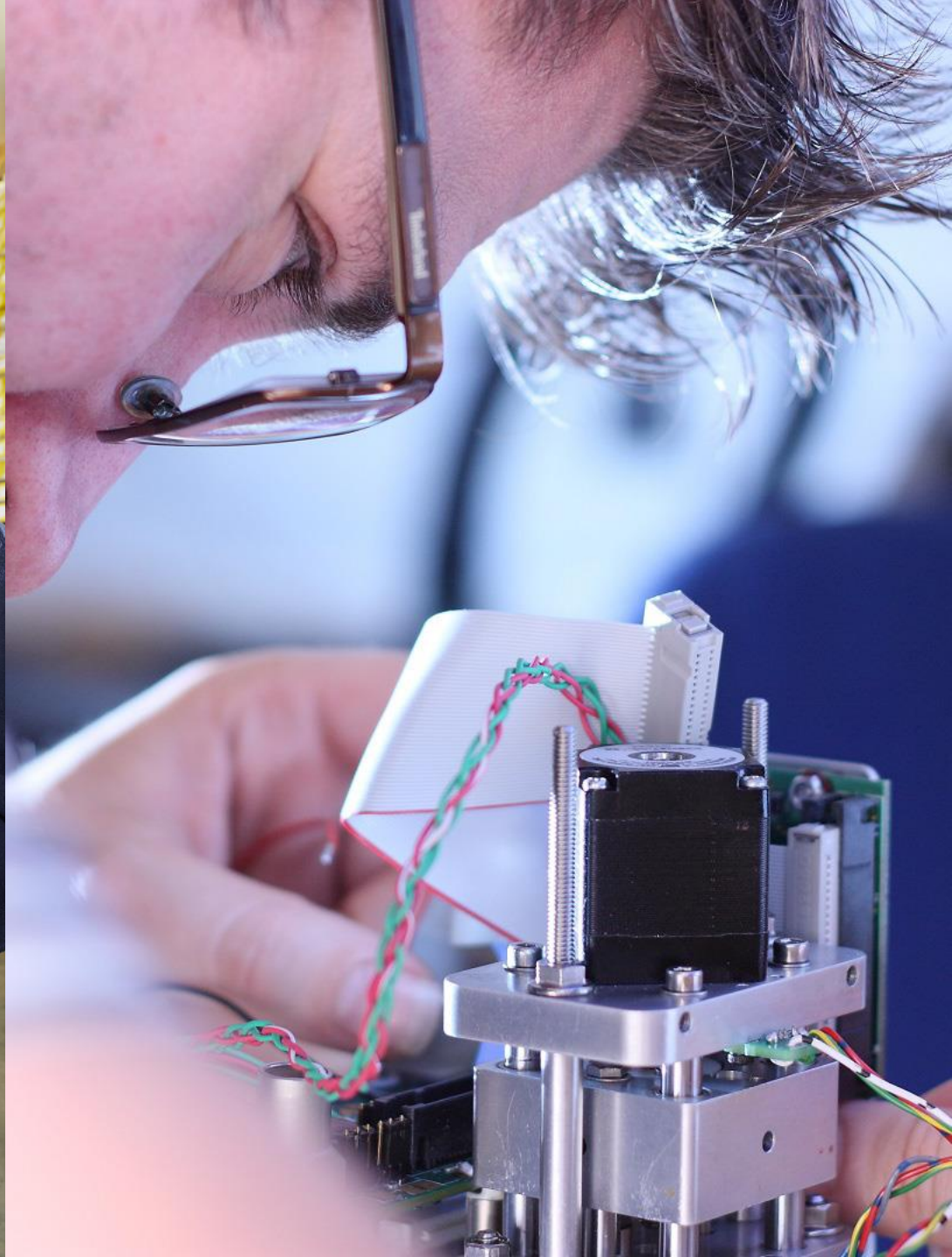
AUTONOMOUS TECHNOLOGIES ALLOWING PERSISTENT UNDERWATER SURVEILLANCE


Hyphalaster inermis
NATIONAL INSTITUTE OF OCEANOGRAPHY
'DISCOVERY' INVESTIGATIONS
St. JC037/027
Date 18/VIII/
Depth of Net
Gear OTSB
50903
CIRRIPEDIA
8/C/2


6500m
Isis


Isis

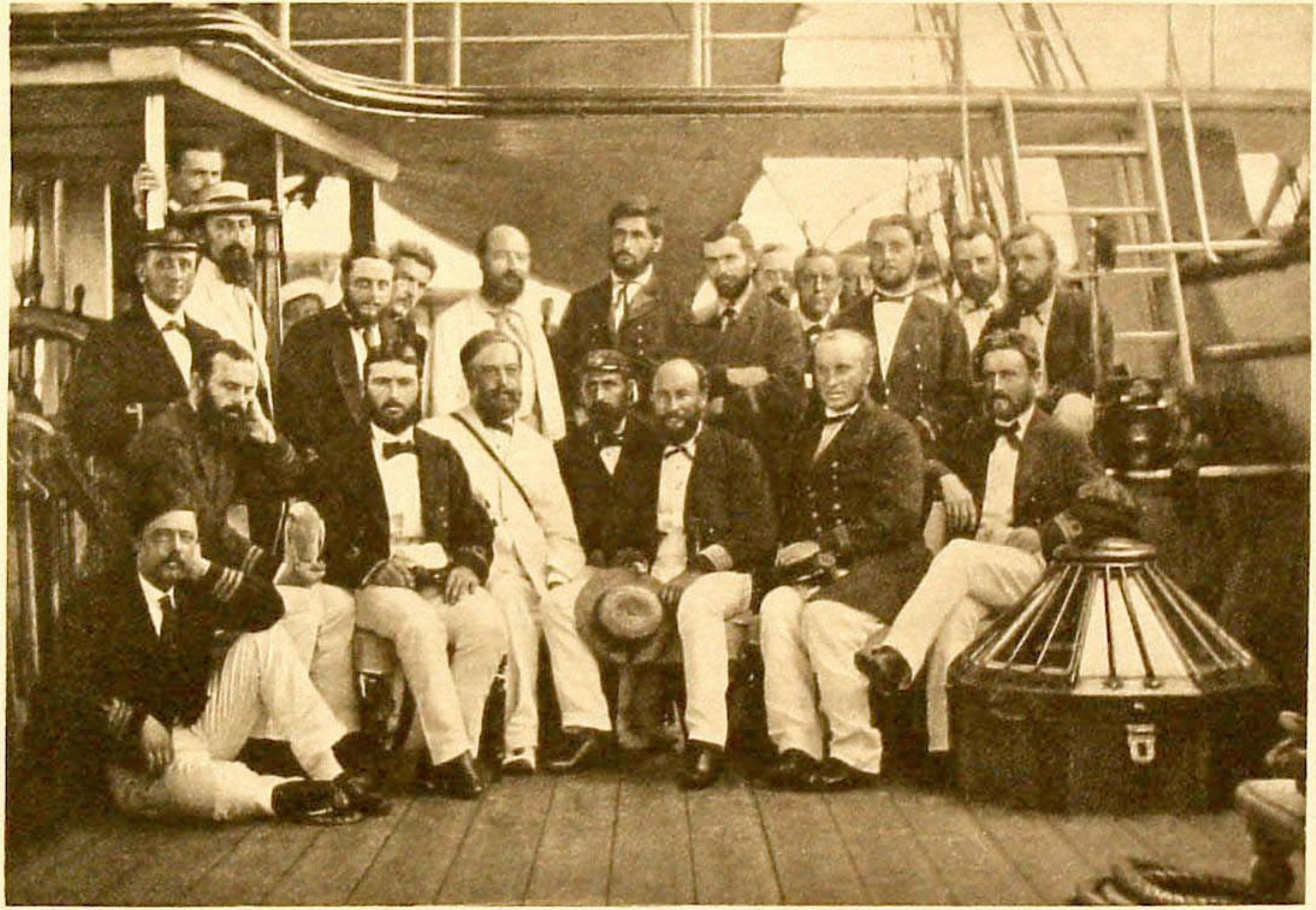

2FGXS
DISCOVERY


LC12
LC13



National
Oceanography
Centre

National Oceanography Centre

HMS Challenger at the naval base at Bermuda, West Indies, taken by Caleb Newbold (ALB0174)

