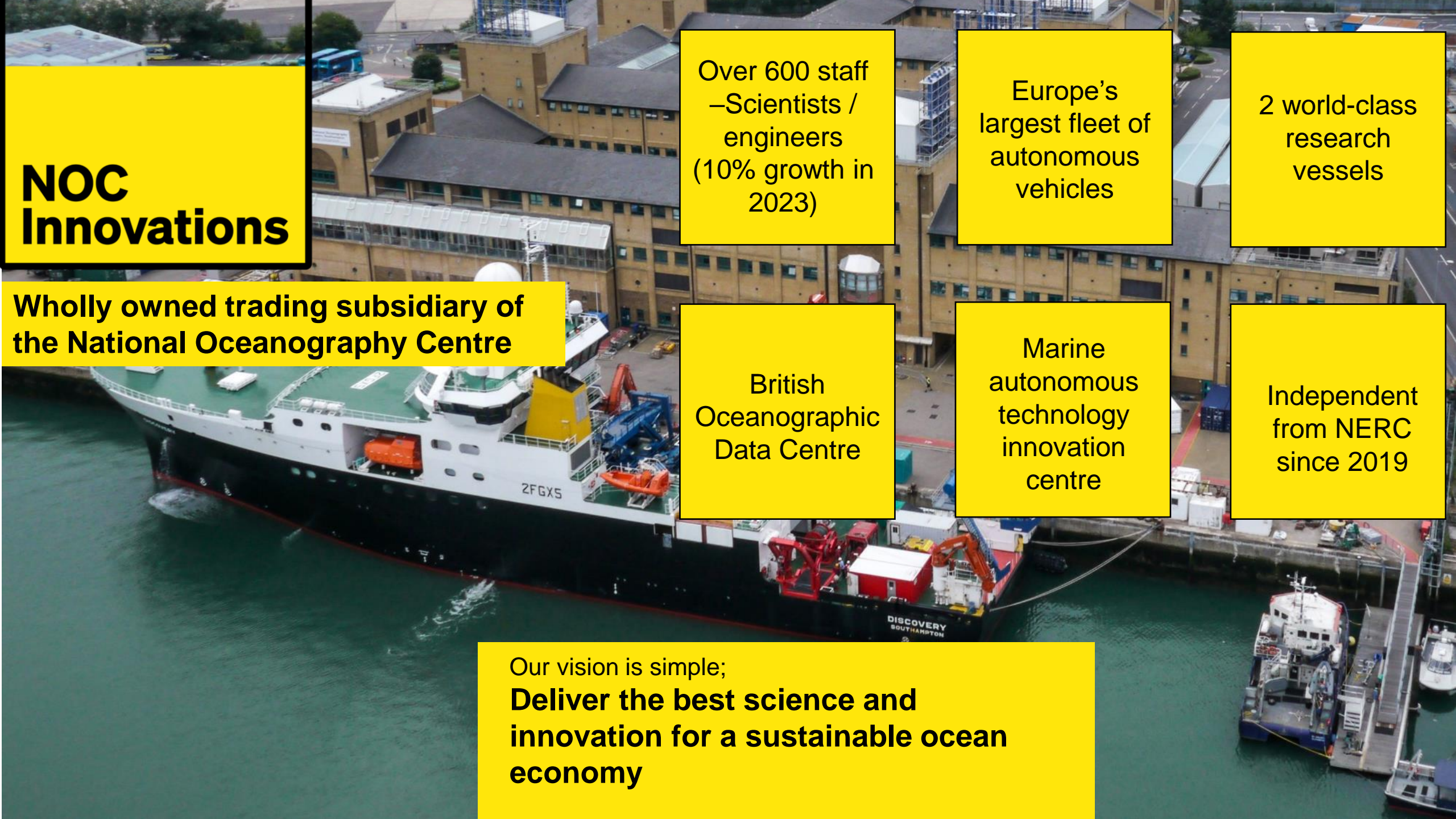


**NOC  
Innovations**



**AUTONOMOUS MONITORING  
SERVICE (AMS)**





# NOC Innovations

Wholly owned trading subsidiary of  
the National Oceanography Centre

Over 600 staff  
–Scientists /  
engineers  
(10% growth in  
2023)

Europe's  
largest fleet of  
autonomous  
vehicles

2 world-class  
research  
vessels

British  
Oceanographic  
Data Centre

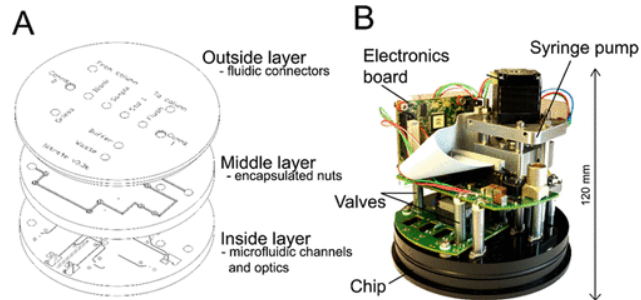
Marine  
autonomous  
technology  
innovation  
centre

