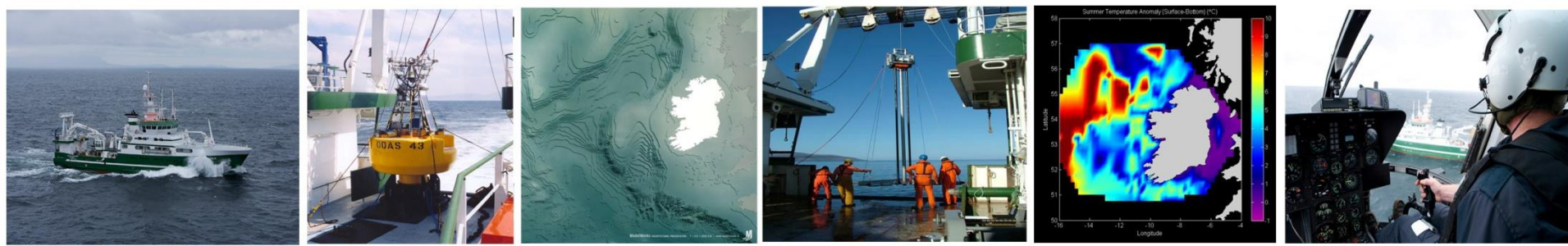


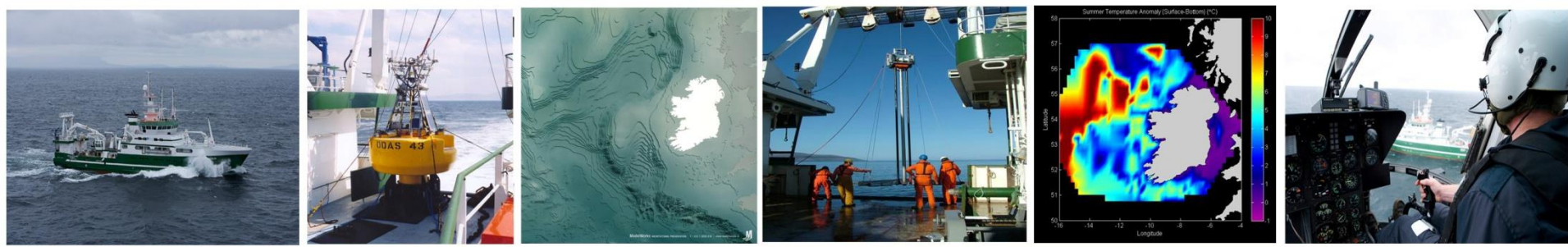
Diver Intervention on the EMSO_SmartBay Cabled Observatory

Conall O'Malley
Marine Institute

Workshop on Sea Operations for Ocean Observatories
25th-26th September
Toulon, France



- **First deployed in 2015**
- **17 Standard Science Ports**
- **4 Expansion ports**
- **25m Depth**
- **Design has been modified over time with diver intervention in mind.**