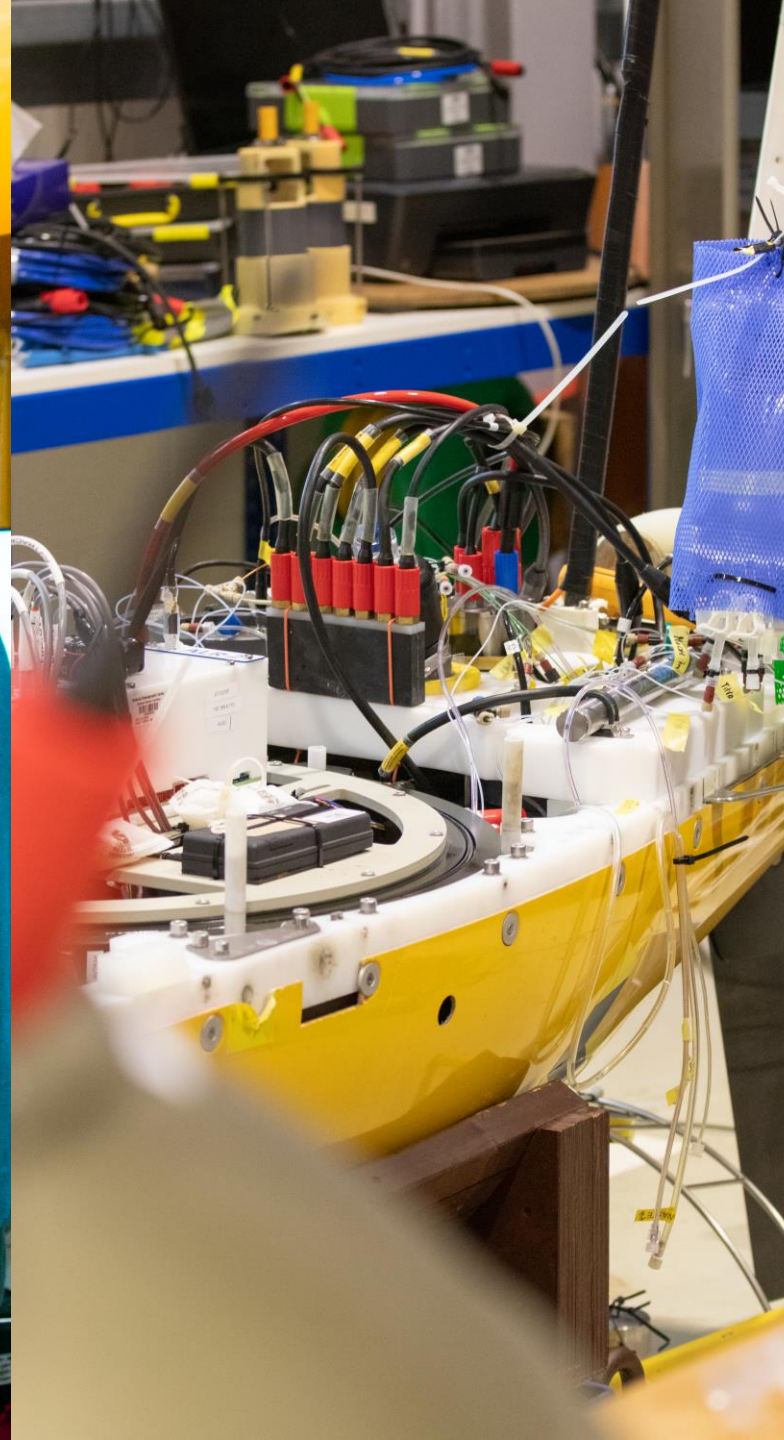


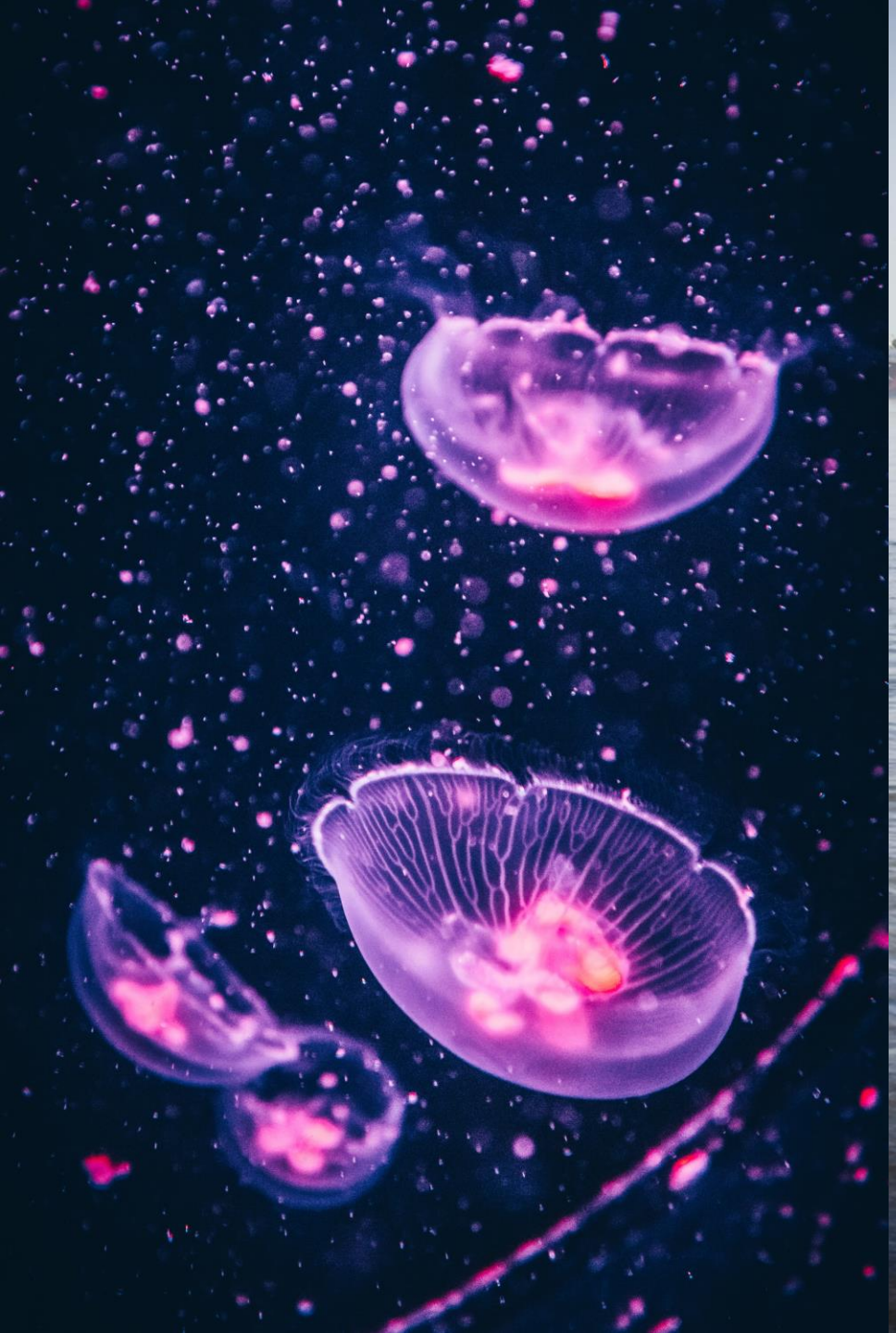
H.M.S. "Challenger." October. 1874.

IS THERE LIFE IN THE DEEP OCEAN?

WHAT IS THE SHAPE OF THE SEAFLOOR?