Independent  
from NERC  
since 2019

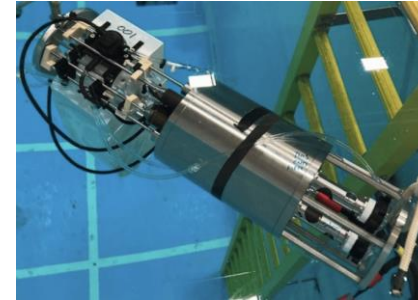
Our vision is simple;  
**Deliver the best science and  
innovation for a sustainable ocean  
economy**

# NOC TECHNOLOGY HIGHLIGHTS

## Sensors



Lab on a chip – chemical sensors (e.g pH, Total alkalinity)

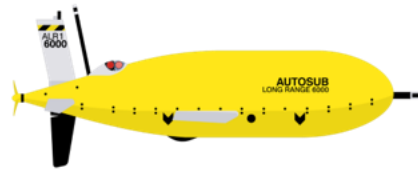


Robotic Cartridge Sampling Instrument (RoCSI)  
environmental DNA (eDNA) sampler

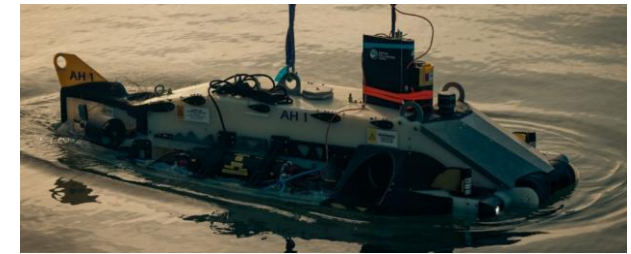
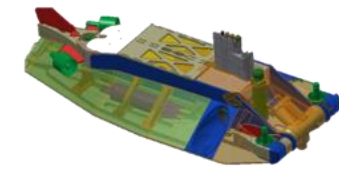
## Autonomous vehicles



**Autosub 5**  
High power, short mission



**Autosub Long Range**  
Low power, long mission

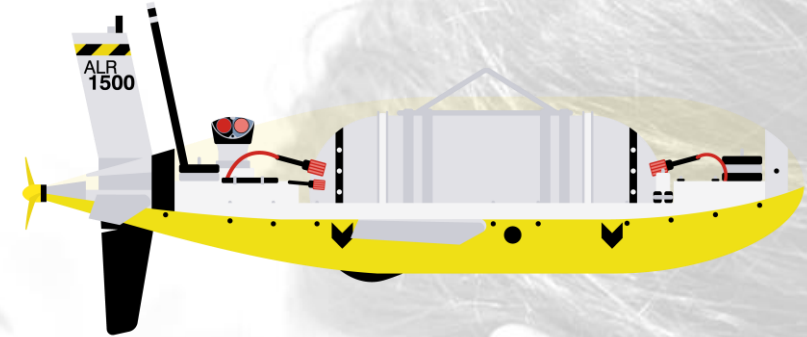
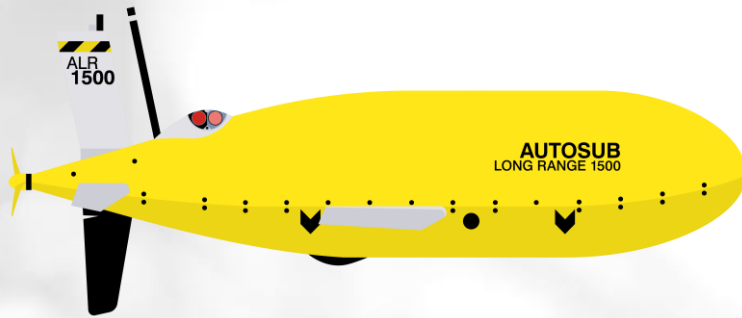


**Hover**  
High maneuverability, short mission



# AUTOSUB LONG-RANGE

Fully autonomous vehicle with many uses



## Engineering

- 3.1m length
- Depth rated to 6,000m & 1,599m (two variants)
- In-house developed command & control platform
- Imagery and chemical sensor payloads
- Carbon neutral in operation

