CYPRUSUBSEA
Consulting and Services C.S.C.S. Limited

Integrating Advanced Payloads with Underwater Gliders

IUCG, Gothenburg 2024-06-14

Daniel Hayes* and CSCS team

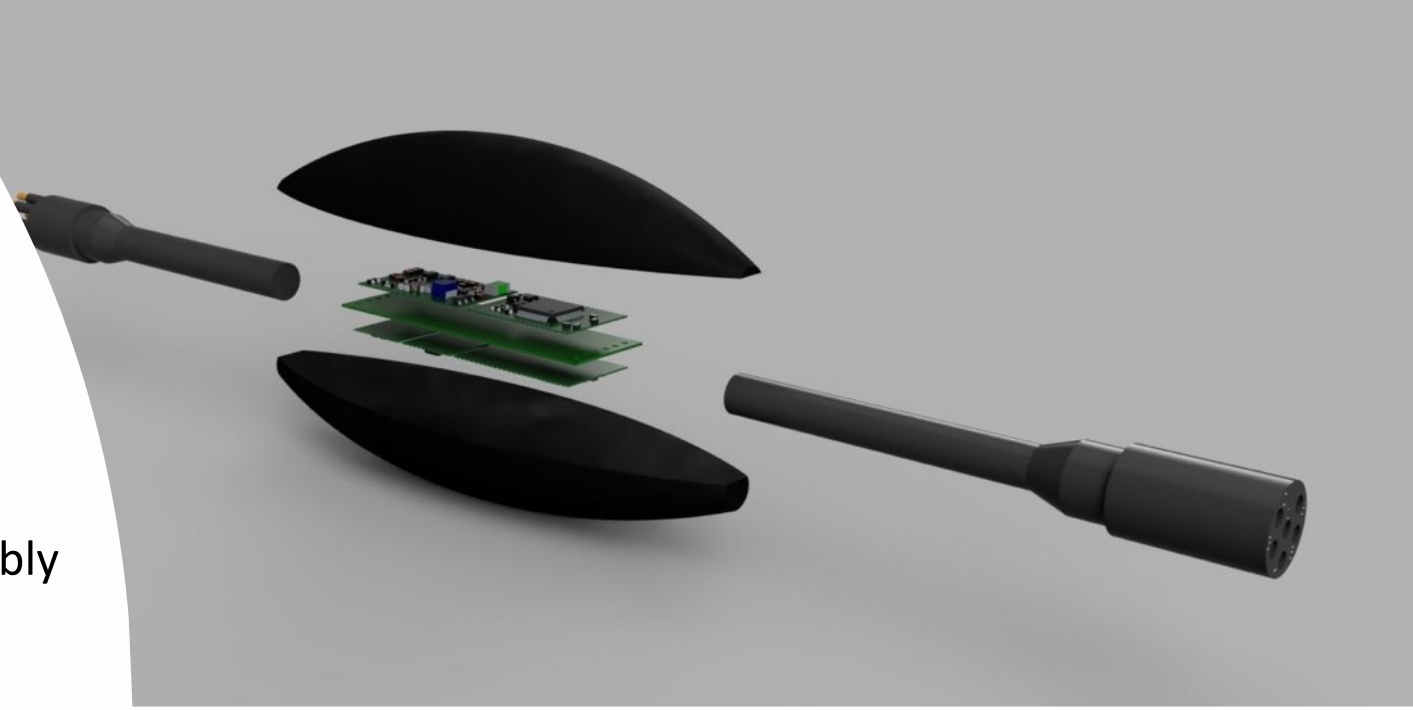
*Now at: CYPRUS MARINE & MARITIME INSTITUTE

Who is Cyprus Subsea?

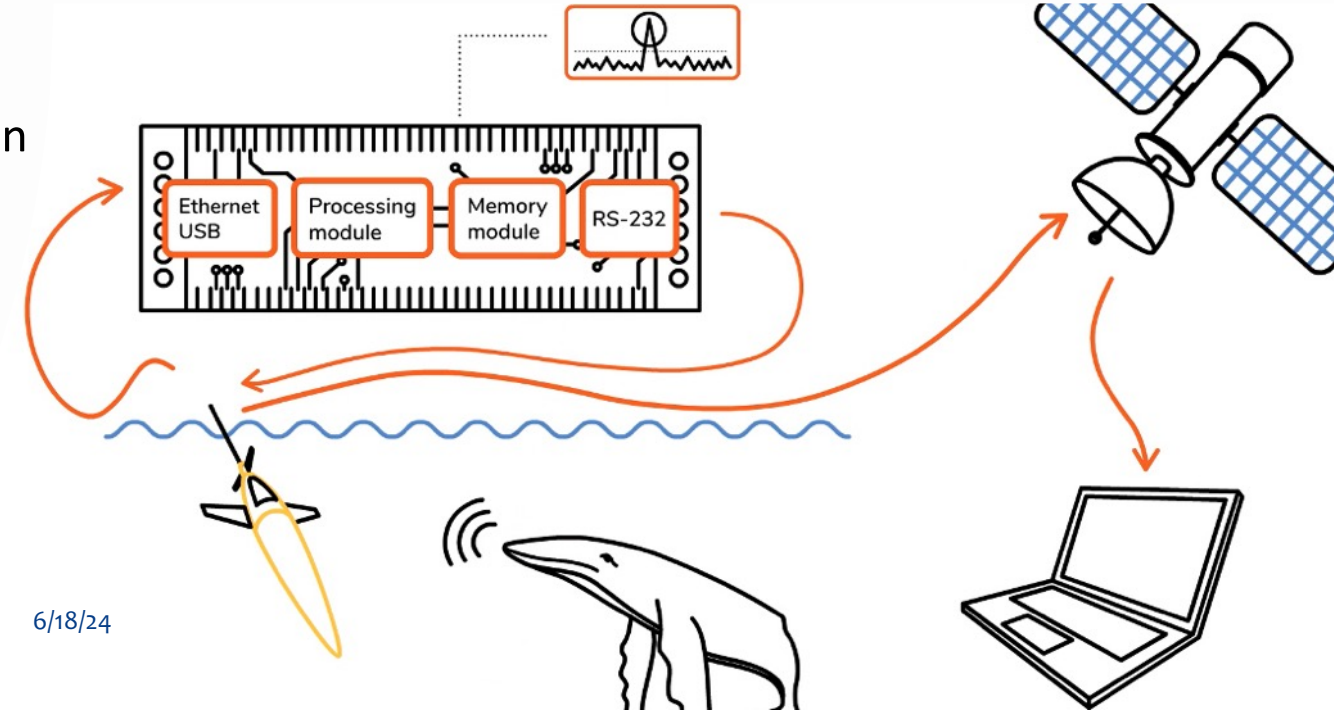
- Est. 2012, in Nicosia, Cyprus
- 5 employees
  - Oceanography
  - Ocean Engineering
- Research and Development Focus