ACKSYS

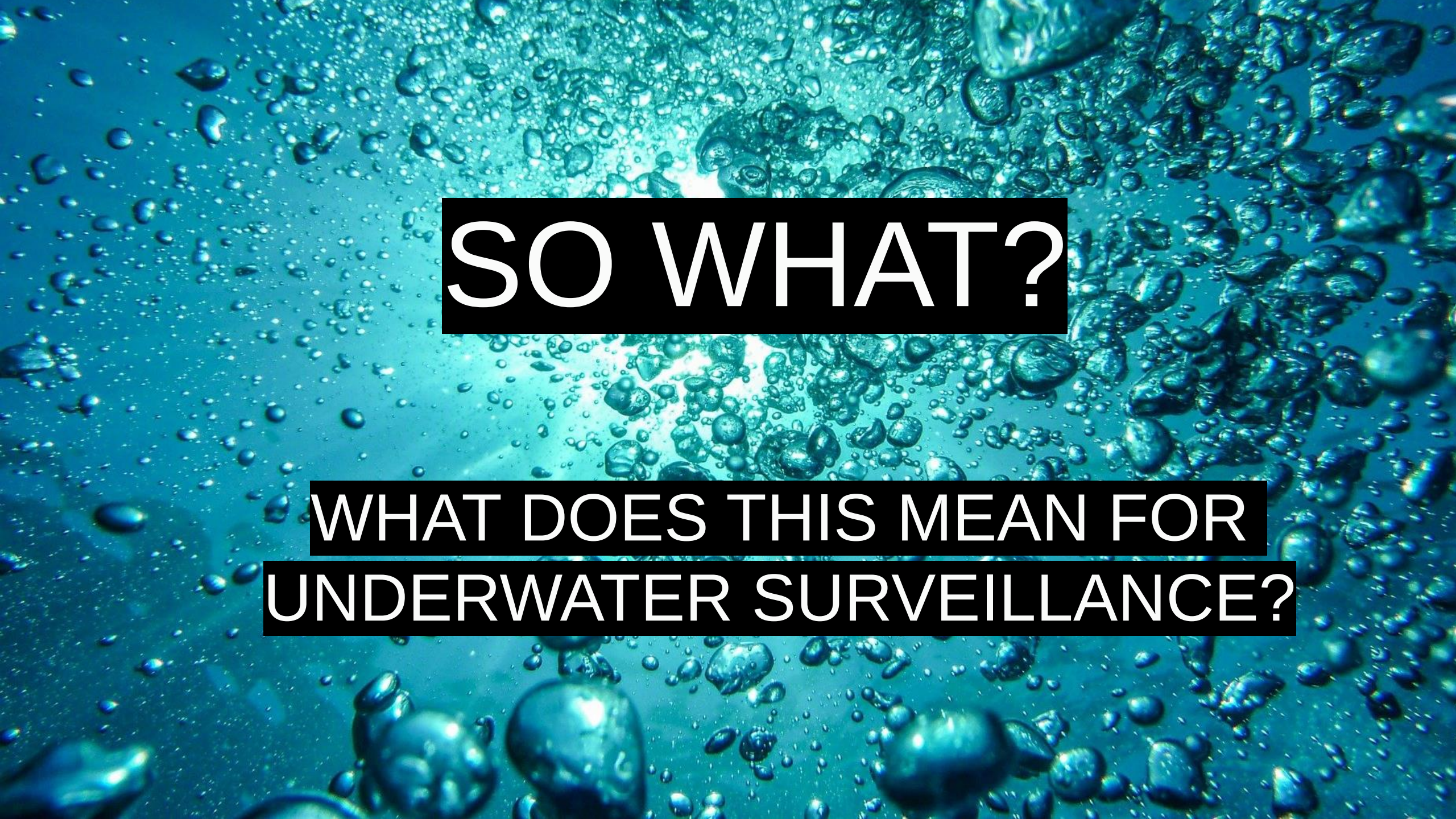





SLOCUM
Electric Glider


ecoSUB m5
robotics
SERIAL

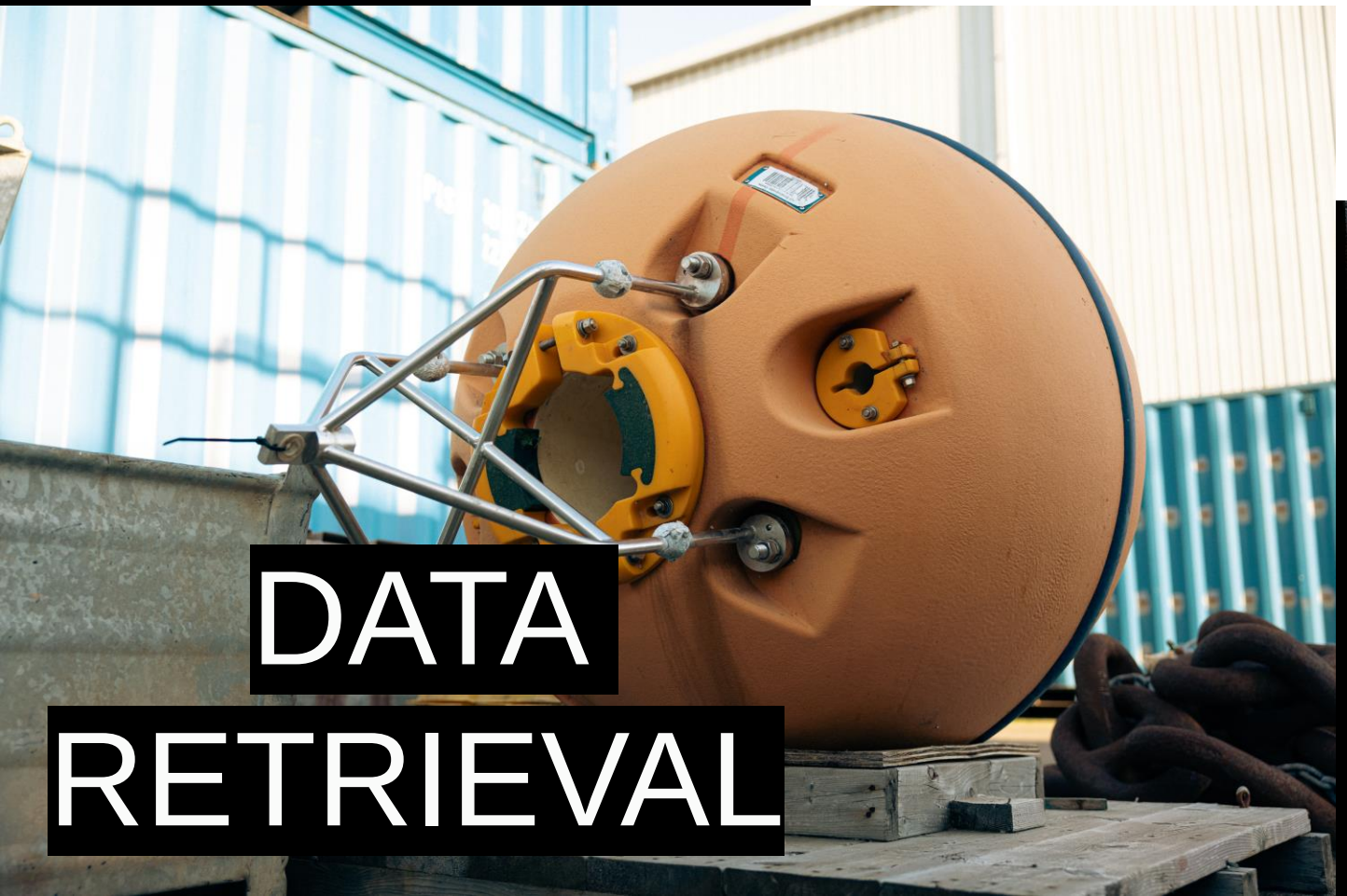

ANI


SO WHAT?
WHAT DOES THIS MEAN FOR UNDERWATER SURVEILLANCE?