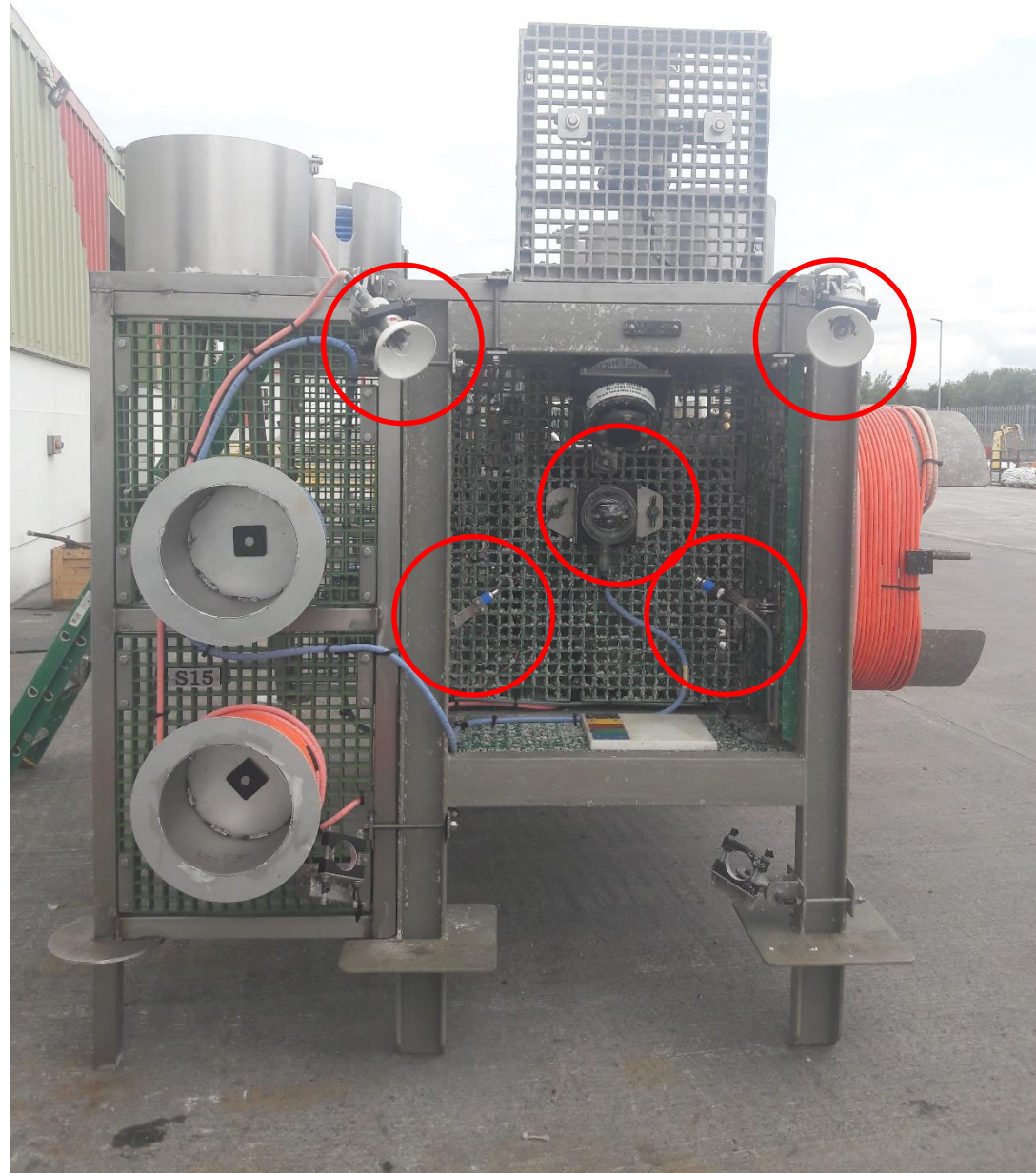
EMSO_SmartBay Cabled Observatory

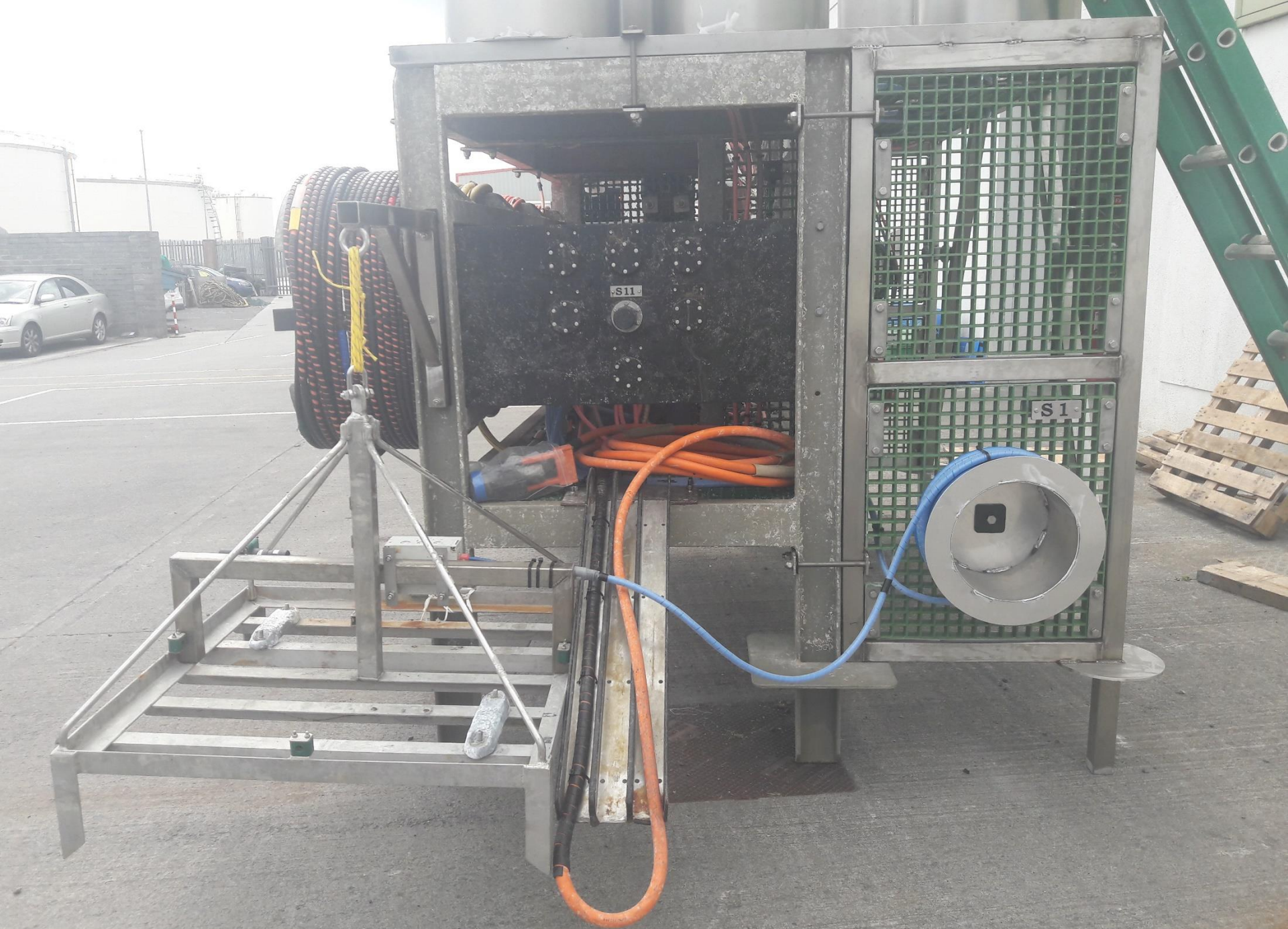
Core Sensors

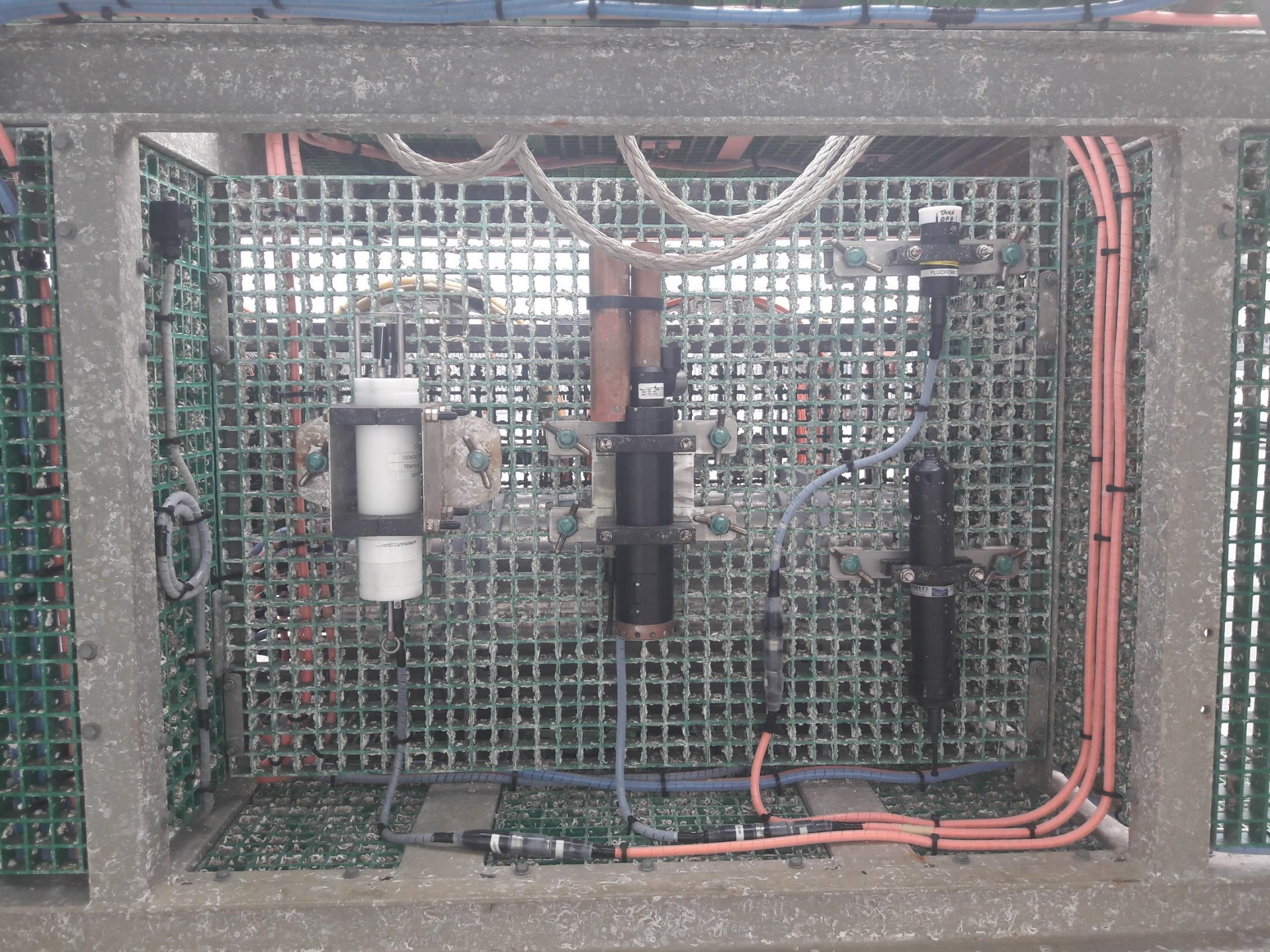
- CTD and a Dissolved Oxygen
- Turbidity and Fluorescence
- ADCP
- HDTV camera & UV anti-biofouling light
- Underwater lamps