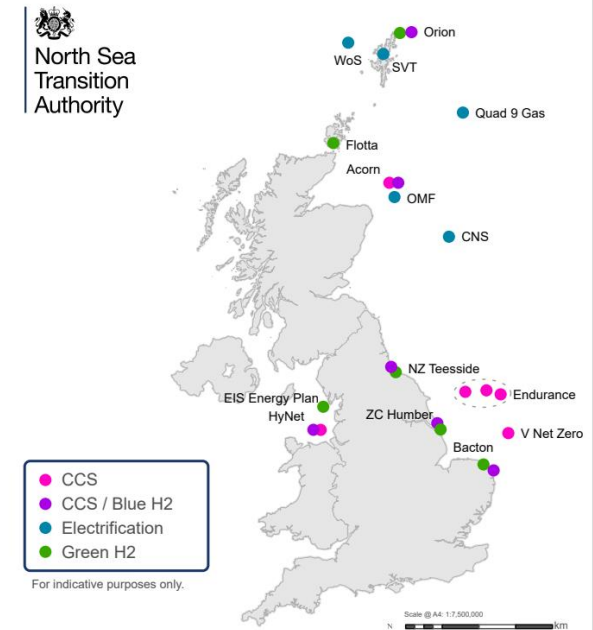
## Demonstrated capabilities

- 2,000km mission
- Deployed globally
- Under ice
- Over 20 different chemical sensors
- Marine Protected Areas, oil fields, etc

# CARBON CAPTURE AND STORAGE WATER COLUMN MONITORING

## Why NOCI?

- Critical technology on the journey to net-zero
- NOC already well-placed in the sector through provision of research informing monitoring requirements
- Ability to offer complete monitoring solution; ALR + NOC sensors + data interpretation
- NOC technology can differentiate between both organic and inorganic sources of CO<sub>2</sub>
- Service provided at no risk to customer to with agreed SLA
- No vessel operational presence required



## CARBON CAPTURE AND STORAGE

### GLOBAL STATISTICS

Market value (2022)	>\$6 BN
Market value (2032)	>\$35 BN
CAGR (2023-32)	>20%

### SEGMENT STATISTICS

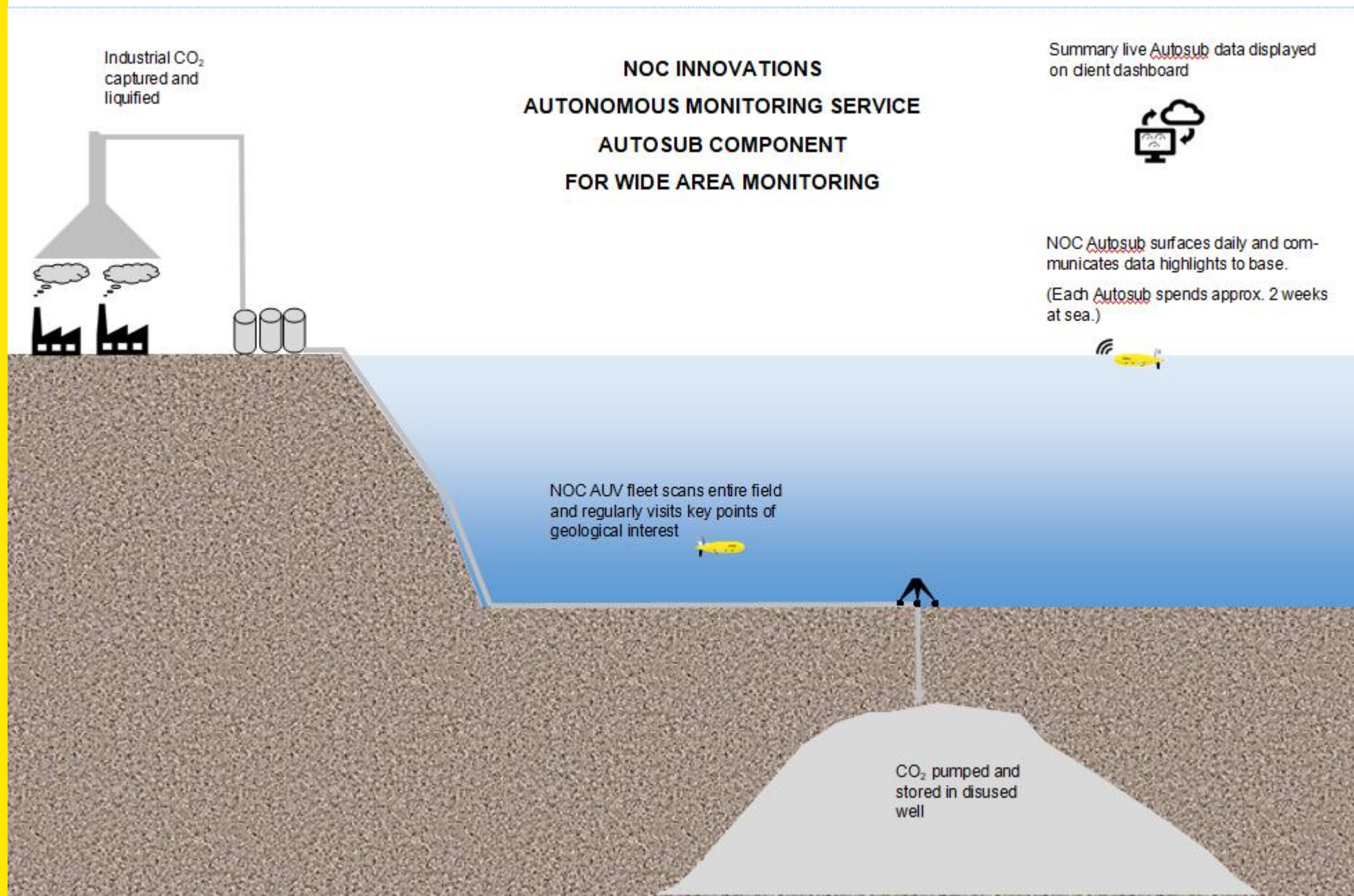
Chemical processing segment (Market share 2022)	>4%
Oxy-fuel combustion segment (Market share 2032)	>20%



