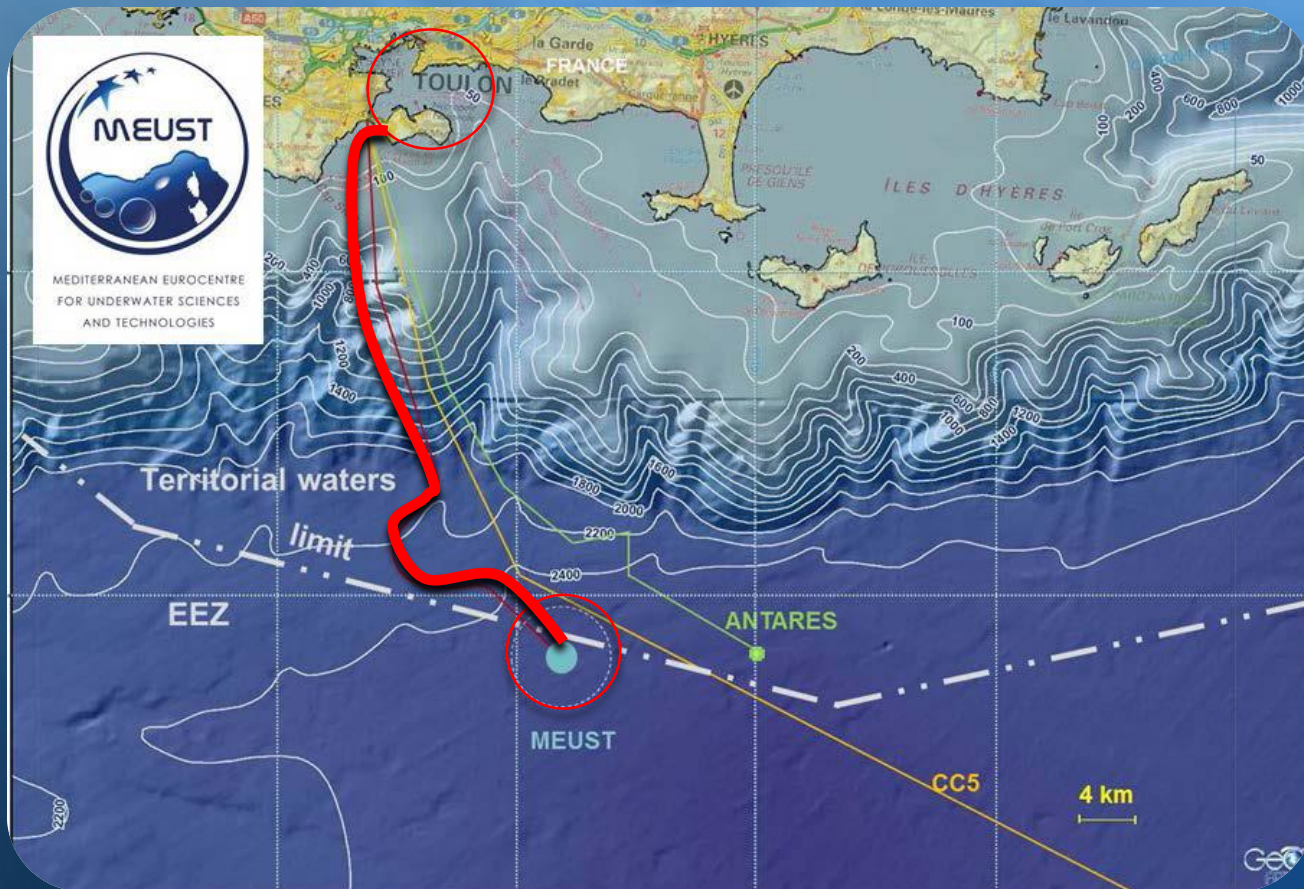
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# Ligurian Western site EMSO – KM3NeT

The underwater observatory is located off Toulon at a depth of 2500 m and is connected to the ground by an electro-optical cable of about 40 kilometres.