- Acoustic fish-tag transponder
- Hydrophone
- Scanning Sonar

EMSO_SmartBay Cabled Observatory Hardware

- **Lights**
- **Camera**
- **UV Lights**





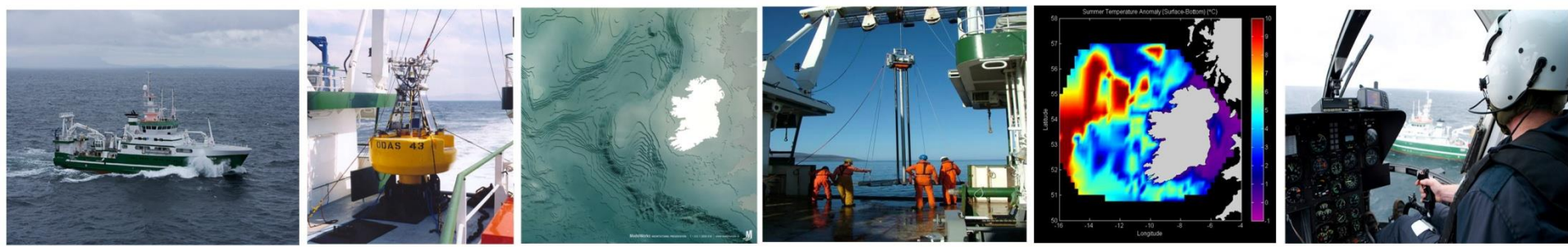






Challenges Faced

- Existing instruments need to be swapped out for maintenance and periodic calibration.
 - Not cost effective to recover Observatory each time an instrument needs to be swapped out.
- New instruments need to be connected to the EMSO_SmartBay Observatory subsea electronics node.
 - Integration of new instruments must not impact on core scientific instruments.

