Development and deployment of a suite of autonomous *in situ* carbonate sensors for the STEMM-CCS gas release experiment

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 654462

Overview

- **Lab On Chip Overview**
  - Introduction to platform
  - Operation overview
- **Chemistry Overview**
  - Carbonate Chemistry: pH, TA and DIC
  - Nutrients: N,P
- **STEMM-CCS Deployments**
  - Baseline Landers (Original and v2)
  - MPI Benthic Boundary Landers
  - ROV Isis
  - Underway System

STEMM-CCS

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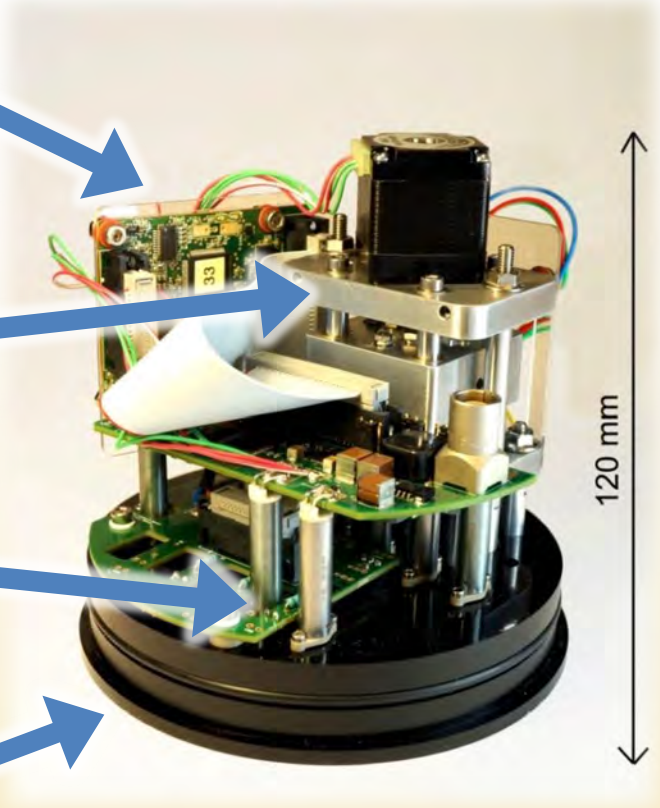
Lab On Chip Sensor

Custom Electronics

Pump

Valves

Chip



56 cm

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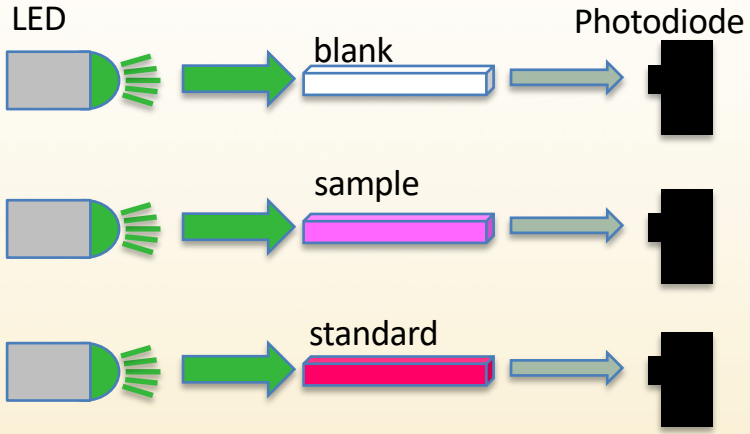
Lab On Chip Sensor General Operation

Measurement:

1. Mix sample and regent to produce a chemical reaction
2. Colourimetric optical measurement (generally)



Slide Credit: A. Schaap

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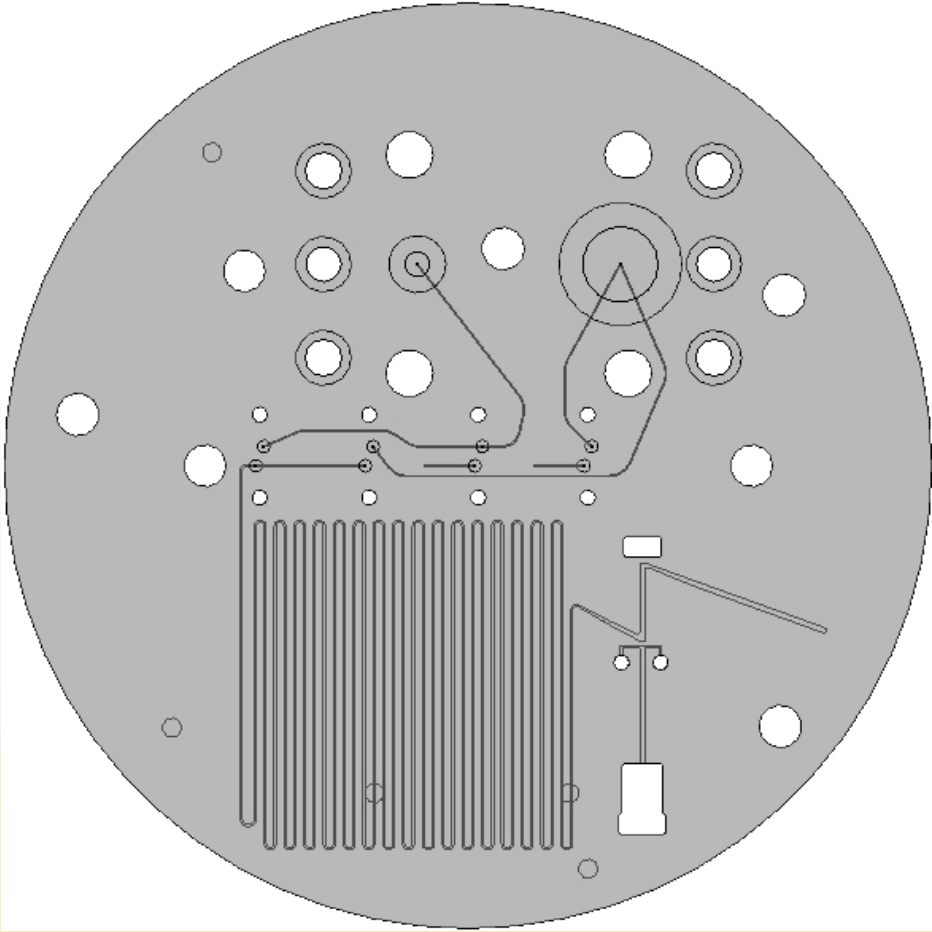
LOC pH

- Field-deployable sensor for automated *in situ* spectrophotometric pH measurements
- Low reagent consumption
- No pre-conditioning required
- Low maintenance
- Self-contained with automated control and data logging
- Up to five measurements per hour
- Low power consumption
- High-sensitivity system with a precision of (0.001 pH units) and accuracy of (better than 0.004 pH units)



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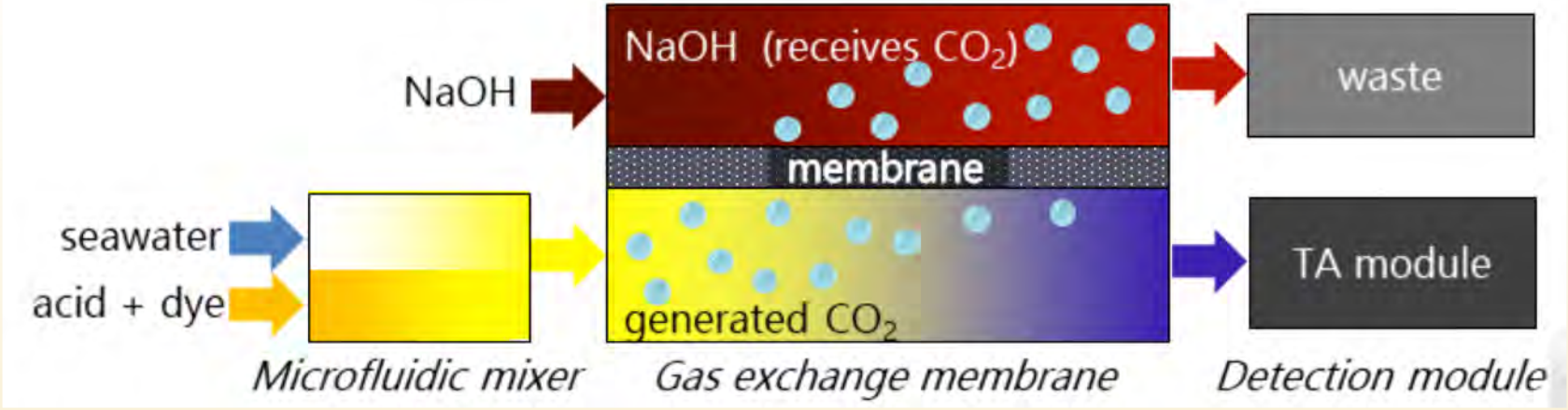
LOC Total Alkalinity