# Ligurian Western site EMSO – KM3NeT

## A NEW WAY TO OBSERVE THE UNIVERSE

Neutrinos, being weakly interacting and neutral, are a unique messenger to study the high-energy Universe. During their long voyage from the farthest reaches of the Universe to the Earth, they are unabsorbed by obstacles and remain undeflected by magnetic fields. Only neutrinos are able to escape from the heart of cataclysmic cosmic phenomena thus revealing the nature of cosmic rays and how they are accelerated to enormous energies.

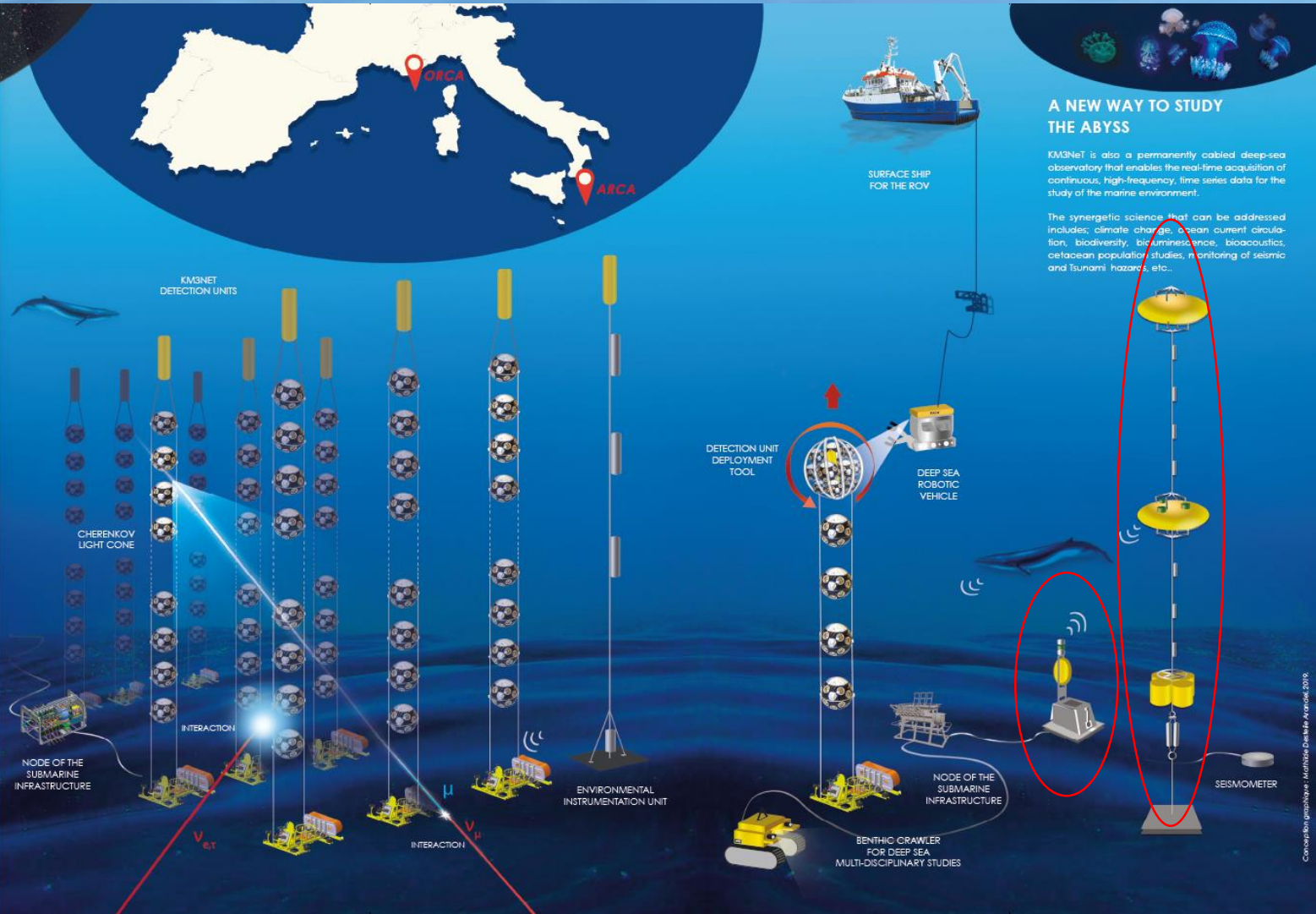
However, a huge amount of matter is necessary to detect neutrinos. KM3NeT uses the Earth as a target to capture neutrinos coming from the skies above the antipodes. Once in a while, these neutrinos collide with an atom and convert to a charged particle, such as an electron or a muon, which will then emit a wake of Cherenkov light when travelling through sea water. It is this very faint flash of light that the thousands of "eyes" of KM3NeT detect to pinpoint the enigmatic sources of high-energy neutrinos in the Universe.