Asia Pacific  
(Market Value 2022) >\$1 BN

# CCS - AMS

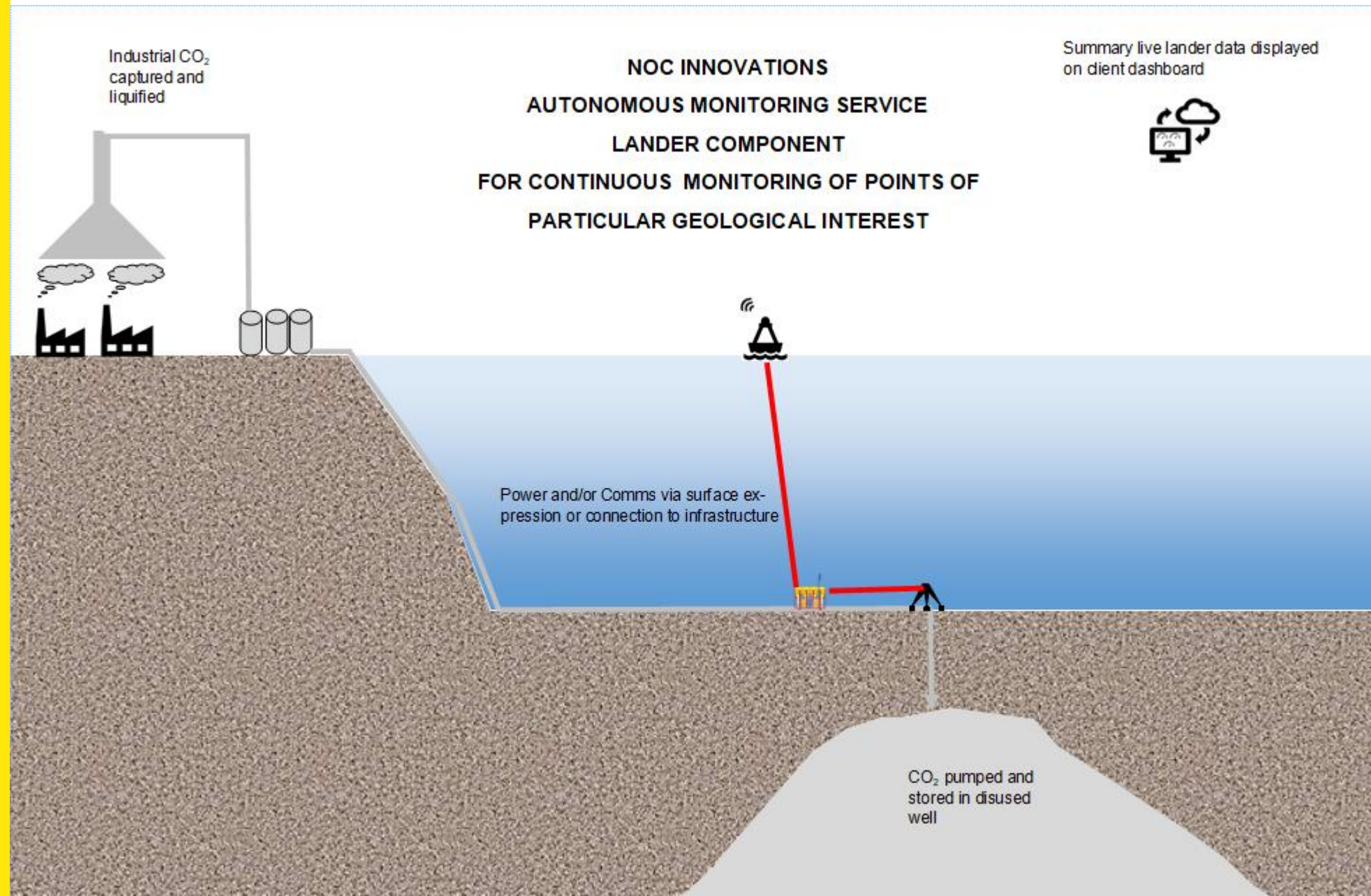
## OPTION 1 AUTOSUB WIDE AREA MONITORING