CYPRUSUBSEA
Consulting and Services C.S.C.S. Limited

Cyprus Subsea's SIRMA™

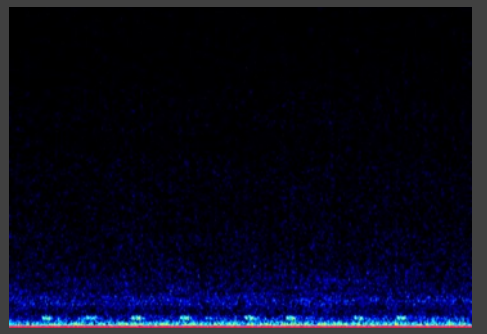


- Smart Interoperable Real-time Maritime Assembly
- Variety of interchangeable modules
  - Processing modules
  - Protocol modules (RS-323, 485, 422, Ethernet, USB, CAN-bus)
  - Power modules (step-up, step-down, protection circuit)
  - Miscellaneous modules (ADC, memory, Real-time clock, etc.)
- Pressure tolerant
- Customizable connector/pin-out
- https://github.com/Cyprus-Subsea/Smart-Cable



Passive Acoustics

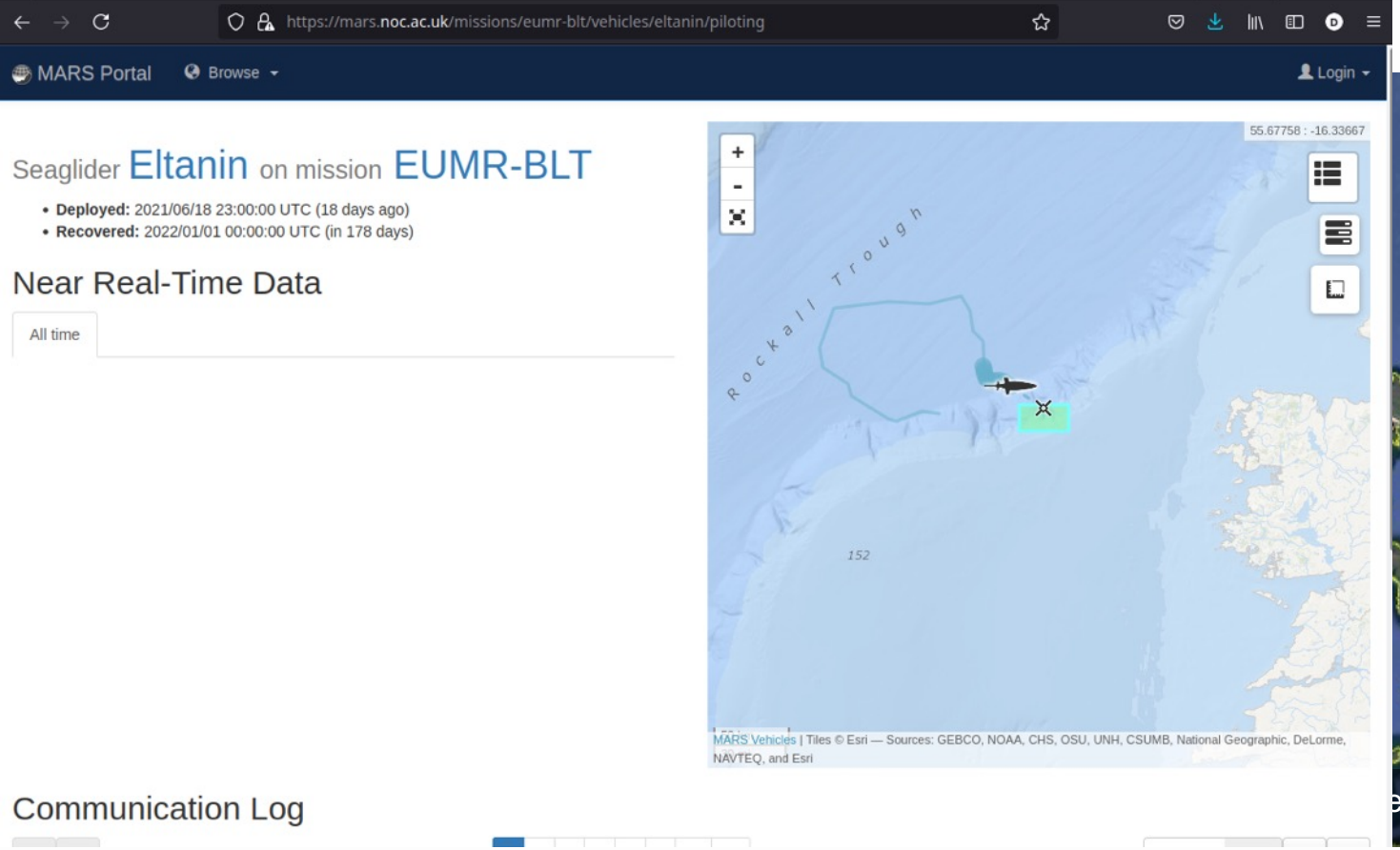
SIRMA™ makes the integration of sensors to platforms possible and facilitates the real-time transfer of data