## A NEW WAY TO STUDY NEUTRINOS

KM3NeT is also an ideal detector to study the fundamental properties of the three flavours of neutrinos ( $\nu_e, \nu_\mu, \nu_\tau$ ). By exploiting the abundant flux of 'atmospheric' neutrinos created by the permanent bombardment of the Earth's atmosphere by cosmic rays, KM3NeT will study the 'oscillation' behaviour of neutrinos as they transform from one type of neutrino into another. In particular, it will be possible to determine the neutrino mass ordering i.e. whether the  $\mu$  mass state of neutrino is heavier or lighter than the other two?

KM3NeT will also scrutinise its data for signs of new physics such as 'sterile' neutrinos, the existence of dark matter and perform neutrino tomography of the Earth's interior.

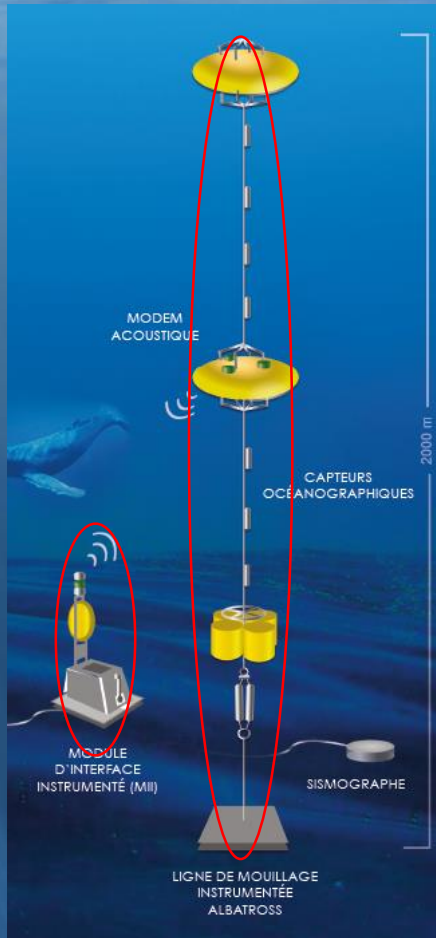


## A NEW WAY TO STUDY THE ABYSS

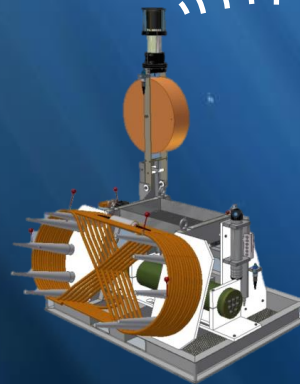
KM3NeT is also a permanently cabled deep-sea observatory that enables the real-time acquisition of continuous, high-frequency, time series data for the study of the marine environment.

The synergetic science that can be addressed includes; climate change, ocean current circulation, biodiversity, bioluminescence, bioacoustics, cetacean population studies, monitoring of seismic and Tsunami hazards, etc...