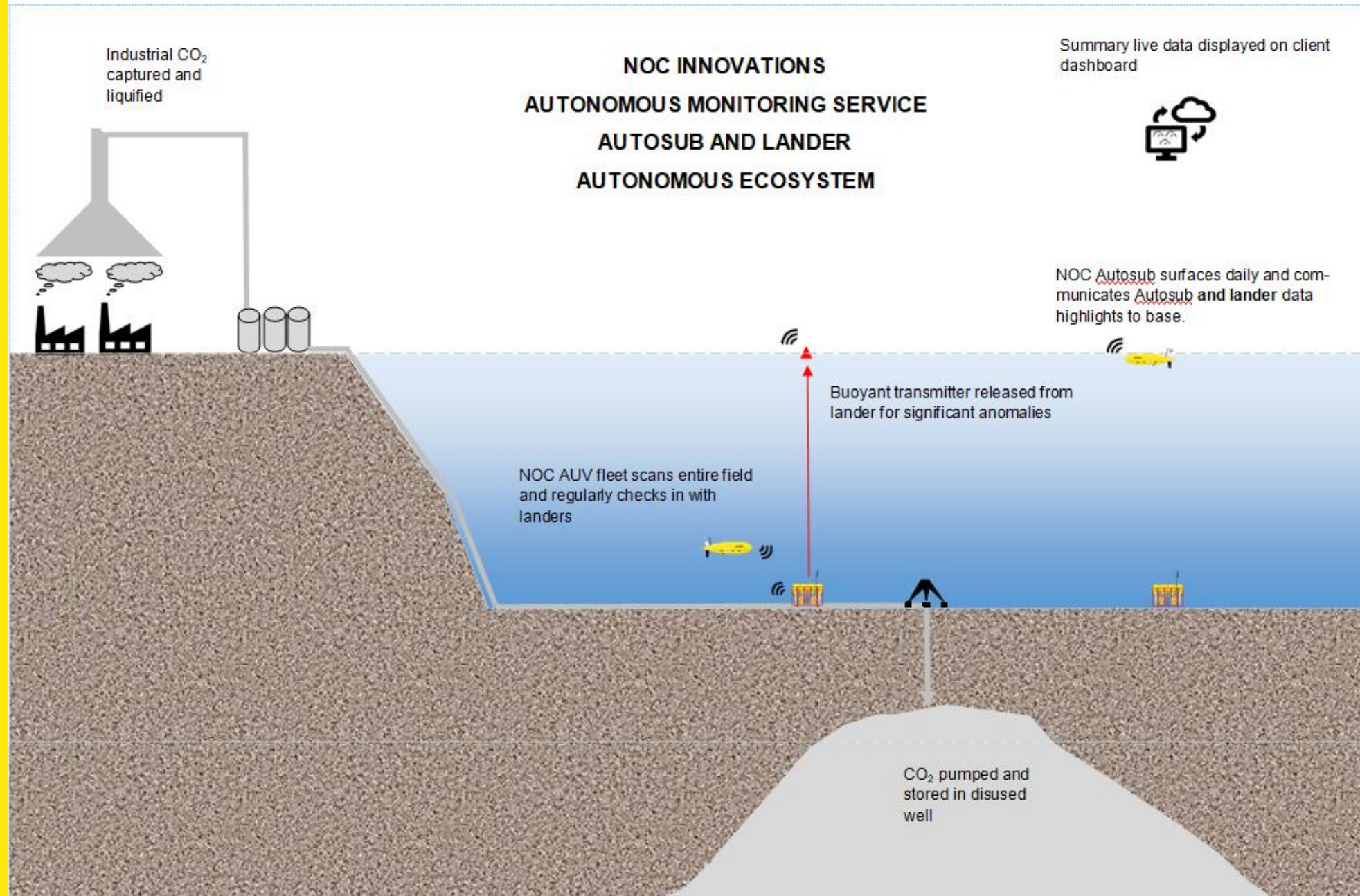
# CCS - AMS

OPTION 2  
LANDER FOR  
MONITORING AREAS OF  
SPECIFIC GEOLOGICAL  
INTEREST



# CCS - AMS

## OPTION 3 FULL AUTONOMOUS ECOSYSTEM – AUTOSUB AND LANDERS





# CCS AUTONOMOUS RESEARCH – STEM-CCS



## STEM-CCS

STEMM-CCS was a €16M project funded by the Horizon 2020 program of the European Union

CO<sub>2</sub> was released 150km offshore from Aberdeen, Scotland at ~3 m below the seafloor, at flow rates between 6 kg/day and 143 kg/day.

STEM-CCS paper:

“Detecting and mapping a CO<sub>2</sub> plume with novel autonomous pH sensors on an underwater vehicle” (Monk et al., 2021)

“All pH sensors integrated on the ROV during the STEMM-CCS experiment successfully detected the small anomalies of bottom water pH caused by the released CO<sub>2</sub> gas, despite the gas release rates being well below what may be tolerated from CCS reservoirs.”