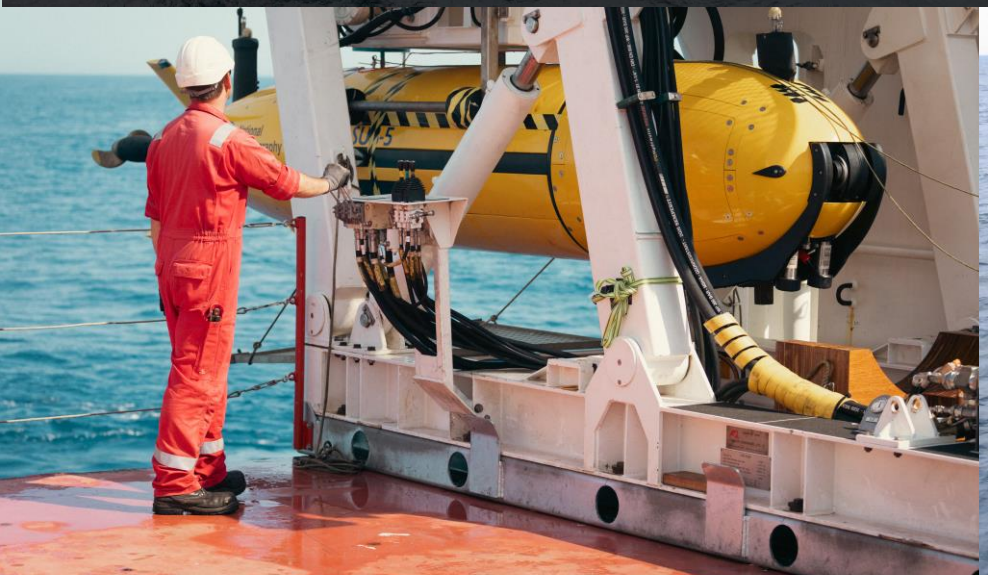
SENSORS


National
Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL
Sample 1
Sample 2
CRM
Acid
Comms
USB
DIC V3.5a
A7124-01-003
Sample
CRM
Cal1
Cal2
Waste
To GX
NaOH in
Total Alkalinity
Sample 1
Sample 2
Reagent
Waste
pH In Situ
S/N: 40

PLATFORM



DATA RETRIEVAL



SHIP+

PERMENANT ARRAY


SHORE LAUNCHED
AUTONOMY

AIR LAUNCHED

DATA VIA SAT COMMS

DATA VIA SURFACE EXPRESSION

North Sea measurements using gliders

Over 8,600km travelled each year

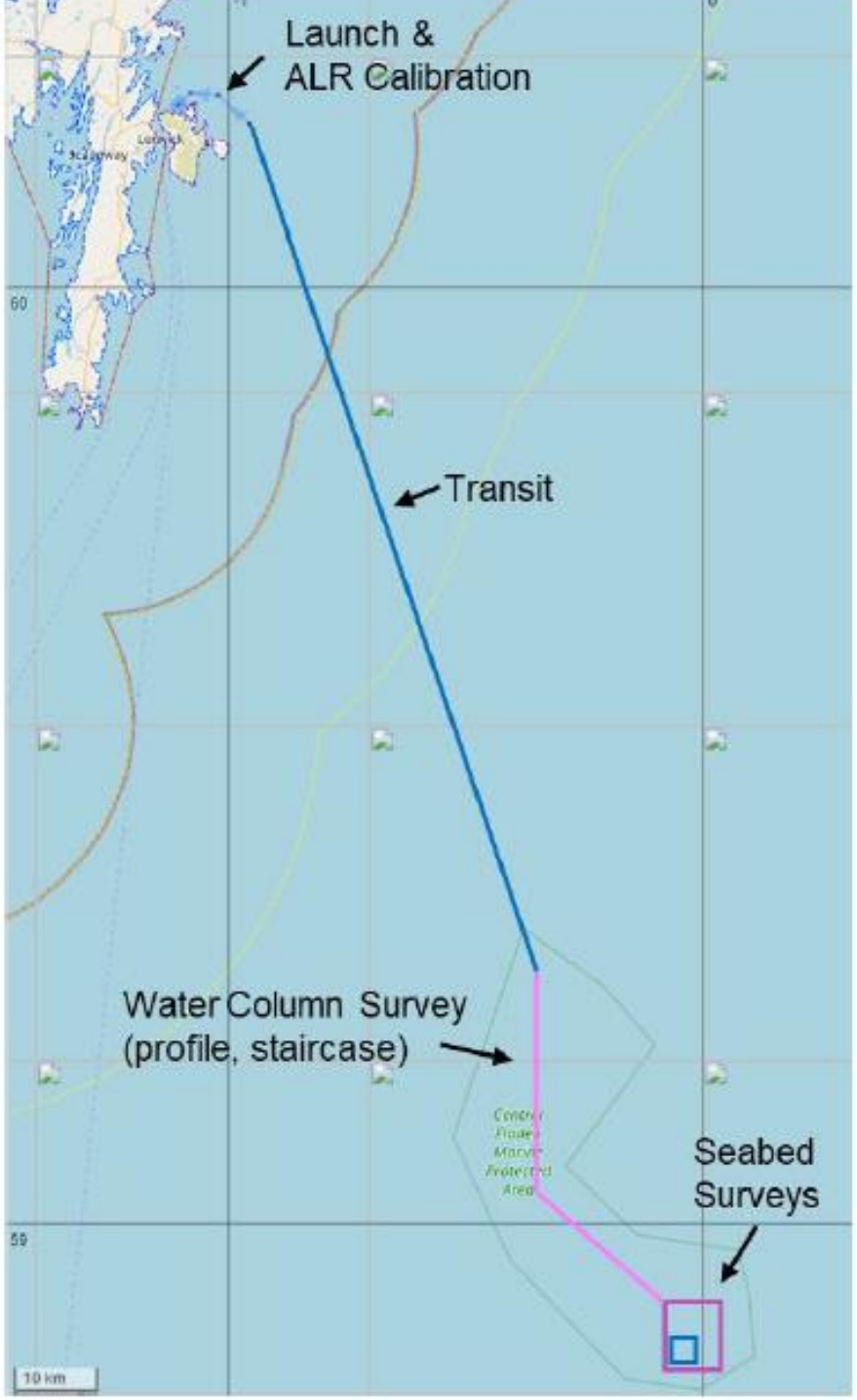
2 gliders

36,480 dives

>41million data points transferred

Glider to NOC data transfer; 0.98hr average

Glider to end user data transfer; 3.2hr average



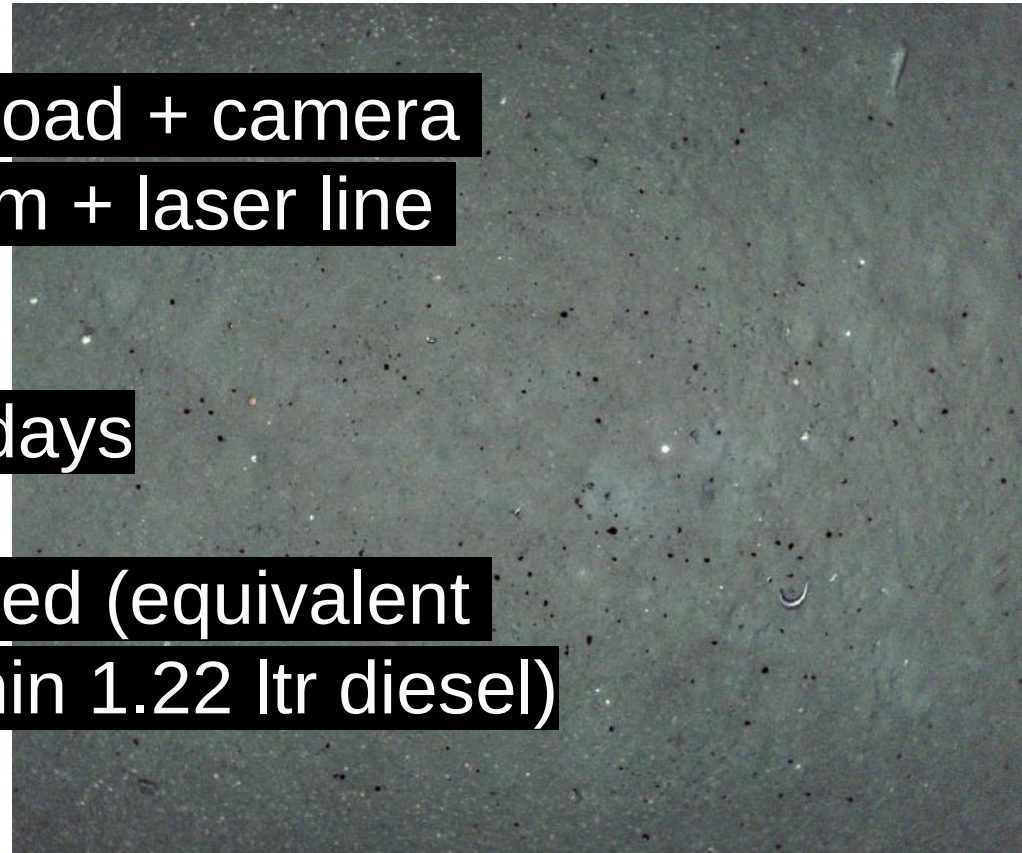
Targeted survey of a Marine Protected Area