# Operating principle of the ALBATROSS mooring line



Communication between on-board computer and instruments is by inductive transmission



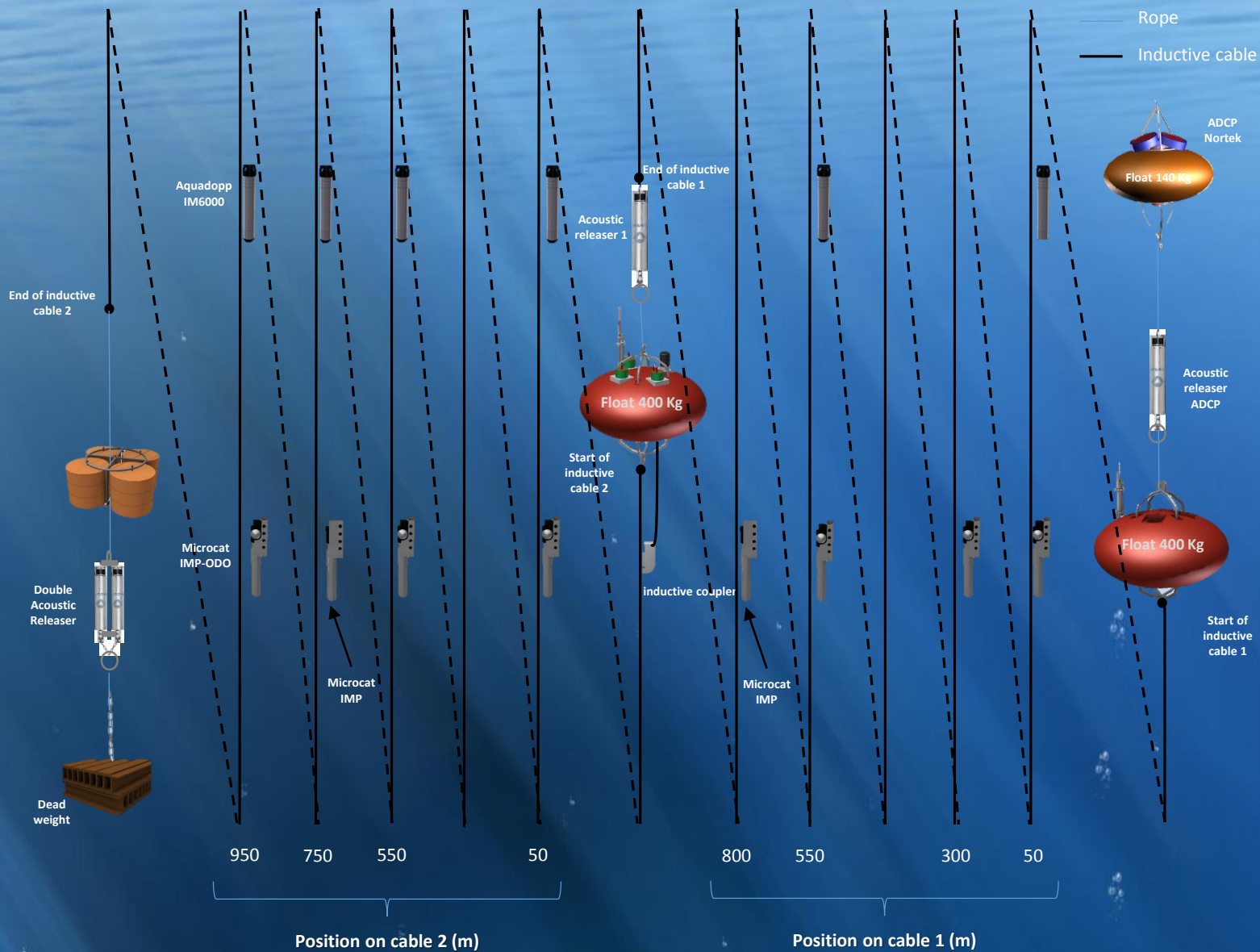
The communication between the module and the mooring line is done by acoustic modems