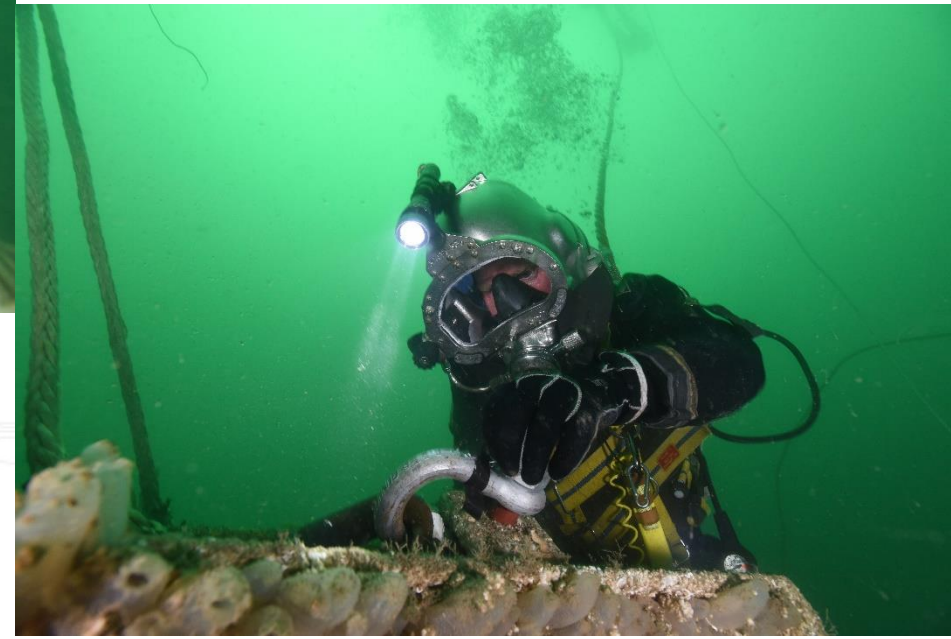


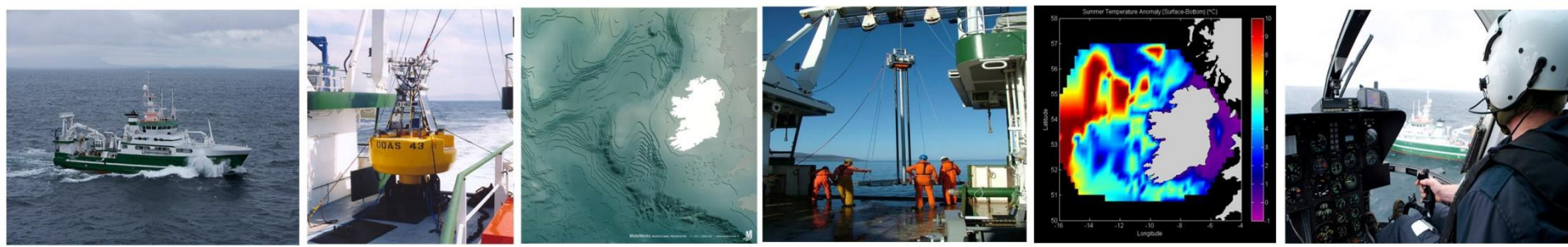
Diving

- Limited by weather conditions.
- Relatively expensive.



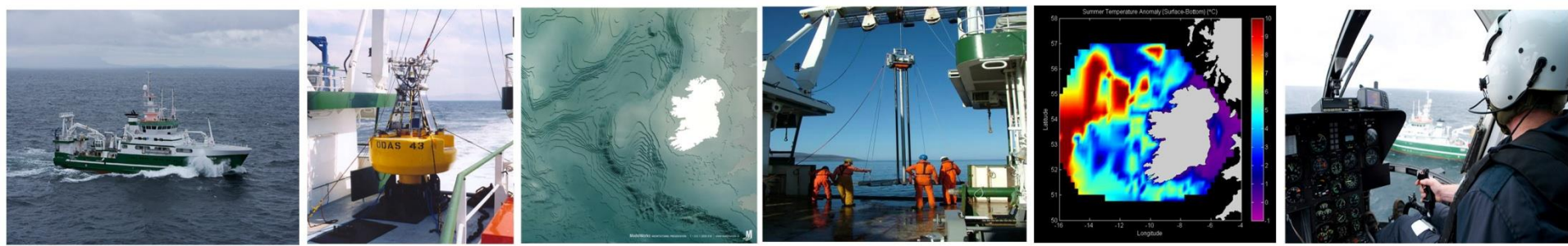
- Important to be as efficient as possible with time on bottom. (c.30 minutes)