# CCS AUTONOMOUS RESEARCH – STEM-CCS

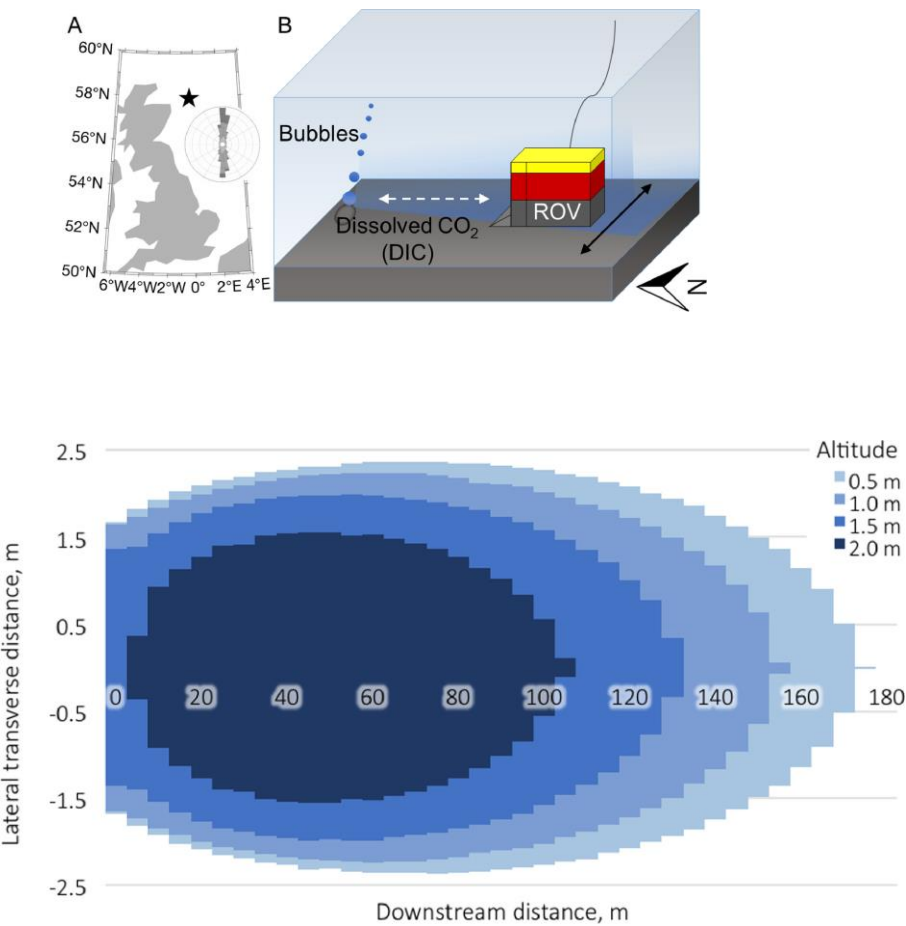


Fig. 8

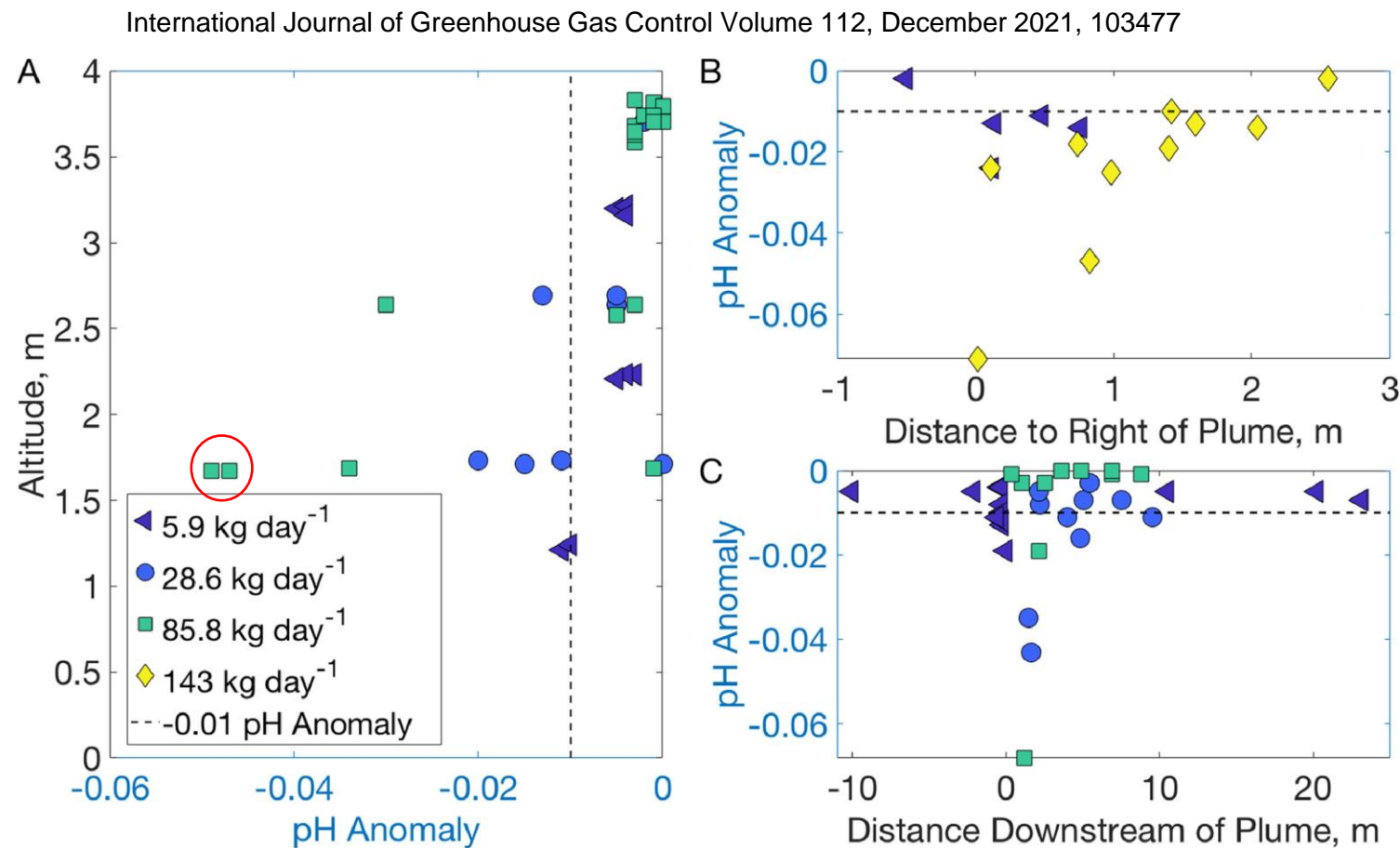


Fig. 5. (A) Vertical profiles from dives 360, 366 and 372. (B) Lateral transects. (C) Longitudinal transects. In all panels a dashed line indicates the pH detectability threshold (0.010 units) and the symbols the gas release rate, following the legend in panel A.