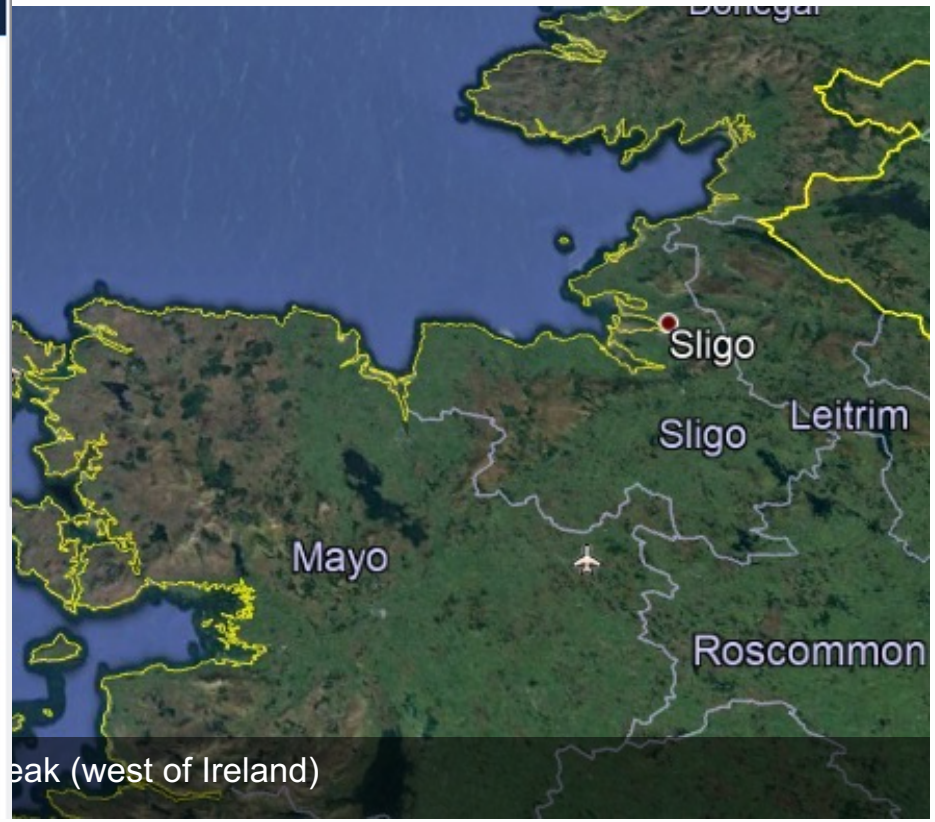


- Seaglider with SIRMA™
- Ocean Sonics icListen HF
- Analyzes data, transmits acoustic spectra
- Near-real-time event detection

OCEAN SONICS

CYPRUSUBSEA
Consulting and Services C.S.C.S. Limited





eak (west of Ireland)

Marine Mammal research

- Integration of hydrophone on SeaGlider
- Possibility of detecting:
  - beaked whales (Sowerby and Cuvier), Sperm whale, Baleen whale (humpback and fin), various delphinids
  - DATA: https://dx.doi.org/10.5285/096690aba290452d9b7208133274b69b

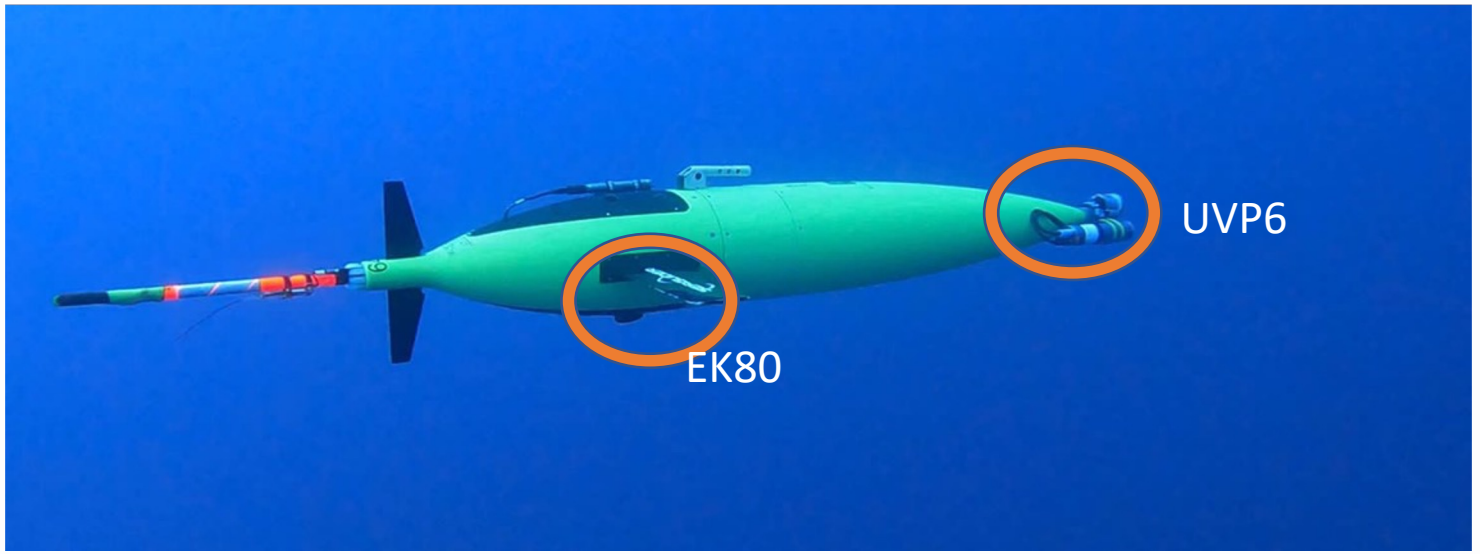
(NERC EDS British Oceanographic Data Centre NOC ERDDAP tool)