Measure the pH of the degassed acidified water



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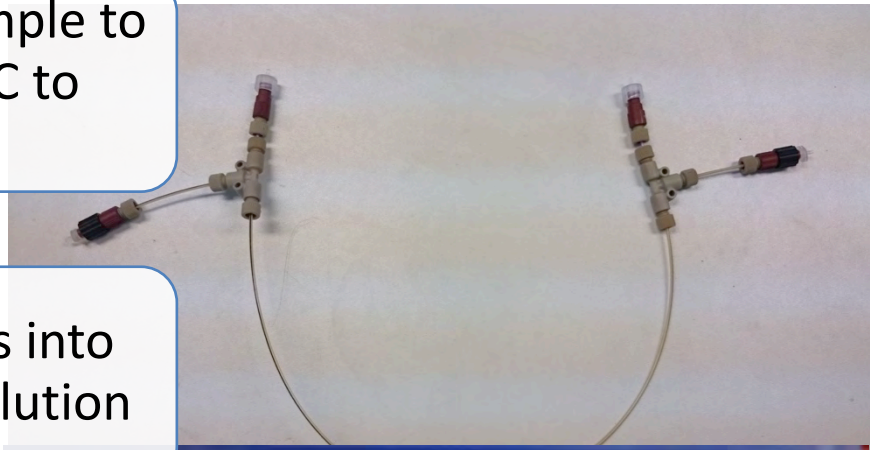
Dissolved Inorganic Carbon: System Overview