# AUTOSUB CCS LONG RANGE SPECIFICATION

## CO2 DETECTION

Flying at between 10m down to 2m above the seafloor the AUTOSUB can detect and quantify CO<sub>2</sub> leaks as small as 274kg/day using a mix of active acoustics and chemical sensors.

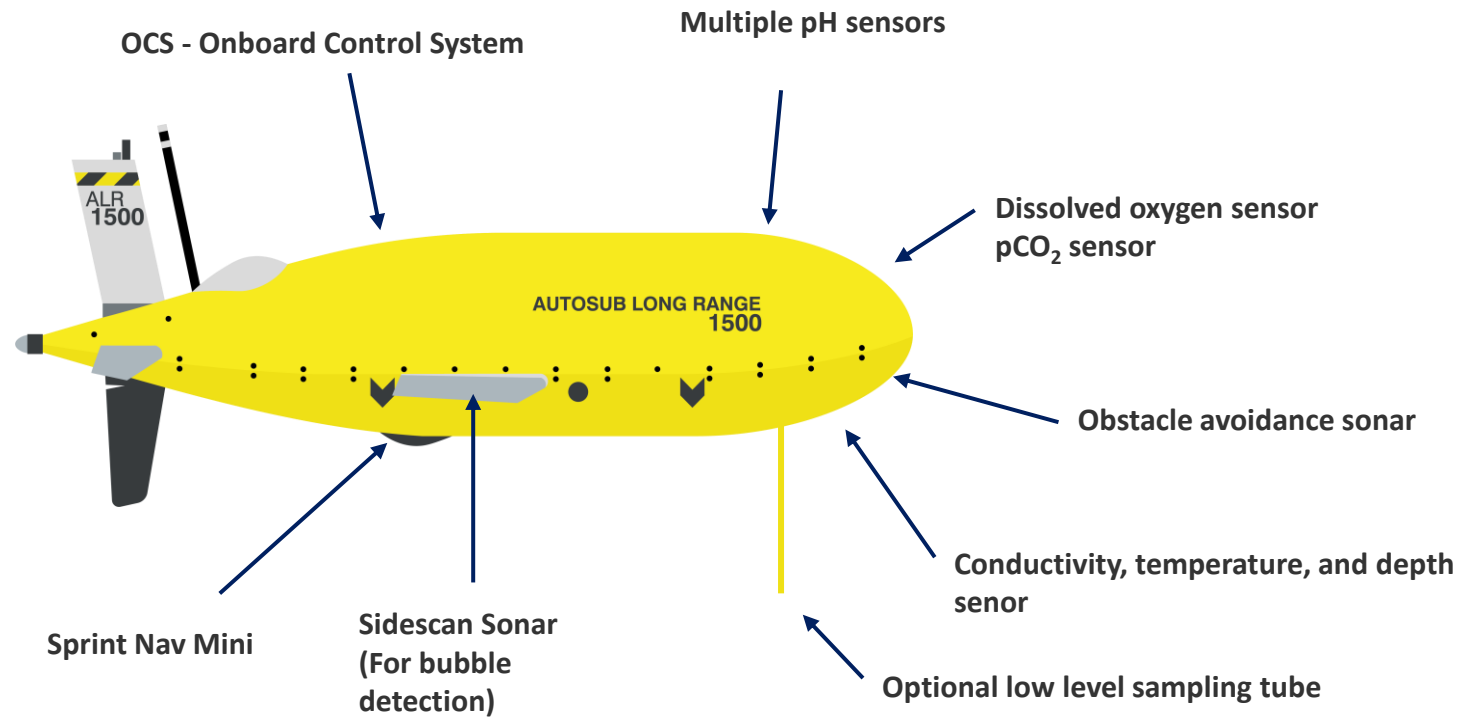
Increased detection sensitivity can be achieved via an optional sampling tube that hangs below the ALR.