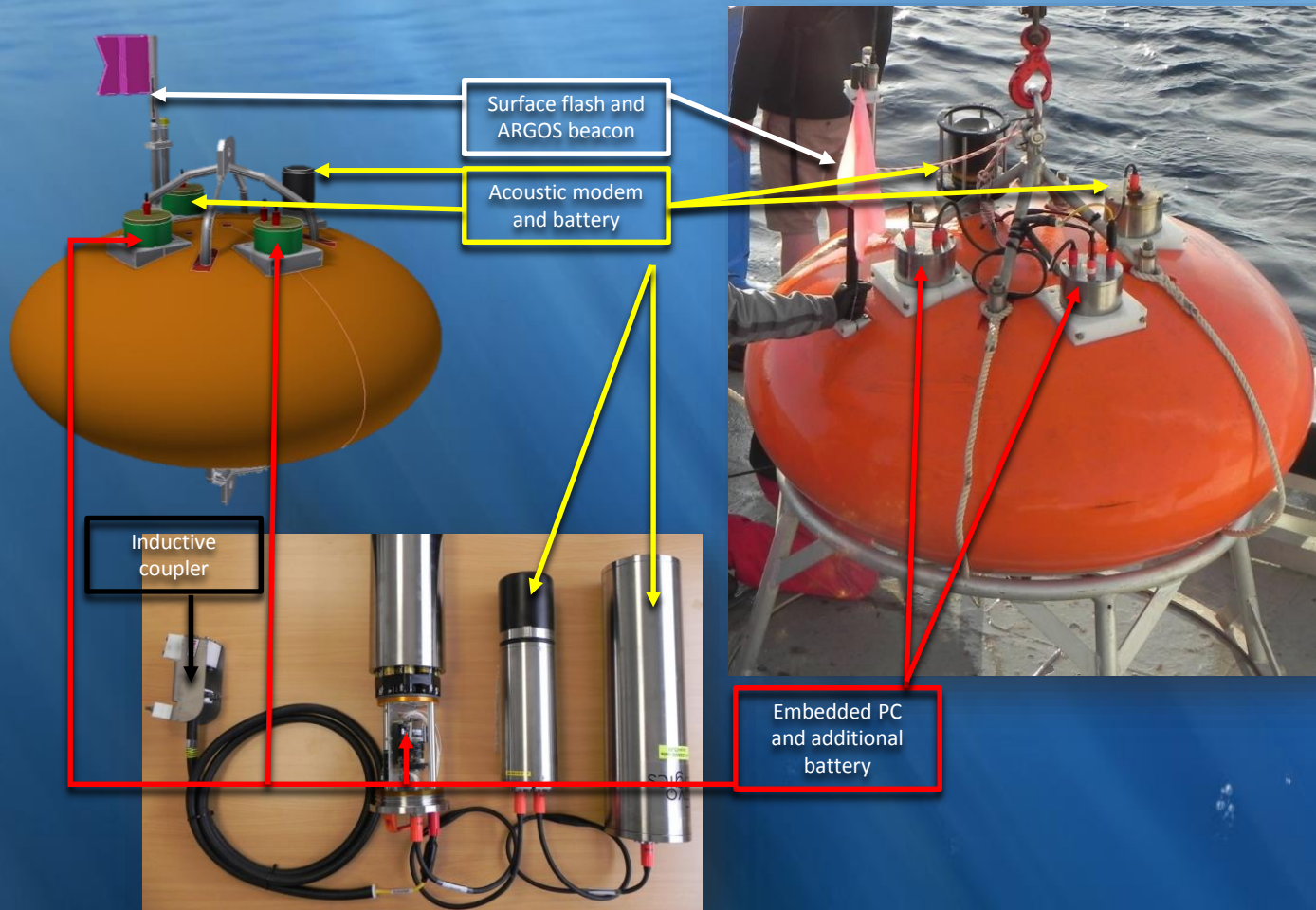
ALBATROSS (Autonomous Line with a Broad Acoustic Transmission for Research in Oceanography and Sea Sciences)

Instrumented Interface Module (MII)