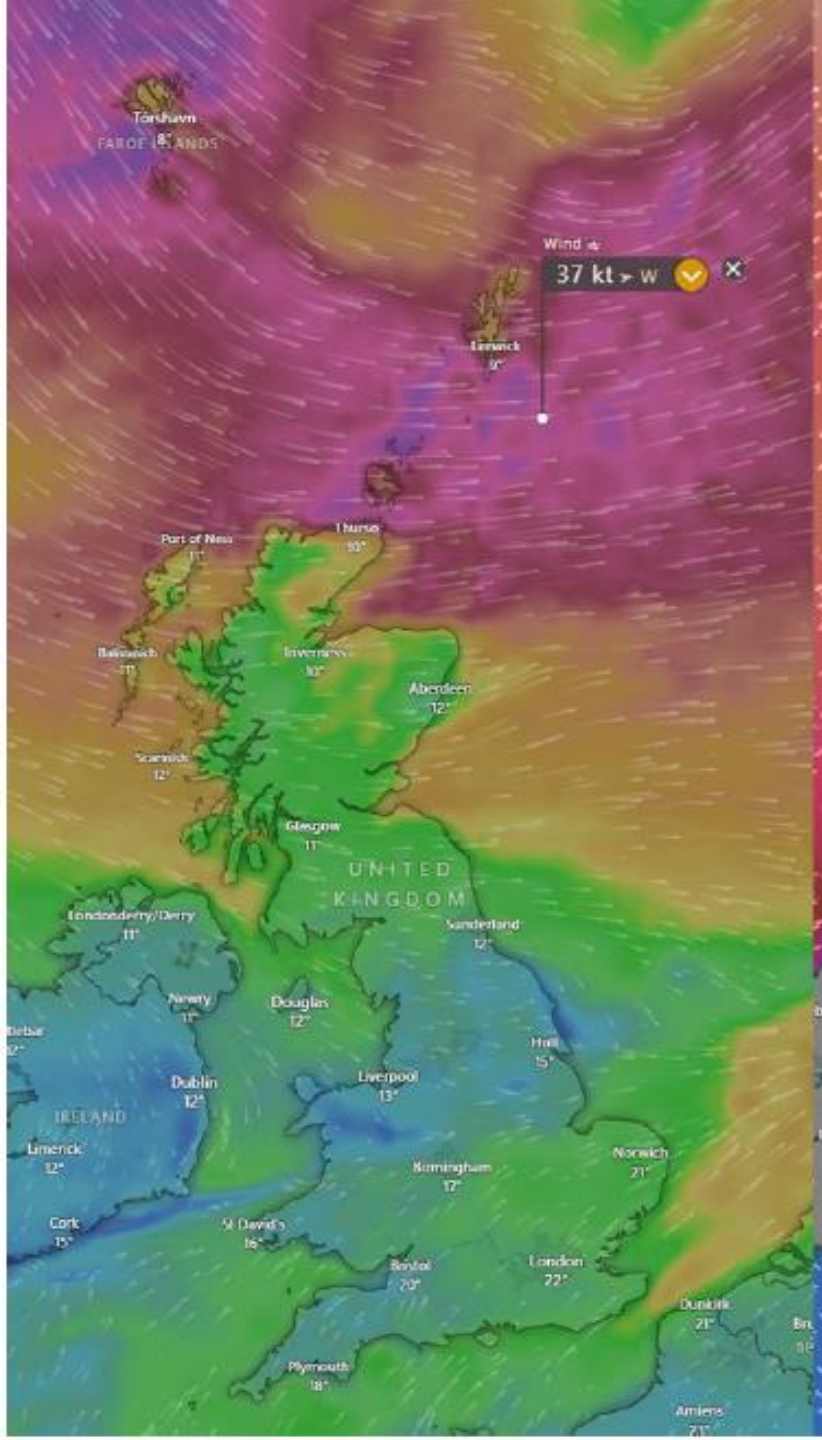
1 x 6,000m rated AUV (12 rechargeable Li Ion 24v)

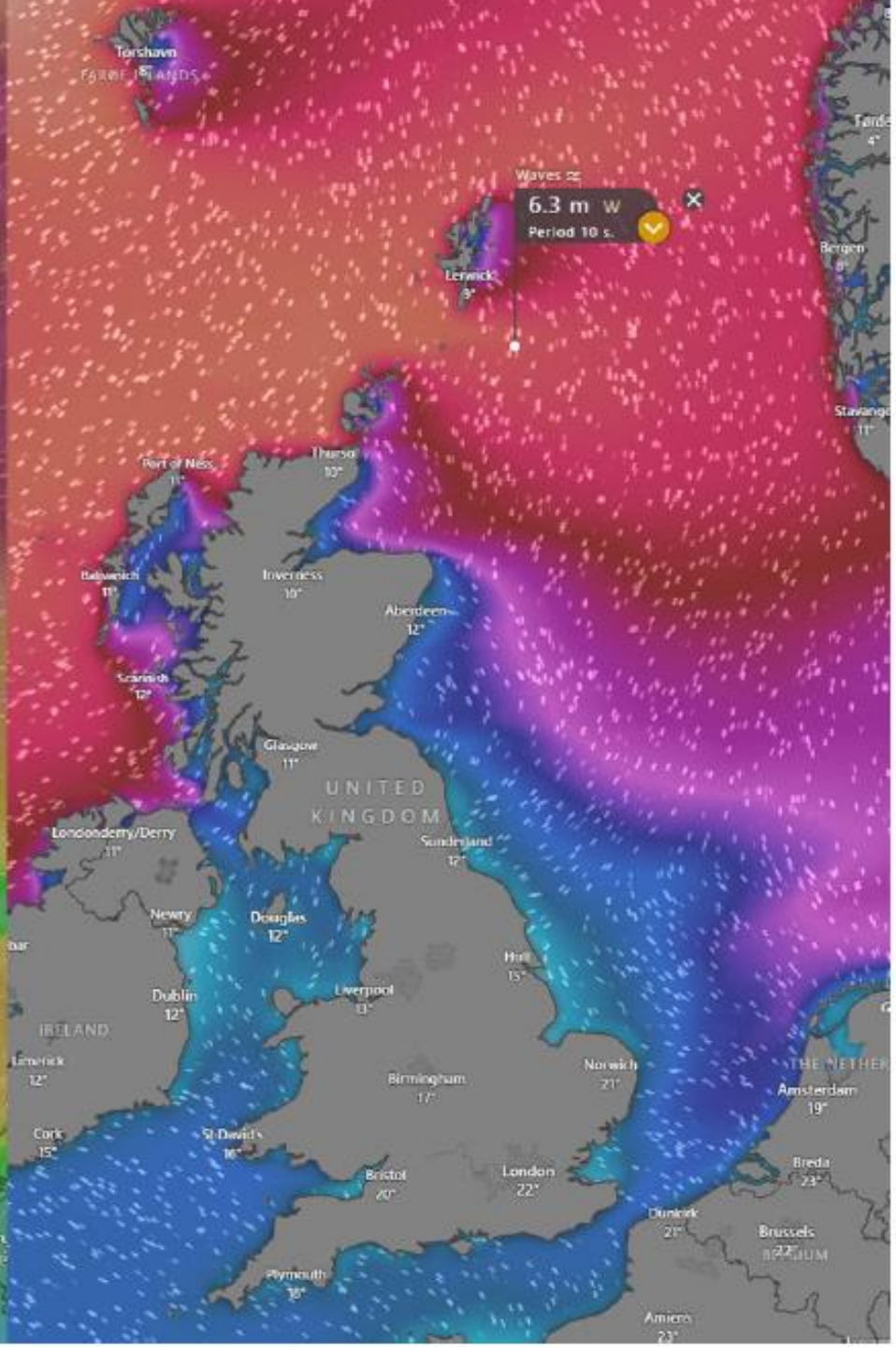
Mixed sensor payload + camera system (stereo cam + laser line bathymetry)