Maximising Efficiency

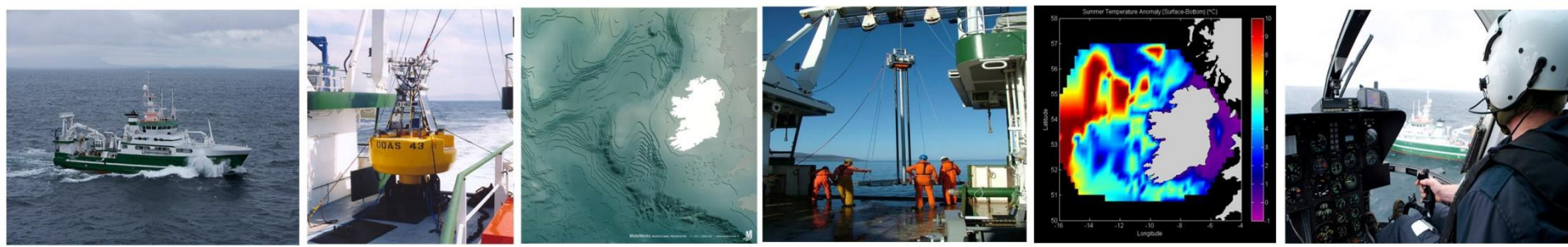
- Each dive needs to be well thought out and planned in relation to the overall objectives.
- Save time where possible, important not to rush tasks or take risks. If a job takes 2 minutes on land it may take 5 minutes underwater. (J.A.W)
- Familiarisation with subsea infrastructure is very important.
- Ensure dives are not wasted. Sensors need to be tested.



Integrating new instruments and sensors

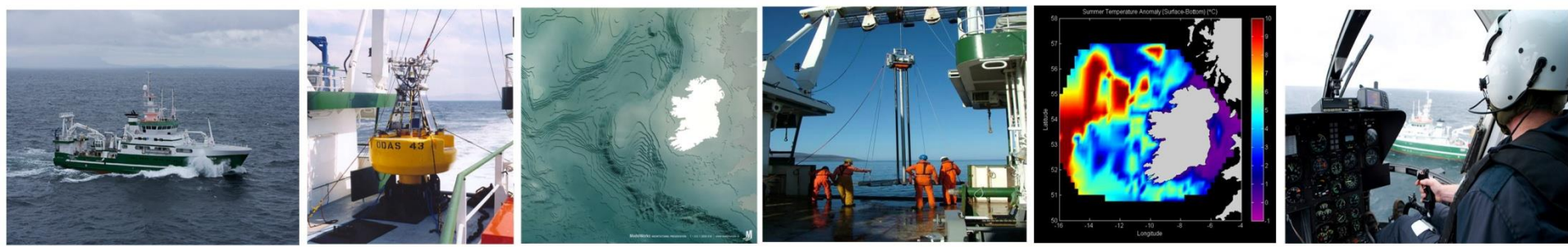
- **EMSO_SmartBay Test Rig** emulates the exact configuration of Observatory electronics.
- **Node control software** can be used to test new instruments and connectors prior to deployment on subsea observatory.





Subsea instrument swap-out and installation

- Instruments need to be connected and disconnected to and from the subsea node by divers.
 - Wet-mateable connectors are very expensive and have a limited number of uses.
- Observatory sits at a depth of 25m...
 - 40 m long cables allow for instrument recovery to surface.