# Schematic of the ALBATROSS mooring line (2019)



# Embedded systems





# Oceanographic sensors

Nortek Aquadopp IM6000  
Deep water current meters





# Sea operations

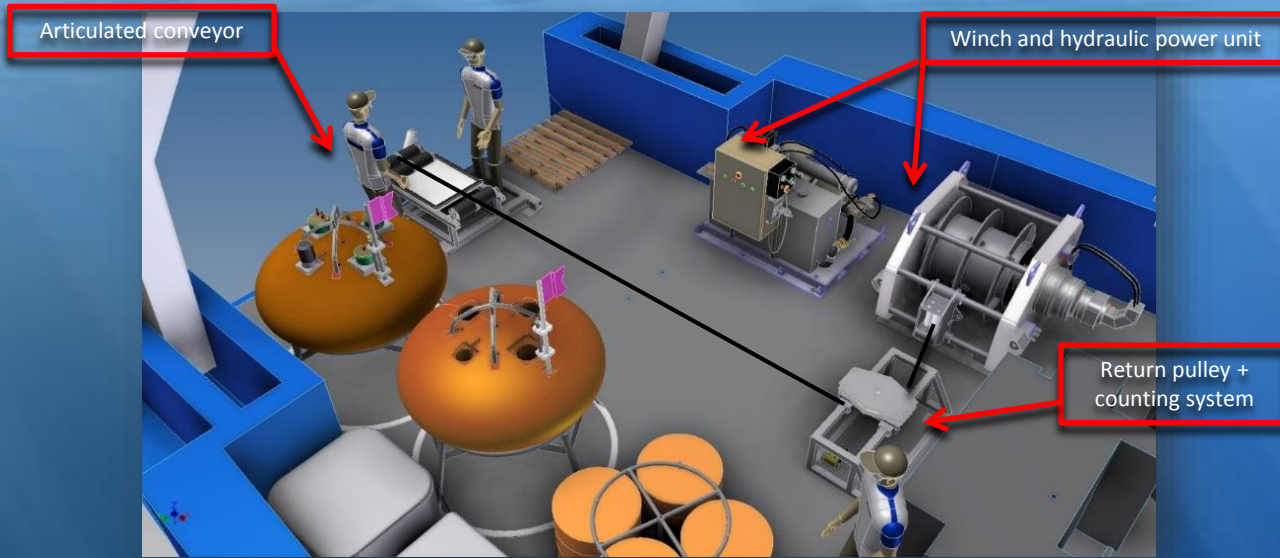
Actual supporting research vessel



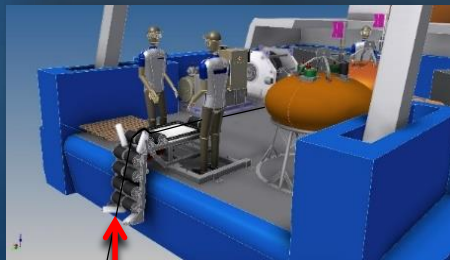
The TETHYS II oceanographic vessel of the French National Fleet  
Overall length: 24.90 m  
Overall width: 7.50 m  
Draught: 3.20 m

# Sea operations

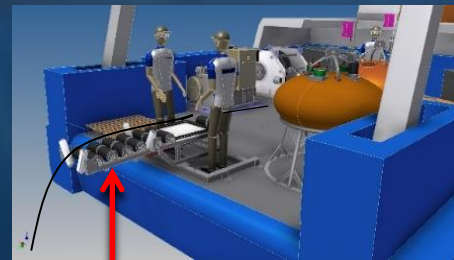
## Tools developed for the deployment and recovery of the ALBATROSS line