National Oceanography Centre

CYPRUSUBSEA
Consulting and Services C.S.C.S. Limited

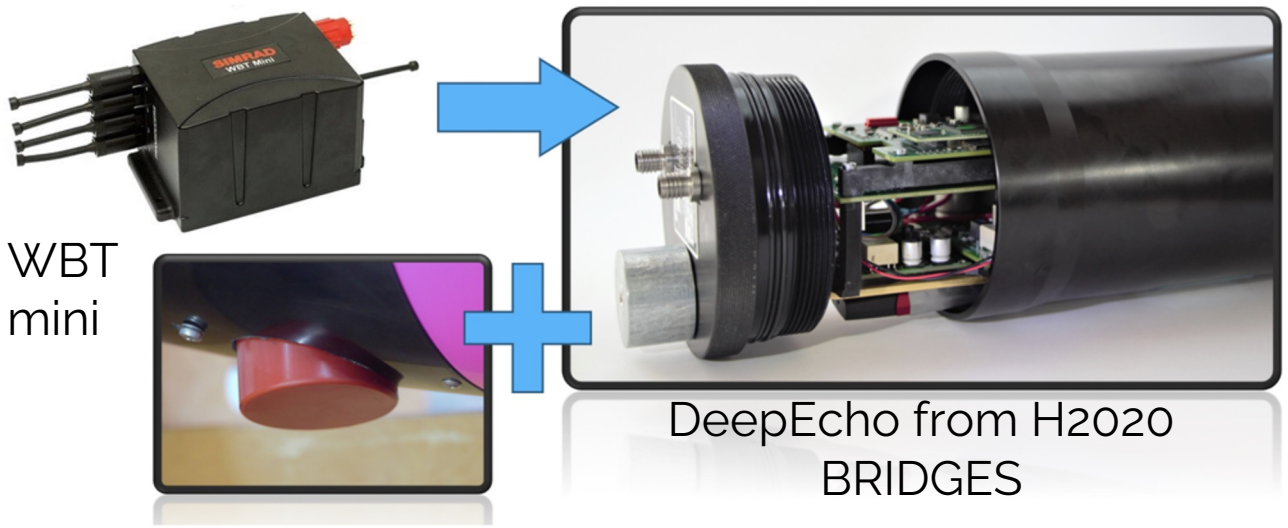
Acoustic and Imaging devices integration

	Seaglider	Slocum	SeaExplorer
EK80	Integrated and tested	In progress on G2 Teledyne on G3	No
UVP-6	Integrated and tested	Integrated on G3	Alseamar

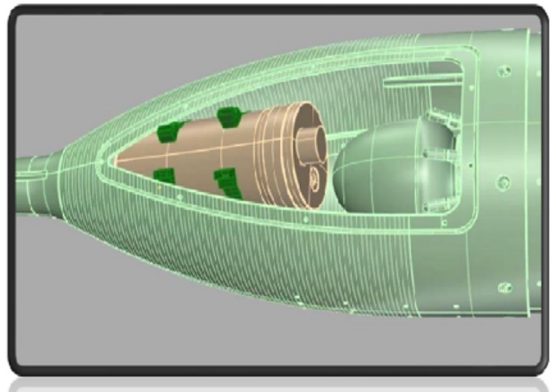


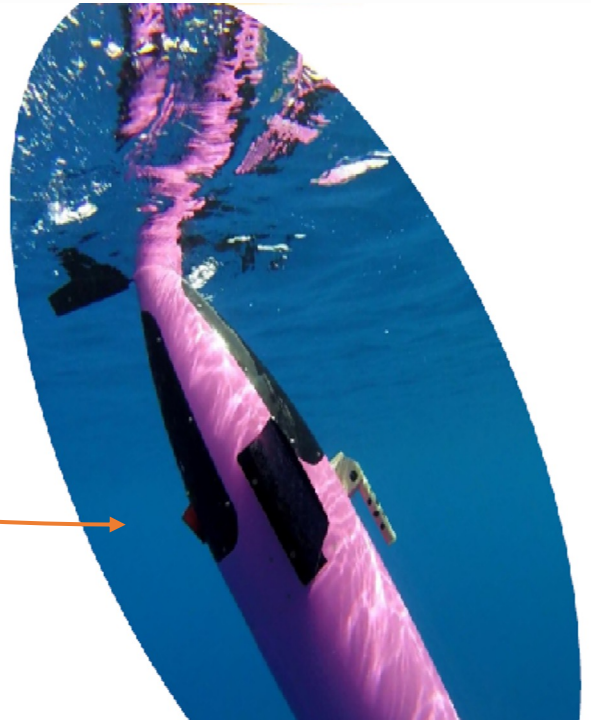
First tests of the full Bioglider solution on Seaglider
Depth rating: 1000 m
Endurance estimate: 1 mo (TBC)

EK80 - Echosounder integration



- **DeepEcho:** scientific wide-band echosounder for detection of fish, plankton, bubbles
- **Kongsberg Simrad WBAT mini-ek80,** Modified to fit in pressure housing
- **Seaglider™**
  - Uses LogDev and SIRMA™
  - Autonomous mode (no RT)
  - Field trials 2021, 22, 23
  - Norway and Cyprus
- **Teledyne Slocum**
  - In progress on the G2