Acidify the sample to convert the DIC to CO_2 gas

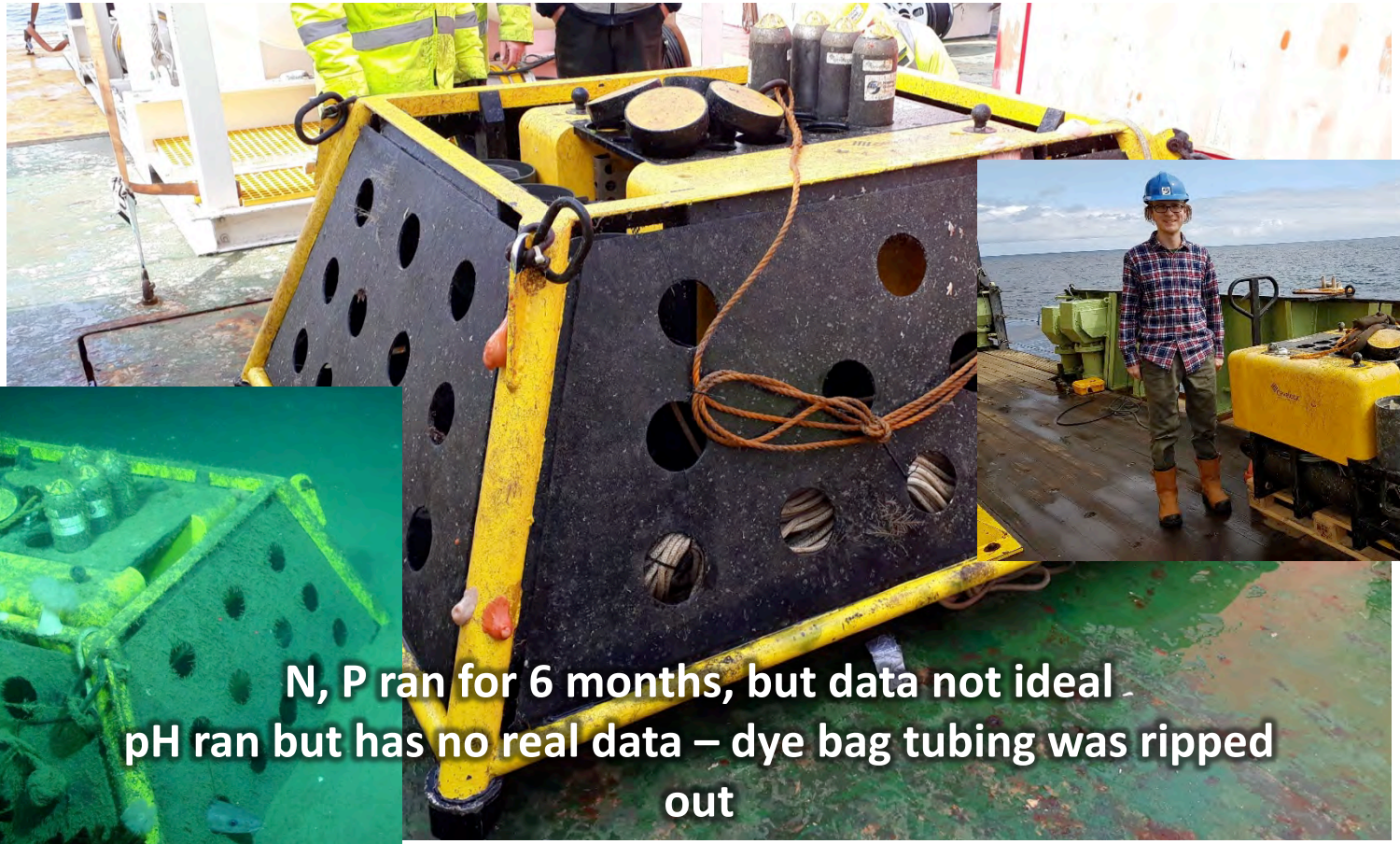


Diffuse CO_2 gas into an acceptor solution

Measure the changes in the acceptor solution conductivity

STEMM-CCS DEPLOYMENTS

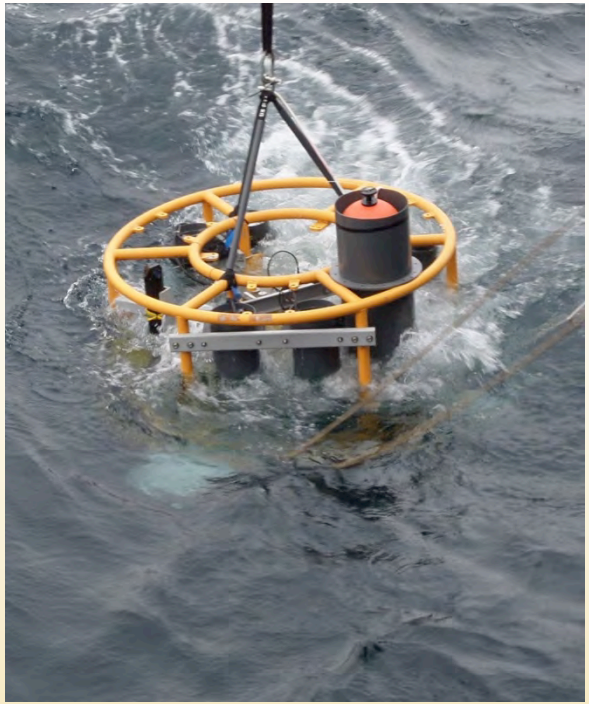
Develogic Baseline Lander



N, P ran for 6 months, but data not ideal

pH ran but has no real data – dye bag tubing was ripped out

Replacement Baseline Lander



Deployed for 25 days (pre-gas to post-gas)
Battery-powered, mostly measuring 2 hourly (pH hourly)
N, P, pH worked well the whole time; TA is off-and-on quality and DIC died early