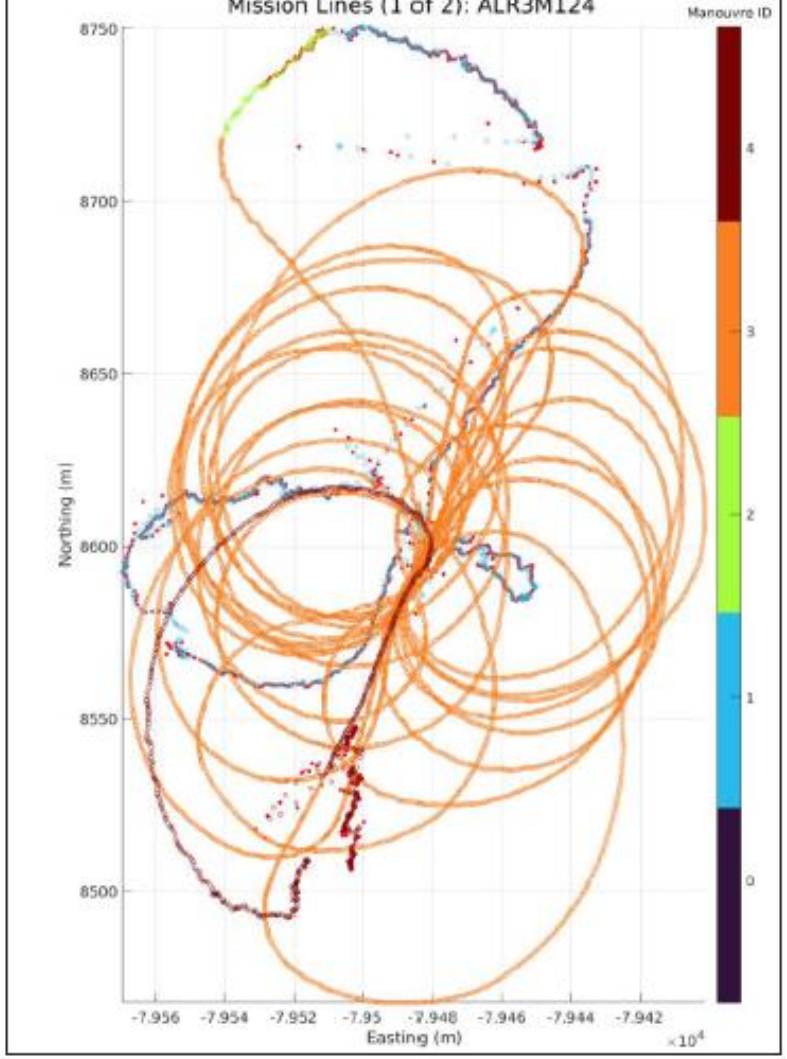
523km over 10.5 days

13 kWh energy used (equivalent energy stored within 1.22 ltr diesel)