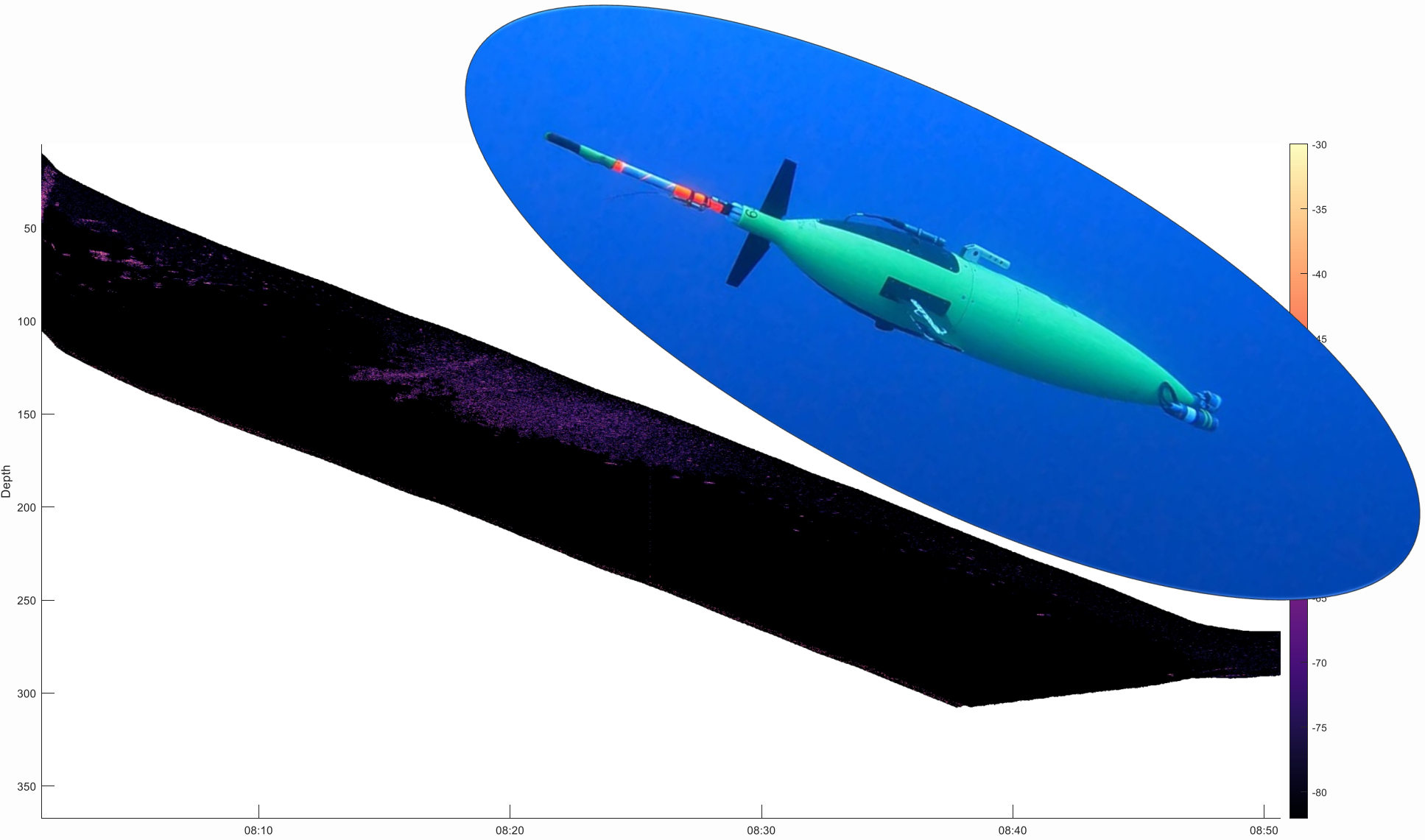


KONGSBERG

BIOGLIDER

Akvaplan niva

EK80 - Echosounder integration



Uses

Biogeochemical, physical

Depth / bathymetry

Zooplankton

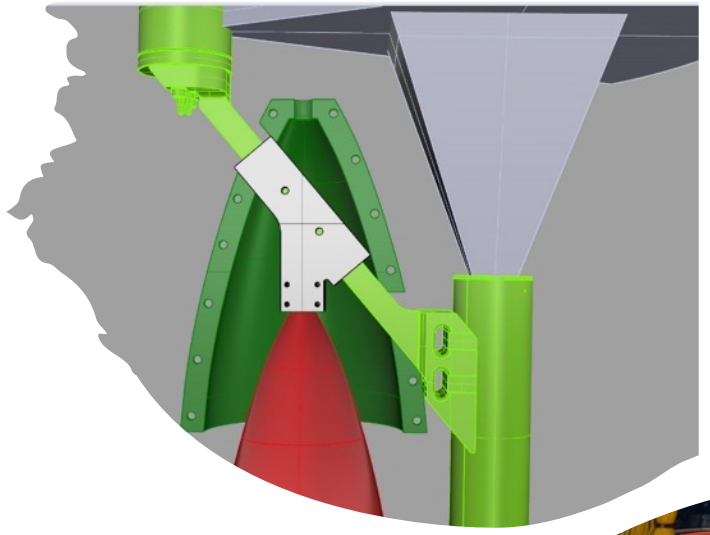
Fish (larvae + juveniles)

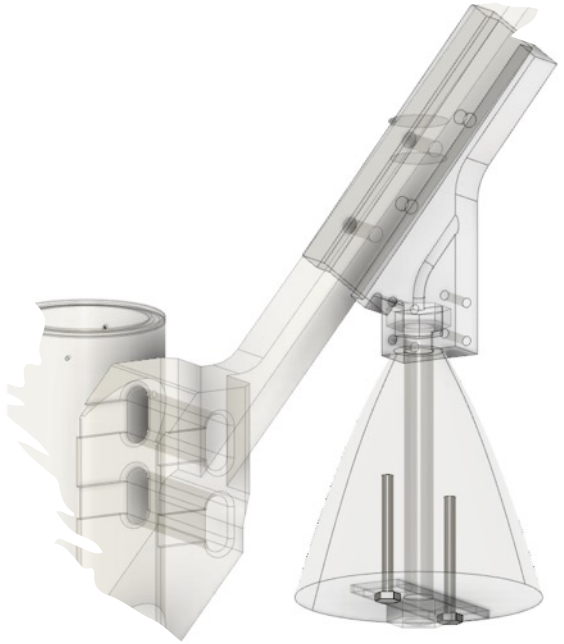
Gas release (natural, human)

Ecosystem, behavioural studies (mammals + prey)