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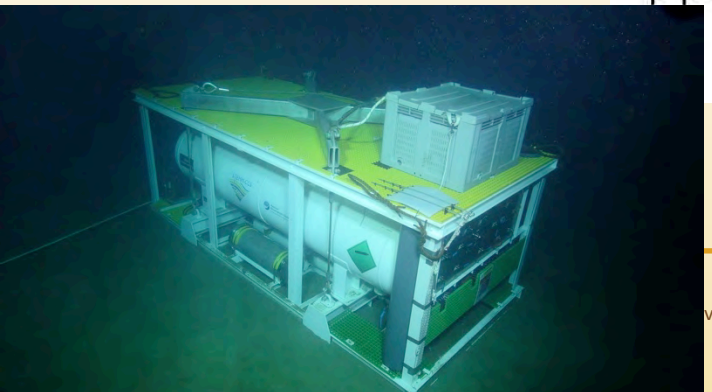
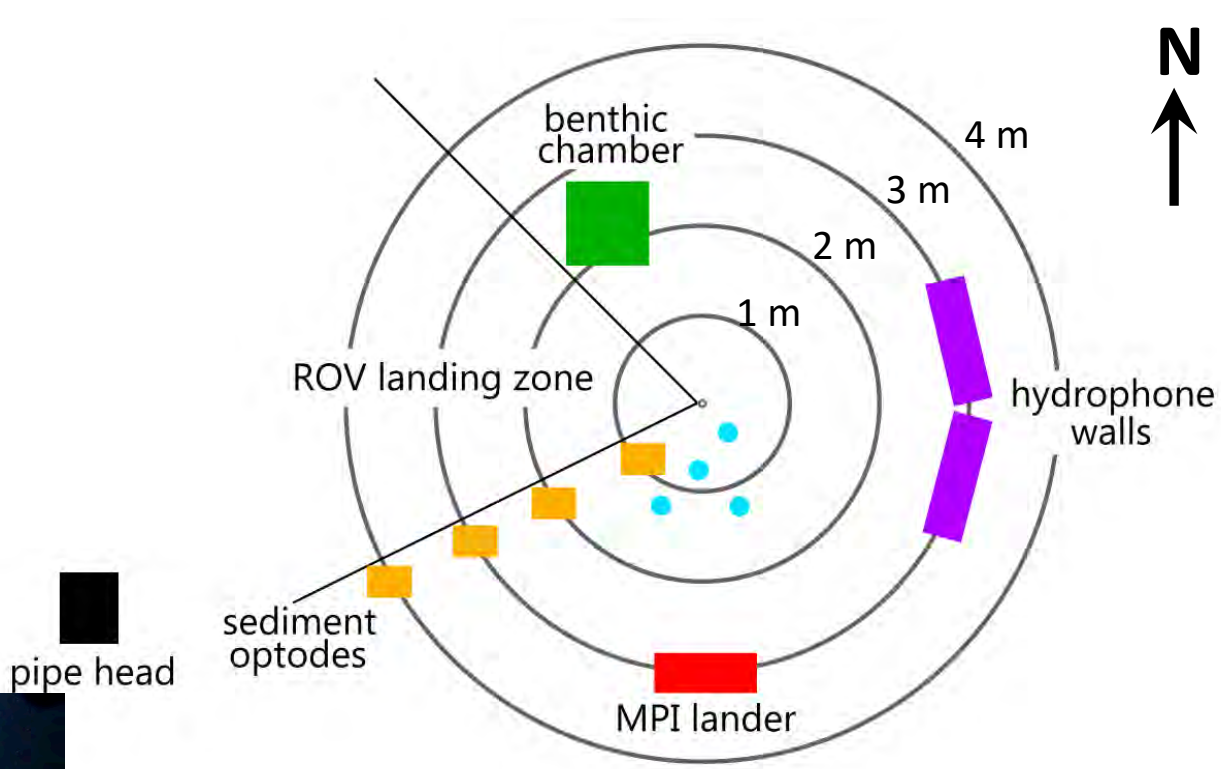
Experimental site layout