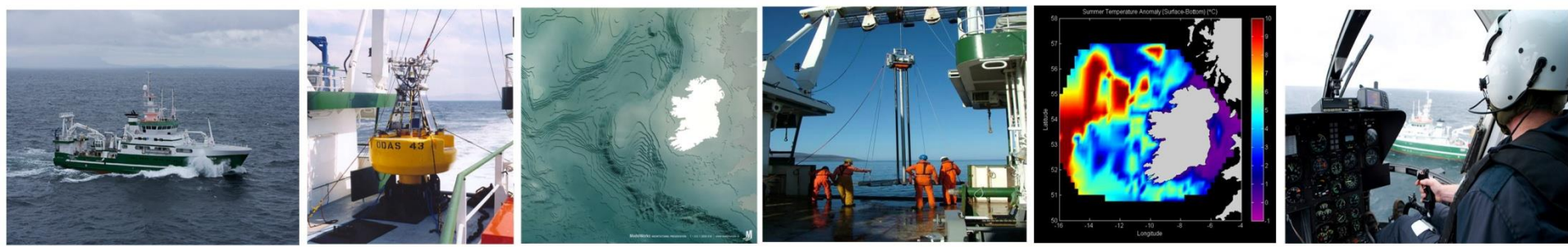
Cabling Strategy

- Every instrument deployed on the EMSO_SmartBay Cabled Observatory is recoverable to surface vessel and allows for safe and dry termination of connections.
- Each cable spooled individually and clearly marked to avoid confusion. Cables are easily re-spooled into drums.
- Unused ports have blanked cables attached which allow for future instrument integration after initial deployment.