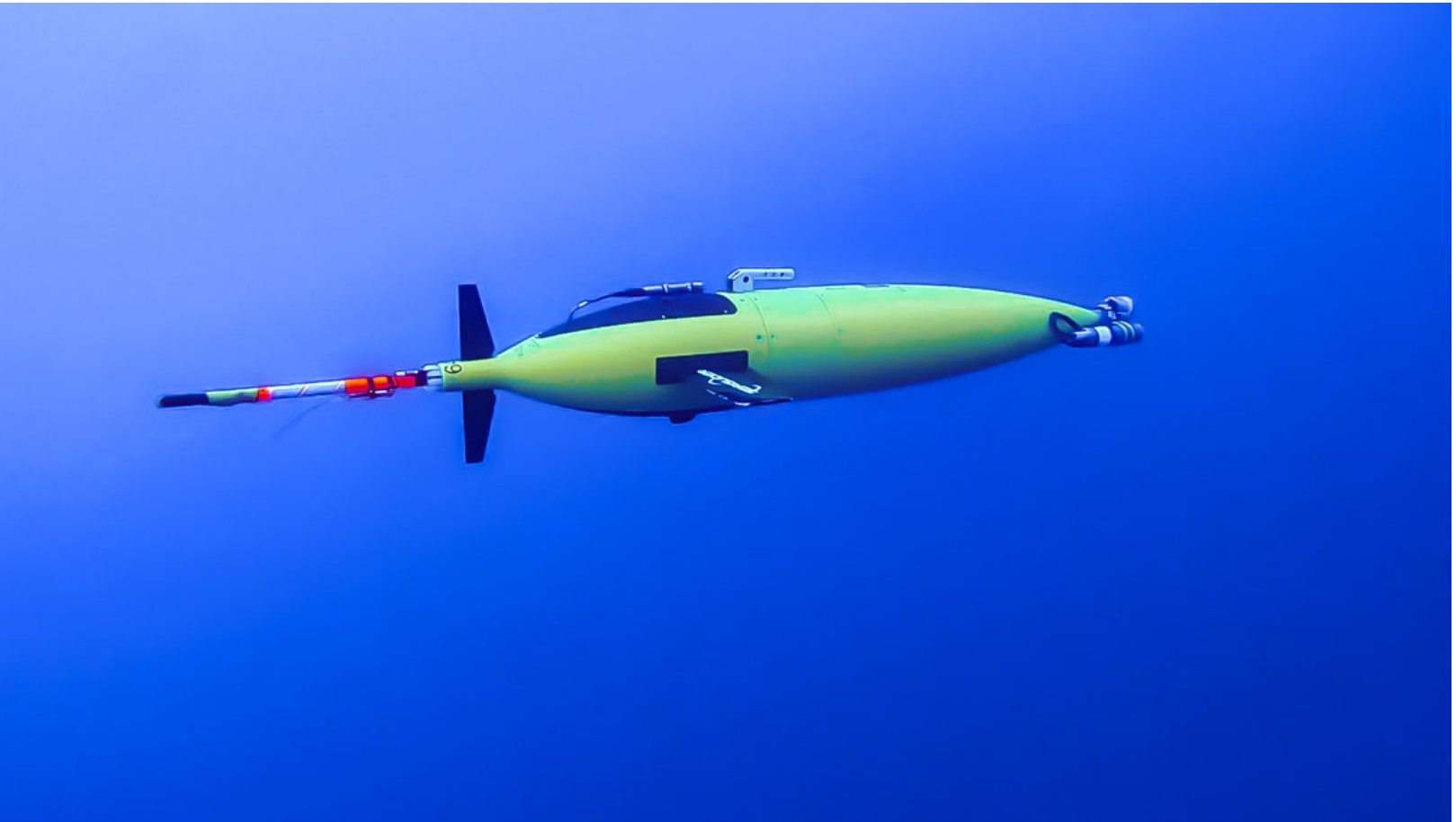
UVP6 - Imaging device integration

- Mechanical integration of the UVP6 on the Seaglider
- Nose mounting using custom bracket and front fairing drain hole
- Plastic arm
- 3-D printed bracket
- Foam needed for ballast and pitch

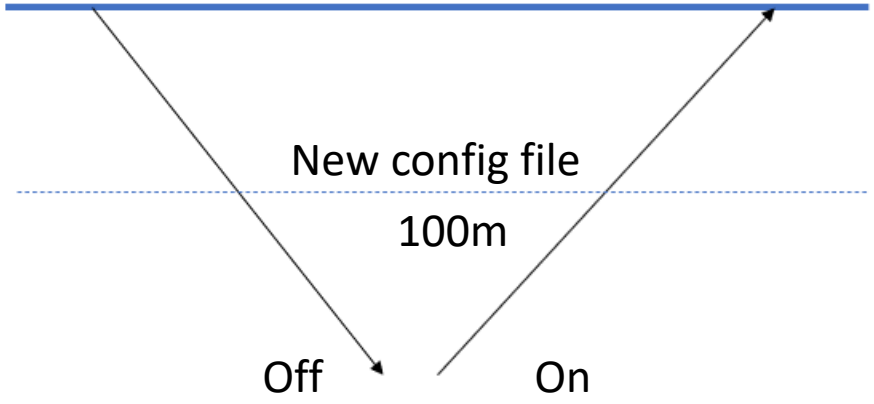




UVP6 - Imaging device integration

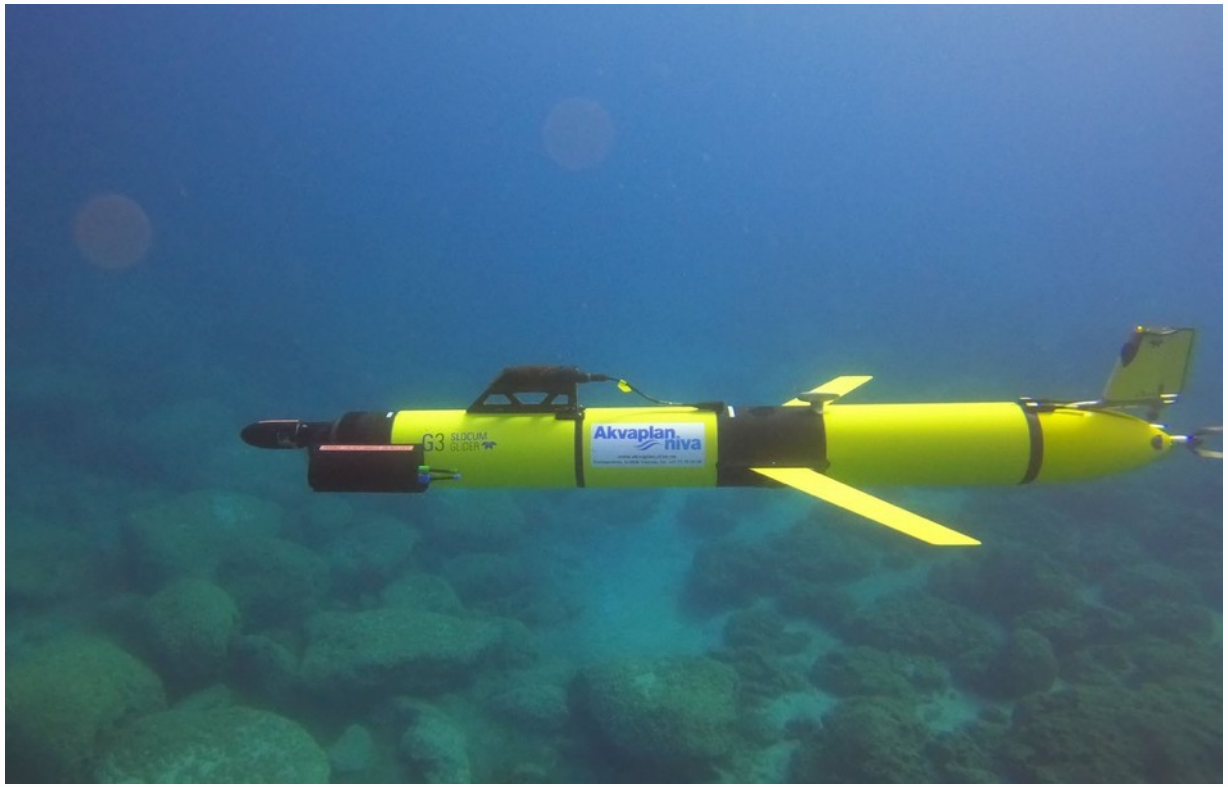


- SIRMA™
  - UVP6 real time operation
  - Receives depths from glider and sets config files
- A snippet of particle size distribution tables sent to shore