Schematic credit: A. Schaap

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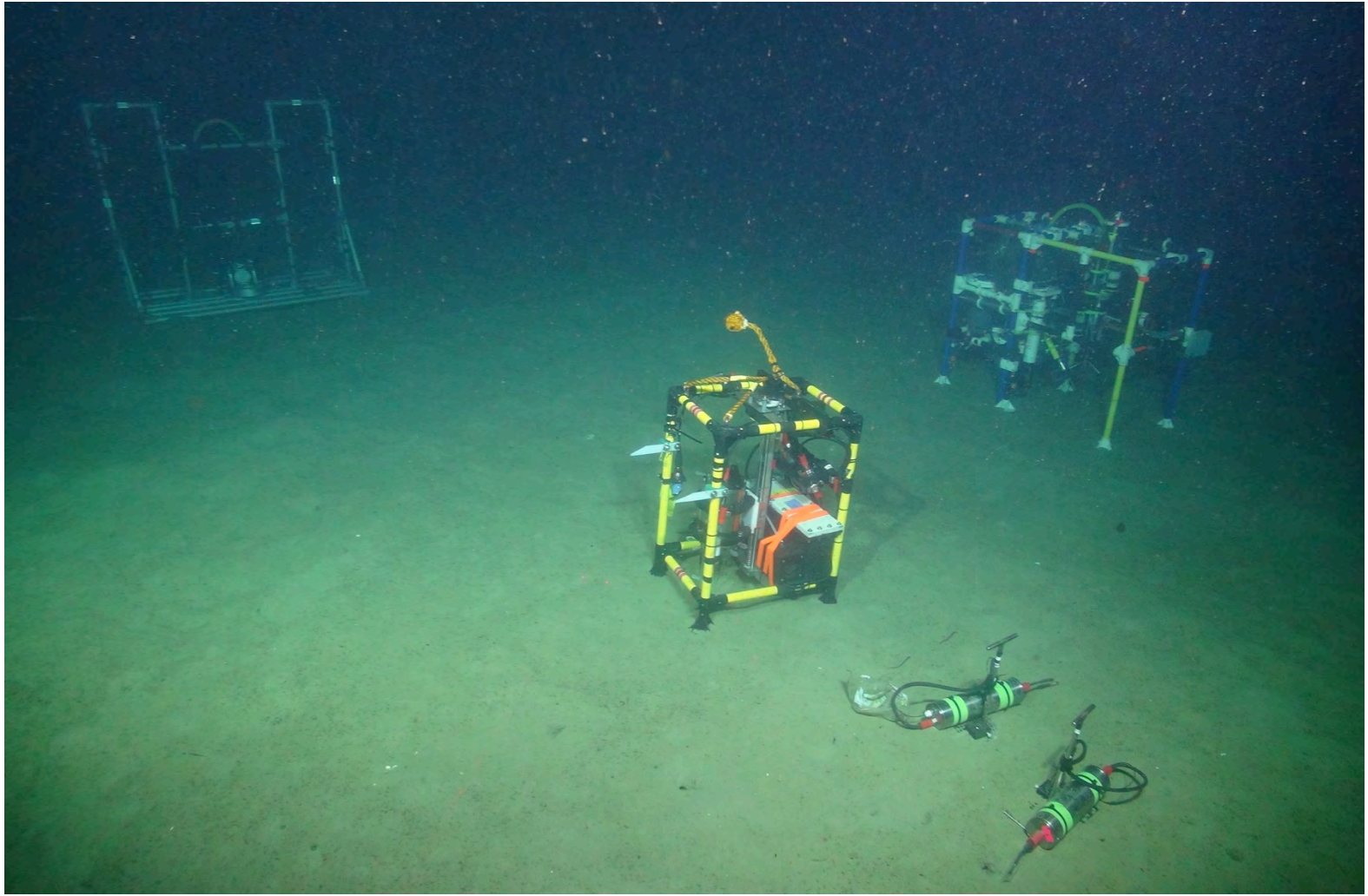
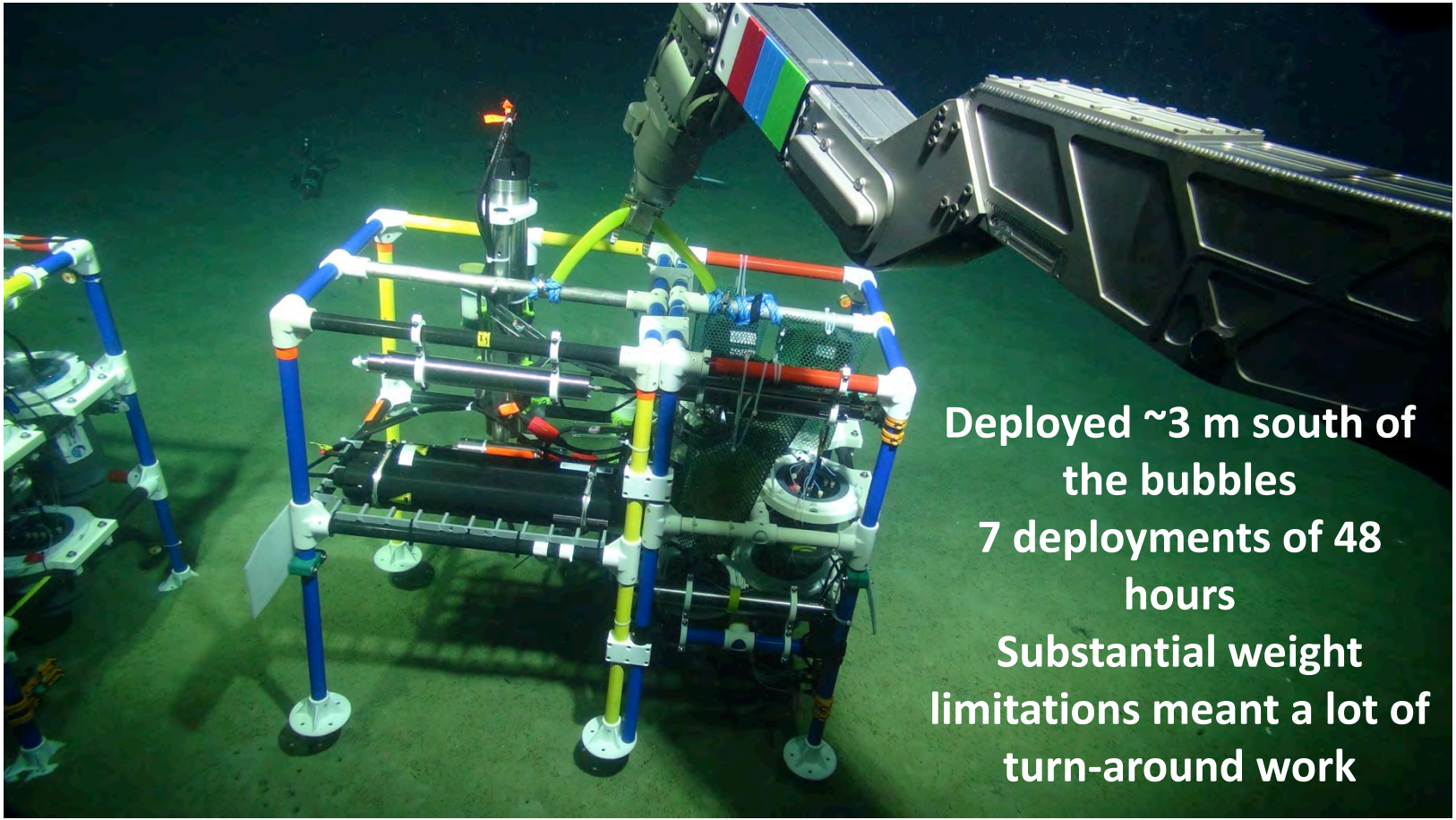
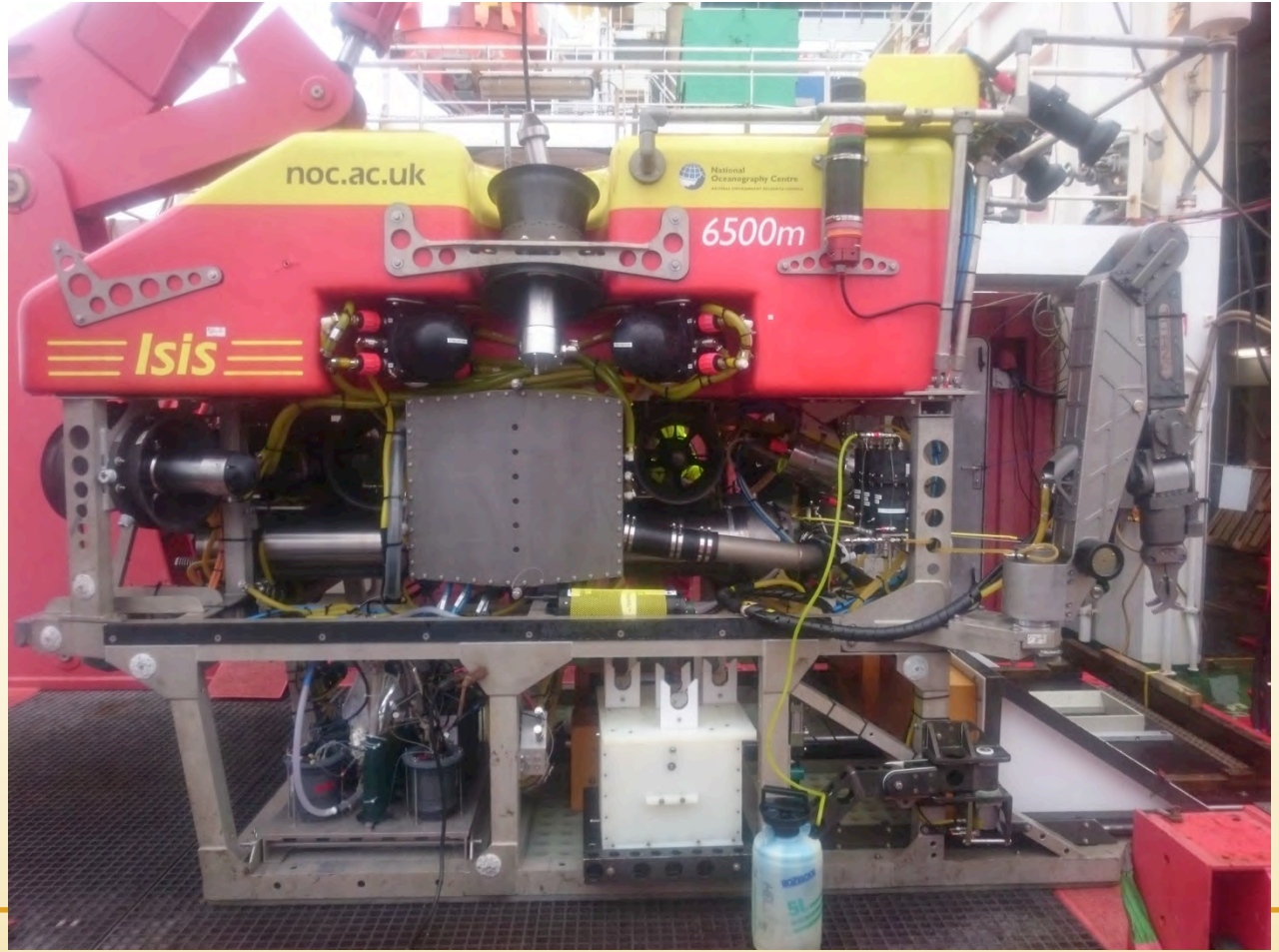


MPI Benthic Boundary Layer Landers





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Summary

- 33 LOCs built and taken on JC180 (36 returned)
- 3 old sensors returned from original baseline lander (Develogic)
- ~200 sensor deployments
- 3 Sensors broke but fixable sensors
- New TA and DIC sensors recorded meaningful data
- More data from Allison's talk (tomorrow)

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Thanks for listening
Any Questions?