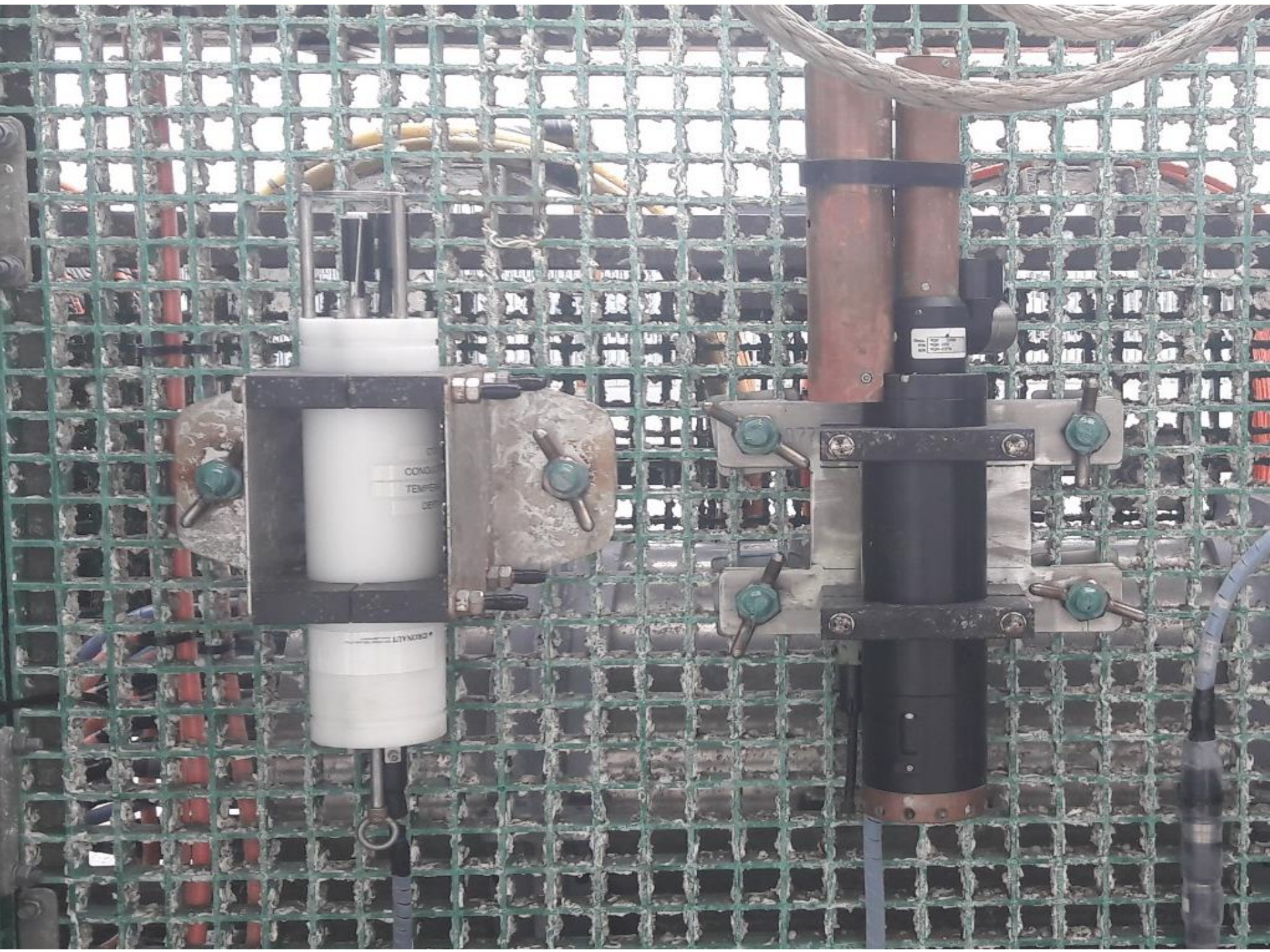


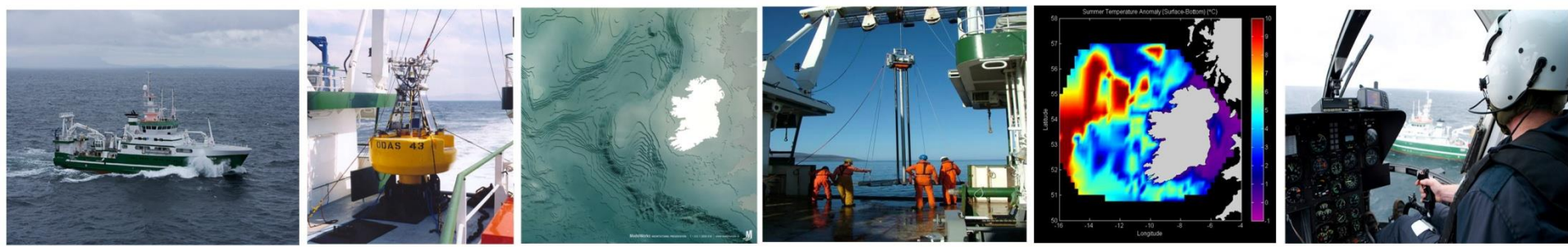




Quick release brackets

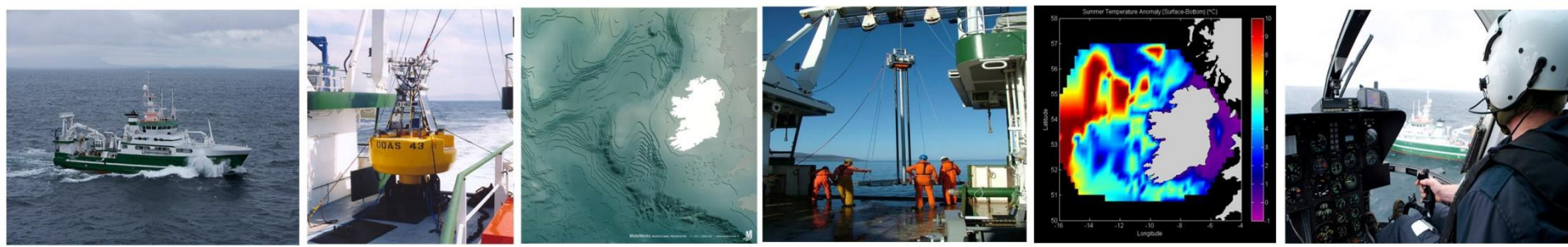
- All instruments are attached to frame using bespoke quick release brackets.
- Butterfly nuts reduces the need for tools, easy to use with gloves.
- Standardised bolt sizes across all brackets.





Familiarising Divers with Infrastructure

- Having the diver understand exactly what is required of him/her is key to maximising the efficiency of diving operations.
- Video and Photo Gallery can be very useful.
- Advances in photogrammetry and augmented reality have been hugely beneficial.
- Consistency of dive team can be an issue. Nothing beats hands-on experience.



- 'Dry Deployment'