## WIDE AREA SURVEY

The AUTOSUB can typically cover ~43km per day which on a standard sweep can cover an area of ~4.3km<sup>2</sup>.

## SUPPORTING SCIENCE

Non-confidential scientific data can be shared with the scientific community and used to enhance ocean research.



# CCS REAL TIME ALERTS AND DASHBOARD

AMS DASHBOARD

NOC Innovations

3D

Routes

Filter

Start Date

01/10/2024

End Date

02/09/2024

Max Lat

90

Min Lon

-180

Max Lon

180

Min Lat

-90

UPDATE POSITIONS

Vehicles

alr-3

Platform type: autosub

Last data: 2024-01-22 15:16:55

LAT 50.8927, LON -1.3953

alr-5

Platform type: autosub

Last data: 2024-01-19 13:19:34

LAT 50.8928, LON -1.3953

CURRENT STATUS:

NO ALERTS

Lat: 50°50'32N

Lon: 01°16'08E

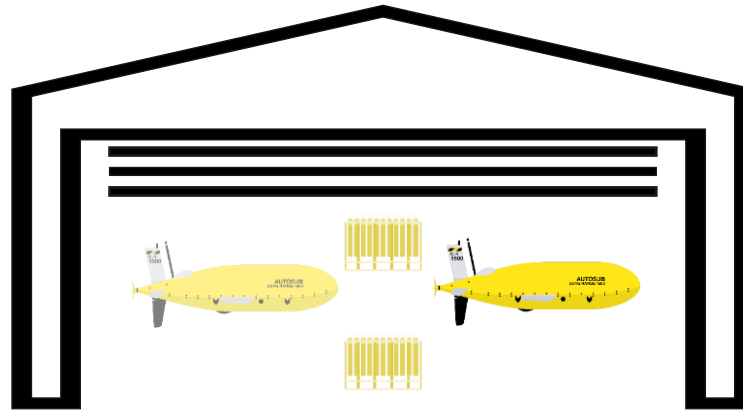
Depth: – m



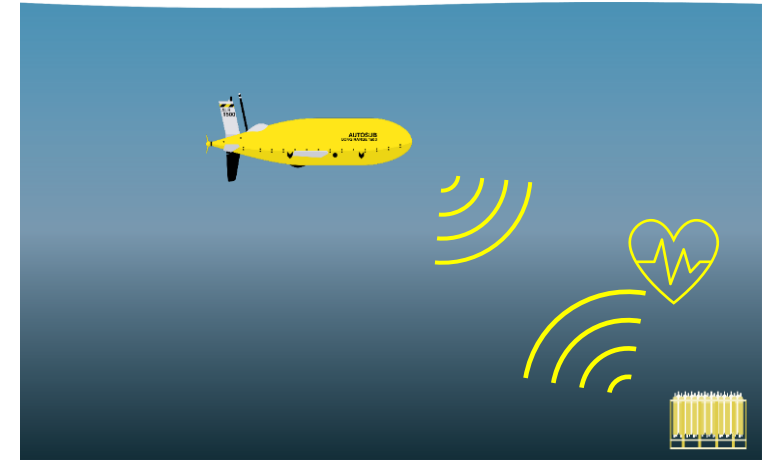
# CCS SERVICE EXAMPLE

- Operating model:
  - 1 vehicle monitoring at any one time (at sea)
  - 1 vehicle being mobilised (on shore)
  - 1 vehicle for resilience mid-mission (on shore)
  - Landers in key locations
- ALR shore launched and recovered
- Landers cycled every 6-12m
- In-region shore base with infrastructure to mobilise
- Mission at sea is based on detecting anomalies to set chemical criteria – “no news is good news”

Vehicles refreshed, recharged and made mission ready at local operational base



Vehicle(s) on mission



**5 year service contract following field demonstration and baselining phase (see later)**

**[All principal suppliers UK Based]**

**NOC  
Innovations**



# QUESTIONS?

[www.noc-innovations.co.uk](http://www.noc-innovations.co.uk)

SCIENCE  
TECHNOLOGY  
INNOVATION