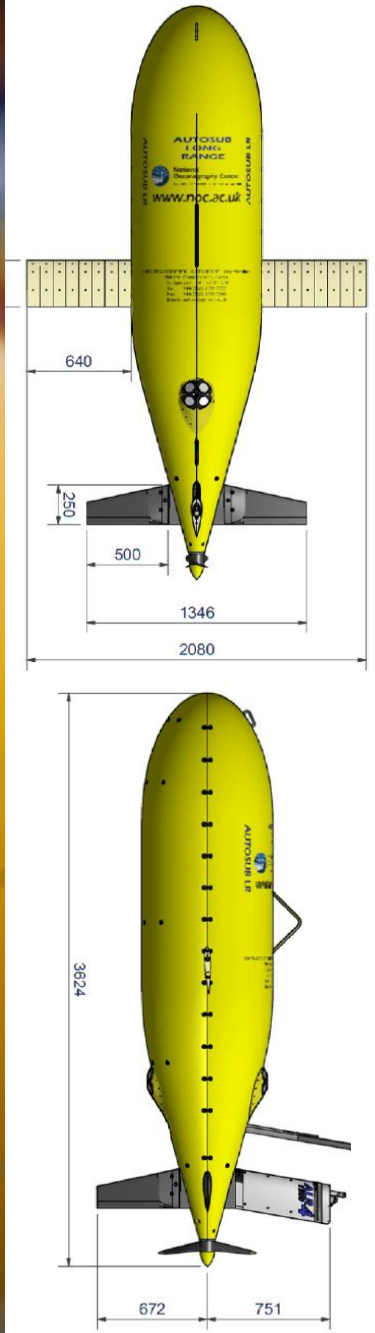
Loiter then recover

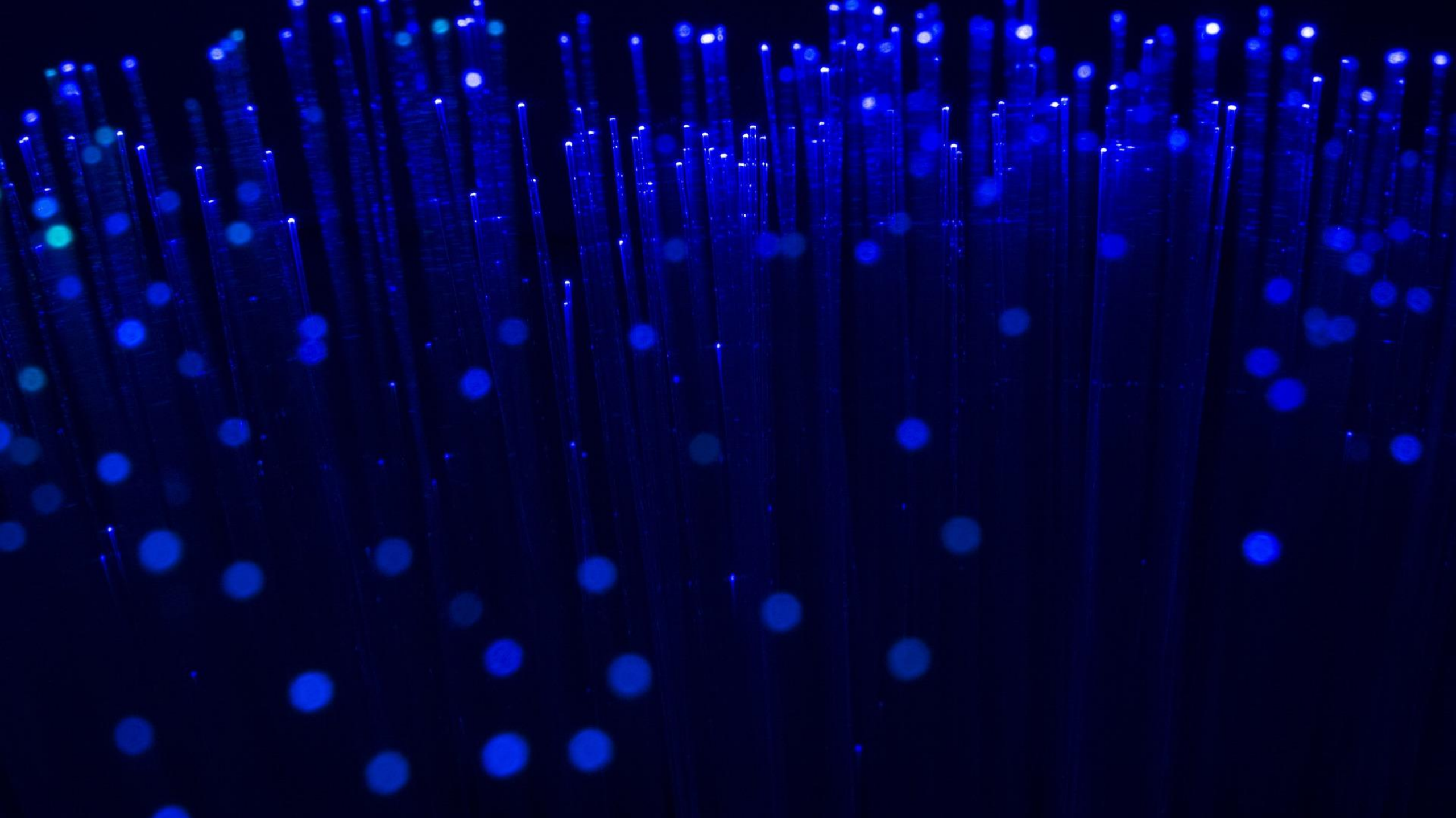
Autonomous anchor system

Multiple anchoring events; up to 12

Allows hibernation to achieve 12mths + missions

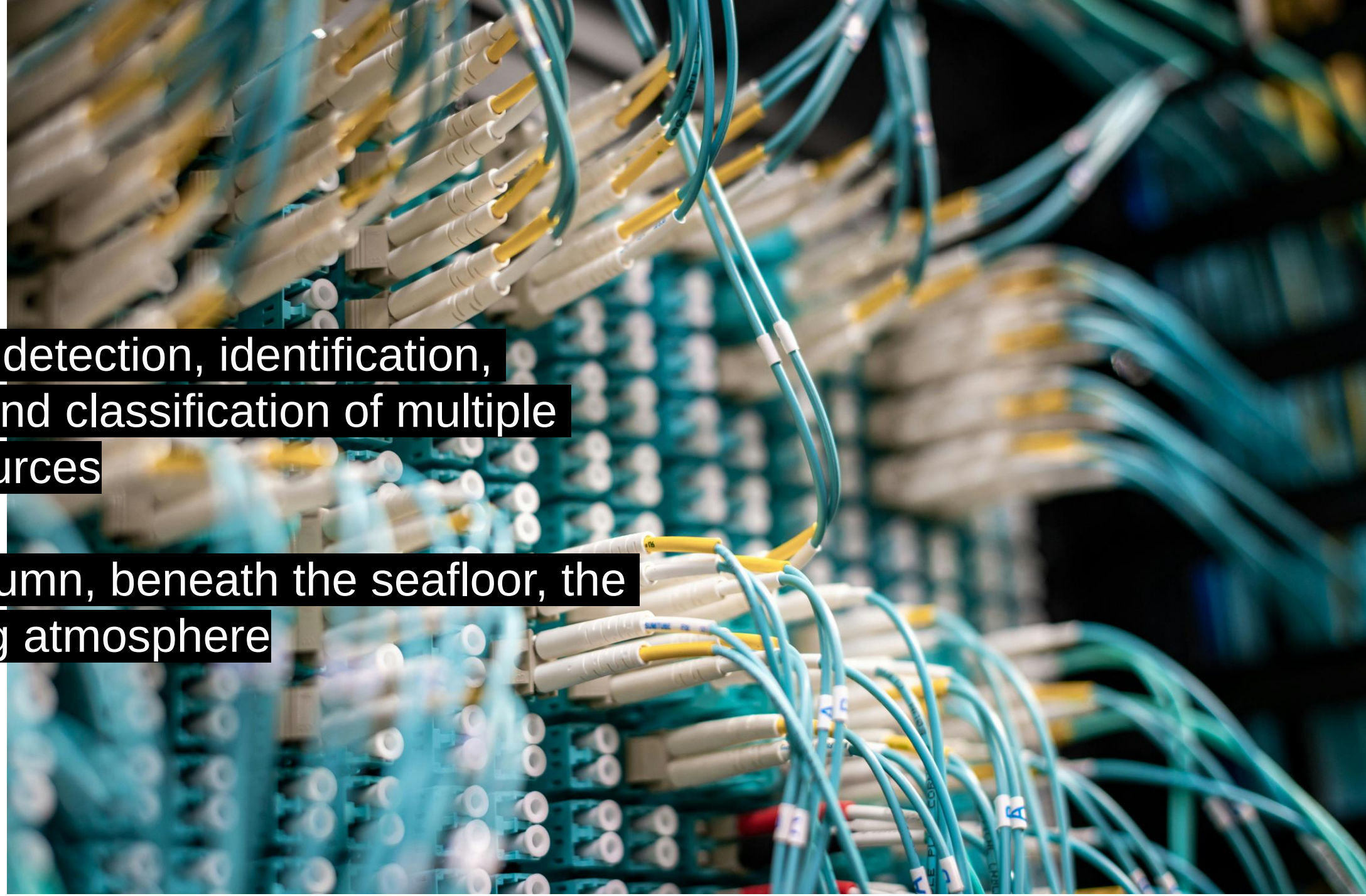
Under-ice trials in 2024/2025





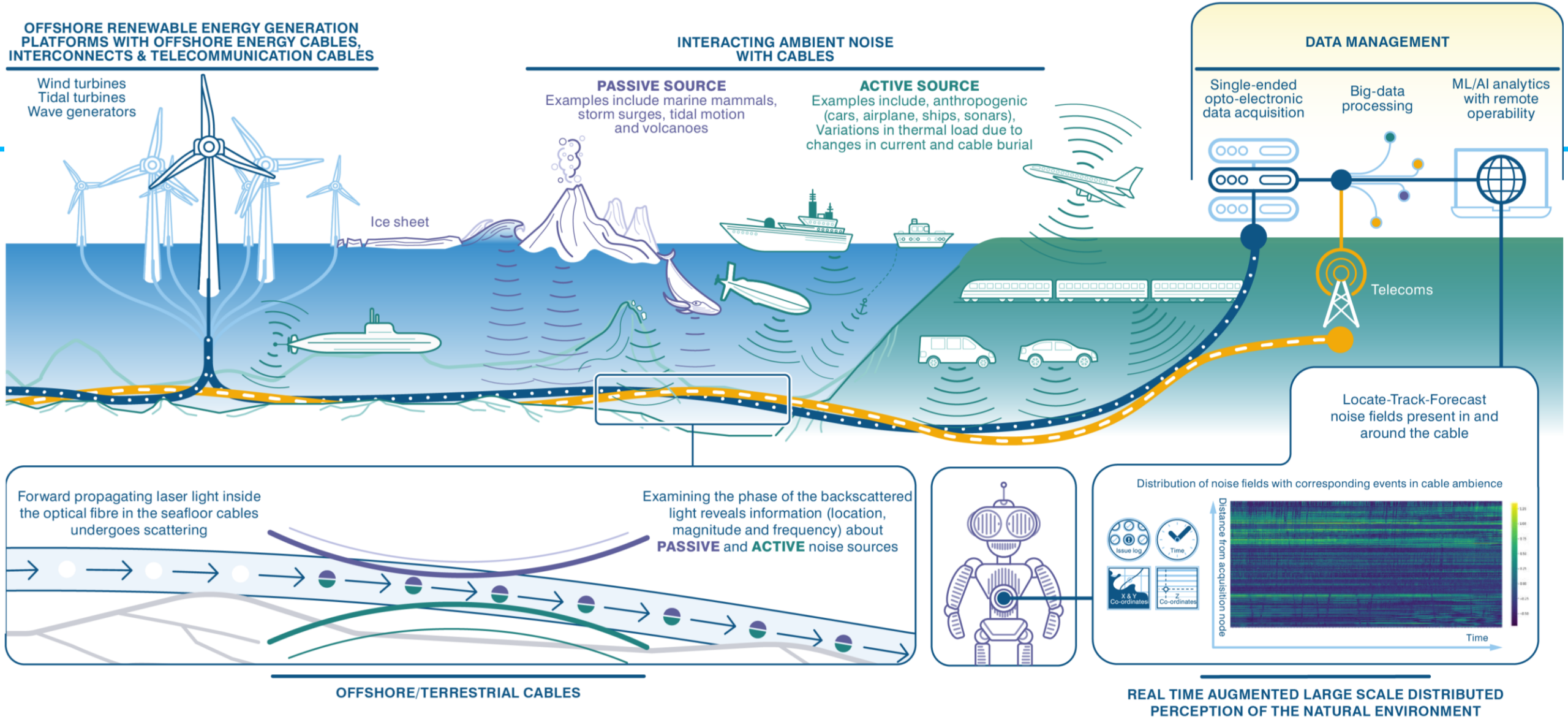

Greenland
Iceland
Finland
Sweden
Norway
Russia
Canada
United States
Poland
Ukraine
Kazakhstan
Mongolia
China
Türkiye
Afghanistan
Iraq
Iran
Pakistan
India
Thailand
Algeria
Libya
Egypt
Saudi Arabia
Mali
Niger
Sudan
Chad
Nigeria
Ethiopia
Kenya
DRC
Tanzania
Angola
Namibia
Botswana
Madagascar
Mexico
Venezuela
Colombia
Peru
Brazil
Bolivia
Chile
Argentina
Indonesia
EIG
LEV
WACS
CBUS
SAm-1
Americas II
ACE
LION2
SAex
EASSY
SJC
UNISUR
BRICS Cable
North Atlantic Ocean
South Pacific Ocean
South Atlantic Ocean
Indian Ocean
Google My Maps


d||a&&n.isFunct
Array(d),k=new
n.ready.promise
er&&(n(d).trigger
function K(){(d.
vent("onload",K);
n(l))break;l.
er:0;width:0;he
(c.style.zoom=1)),c.
c?!1:!b||b!==!0
c?!0:"false"===c?
"string"!=typeof b)
n.camelCase(b)



Coherent detection, identification, tracking and classification of multiple sound sources

Water column, beneath the seafloor, the overlaying atmosphere



Distinguish **what, where and when** activity is occurring along a cable using novel optoelectronic interrogation (OI)

OI is embedded with bespoke analytics and big-data processing that combines NOC's world-leading oceanographic expertise with artificial intelligence and machine learning to decipher the important information from the ambient noise

THE CABLE+ FUTURE?

Access to **a global Submarine Fibre Optic Cable network**, both on shelf seas and over ocean basins including strategic geopolitical hotspots, shipping routes, harbours and critical infrastructure (e.g. offshore energy and telecoms).

Utilising this network, remotely accessible, surveillance of the environment and vessels (surface and submersible) in deep and shallow waters,.