CYPRUSUBSEA
Consulting and Services C.S.C.S. Limited

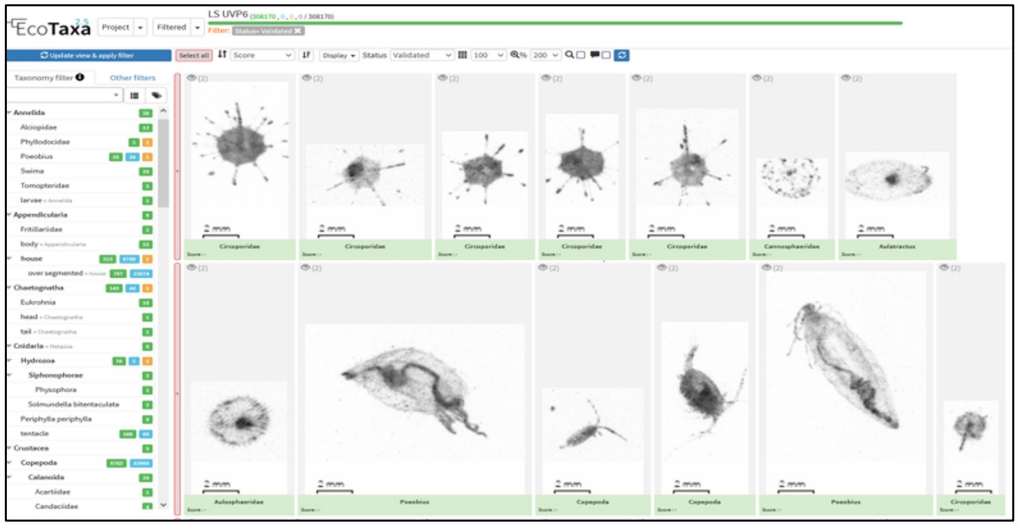
UVP6 - Imaging device integration



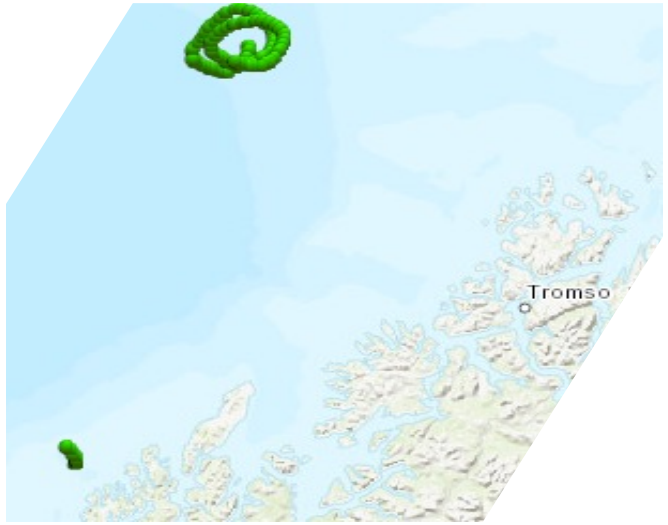
Slocum
First tests in January 2023 on the G3 version
Back Seat Driver interacts with SIRMA™: allows real time transfer of particle statistics and depth dependent control
Work in progress on the G2.

Already more than 6000 profiles from gliders

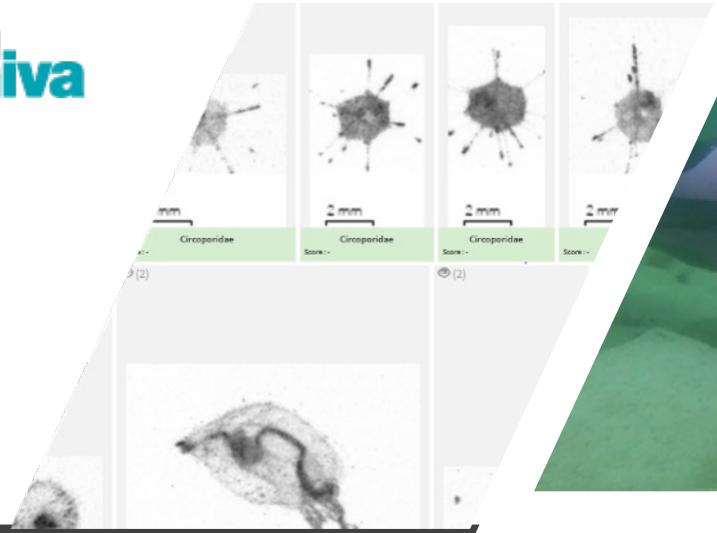
UVPapp improvement (merging, metadata, piloting…)
Matlab tool coding for data preparation for EcoPart and Ecotaxa (Blue cloud)