3D modeling of the TETHYS II



Articulated conveyor in low position



Articulated conveyor in the upper position



# Sea operations

*The real life*



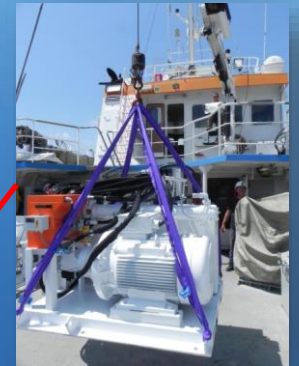
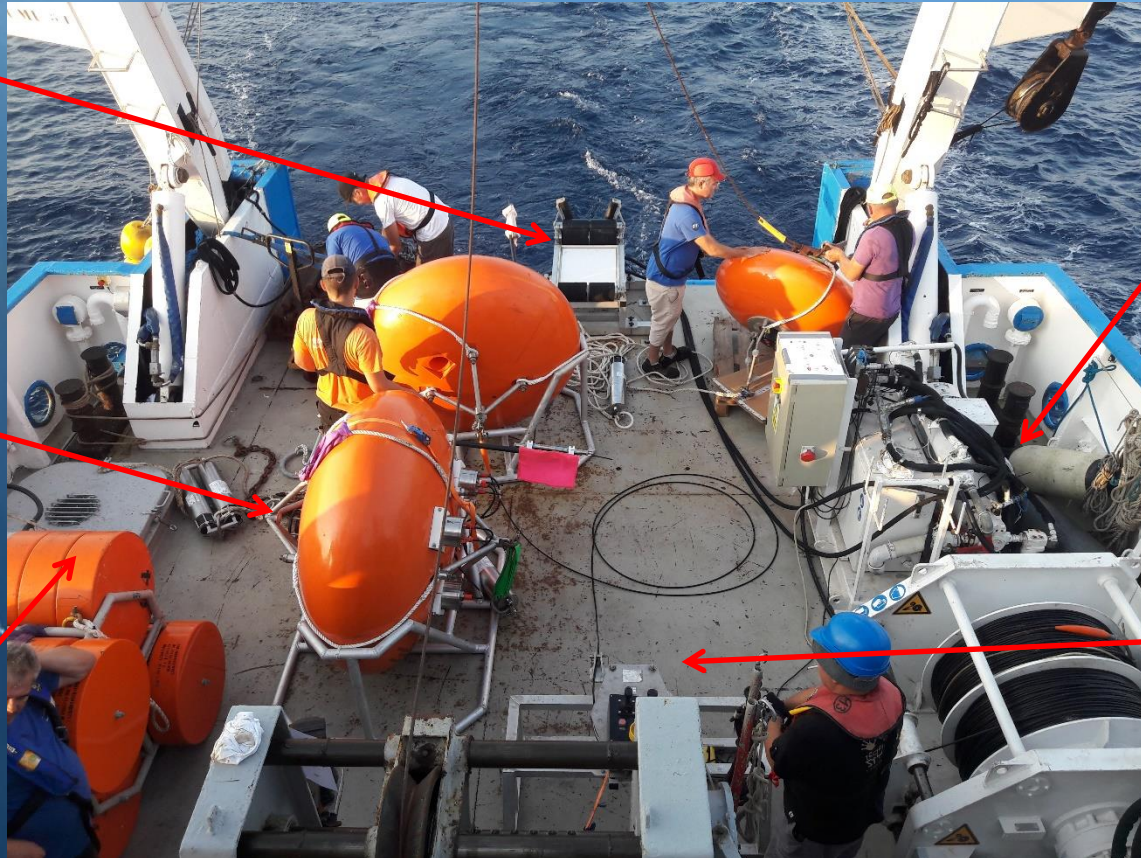
Conveyor belt



Lenticular floats



Security float



Winch and hydraulic power unit



Return pulley

# Sea operations



Instrument on the conveyor



Cable in the return pulley



Cables on the winch

# future offshore operations

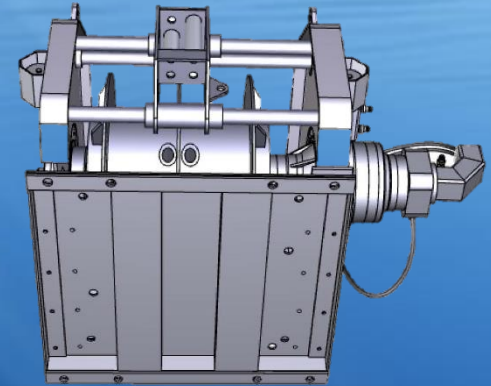


## Objectives

Maintenance operation of the ALBATROSS mooring line during a mission onboard the oceanographic vessel "Pourquoi pas?".

Mechanical, electrical and hydraulic adaptation

=> Validation of tool interoperability (available to the community for the implementation of inductive mooring lines).



Winch



Hydraulic power unit

Thank you for your attention