Ability to **detect and track (range, bearing, time) quiet vessels in high noise environments** such as shelf seas (sea states, clutter from environmental and other man-made noise).

Underwater communications from submersible vessels close to seafloor cables and **possible two-way communications** between submersible vessels and seafloor cables for command and control, improved underwater navigation or using the cable as a possible ‘sound’ source (requires seafloor cable power/gateway/repeater integration)

Ocean environmental data collection for real-time tactical awareness (local information on changing water column acoustic structures, seafloor topography and acoustic properties, sea-ice thickness and extent, sea surface state).

UK Home and UK Overseas Territories **territorial waters policing** (for example monitoring and tracking illegal fishing and smuggling activities).

Airborne threat early warning systems using energy (eg. wind farm) assets.

Underwater **test explosion monitoring**. and surveillance of long-range seismic monitoring activities

THE CABLE+ FUTURE?

Access to an **unrivalled global surveillance network**, both on shelf seas and over ocean basins including strategic geopolitical hotspots, shipp
infra
cable

Rem
surve
subme
airborn

Ability to **detect and track (range, bearing, time) quiet vessels in high noise environments** such as shelf seas (sea states, clutter from environmental and other man-made noise).

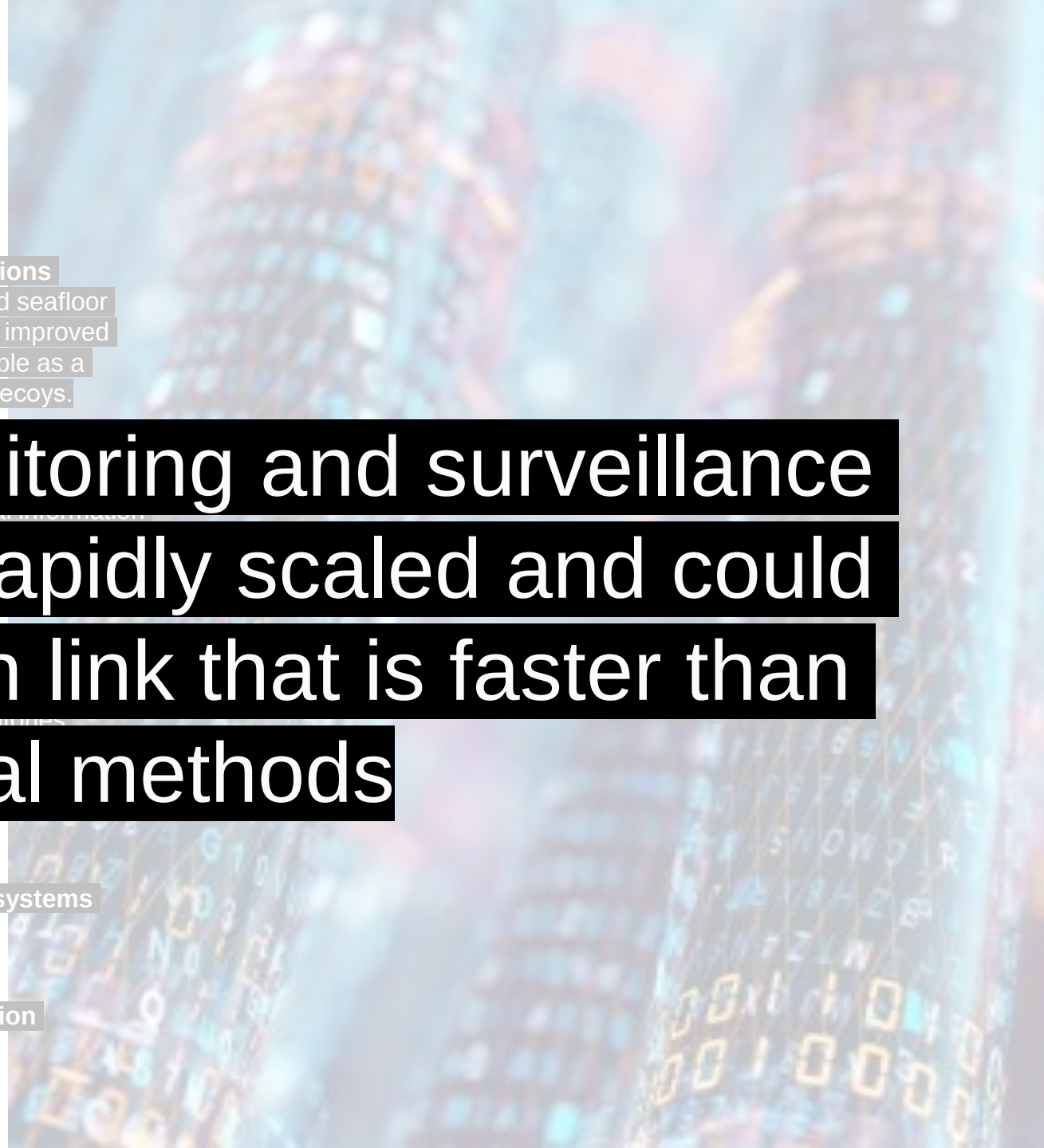
Covert, real-time, underwater communications from submersible vessels close to seafloor cables.

Possible two-way communications between submersible vessels and seafloor cables for command and control, improved underwater navigation, use of cable as a possible ‘sound’ source e.g. for decoys.

Airborne threat early warning systems using wind farm assets.

Underwater **nuclear test explosion monitoring**.

A truly autonomous monitoring and surveillance ecosystem that can be rapidly scaled and could unlock a communication link that is faster than conventional methods



“Worlds Beneath the Waves” unveiled at the National Museum of the Royal Navy