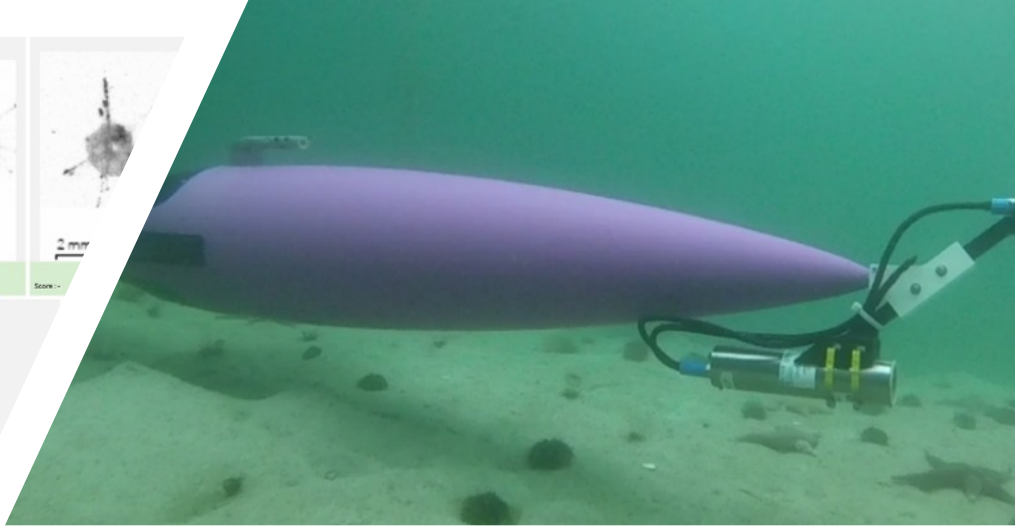


Learning set creation for the automatic classification of UVP6 images : 650 000 images sorted



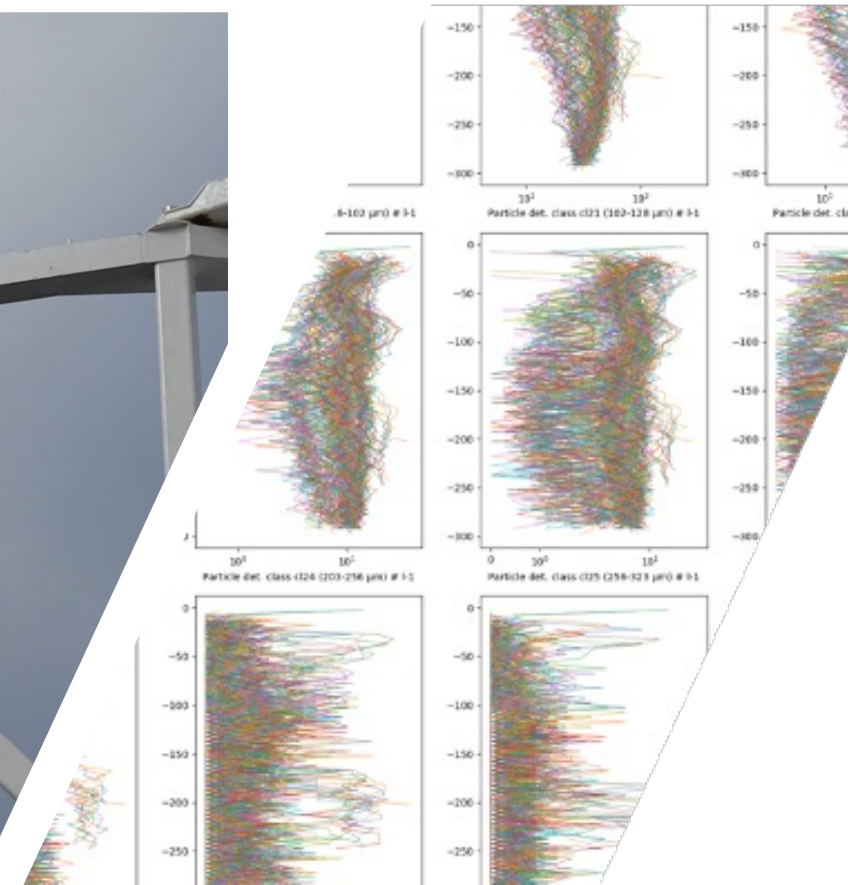
Akvaplan niva





UVP6

- Norwegian and Arctic technical trials 5/21, scientific trials 2022, -23, -24
- Best Practices for use of UVP on Gliders:
  - Integration, configuration, and operation
  - Automatic sample metadata filling
  - Automatic useful depth selection
  - Association of glider-CTD data with UVP data
  - TechOceans D4.1



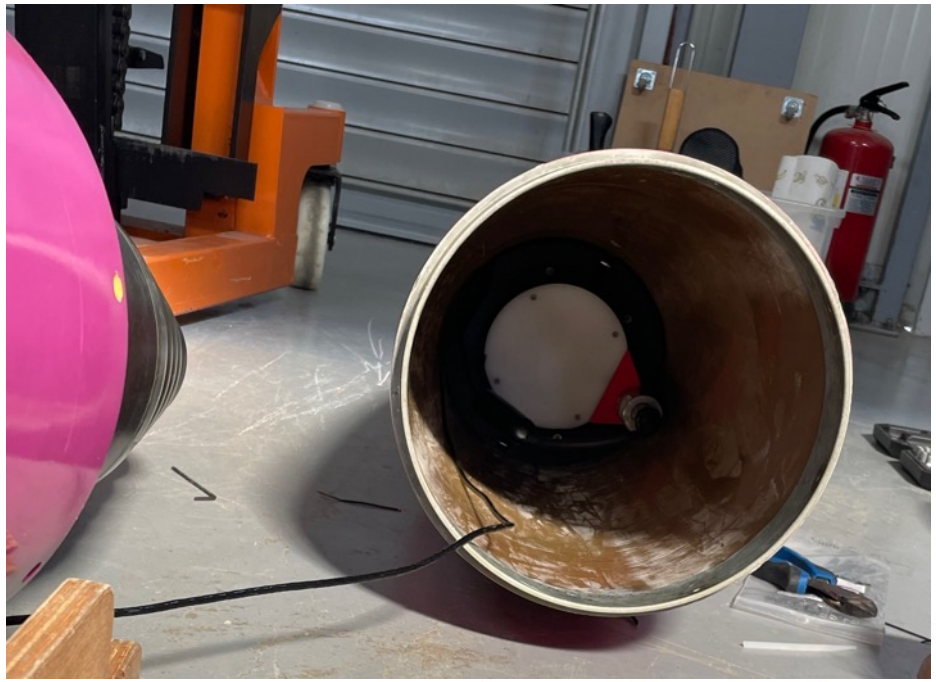
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000858 (TechOceanS). This output reflects only the author's view and the Research Executive Agency (REA) cannot be held responsible for any use that may be made of the information contained therein.

TechOceans
TECHNOLOGIES FOR OCEAN SENSING

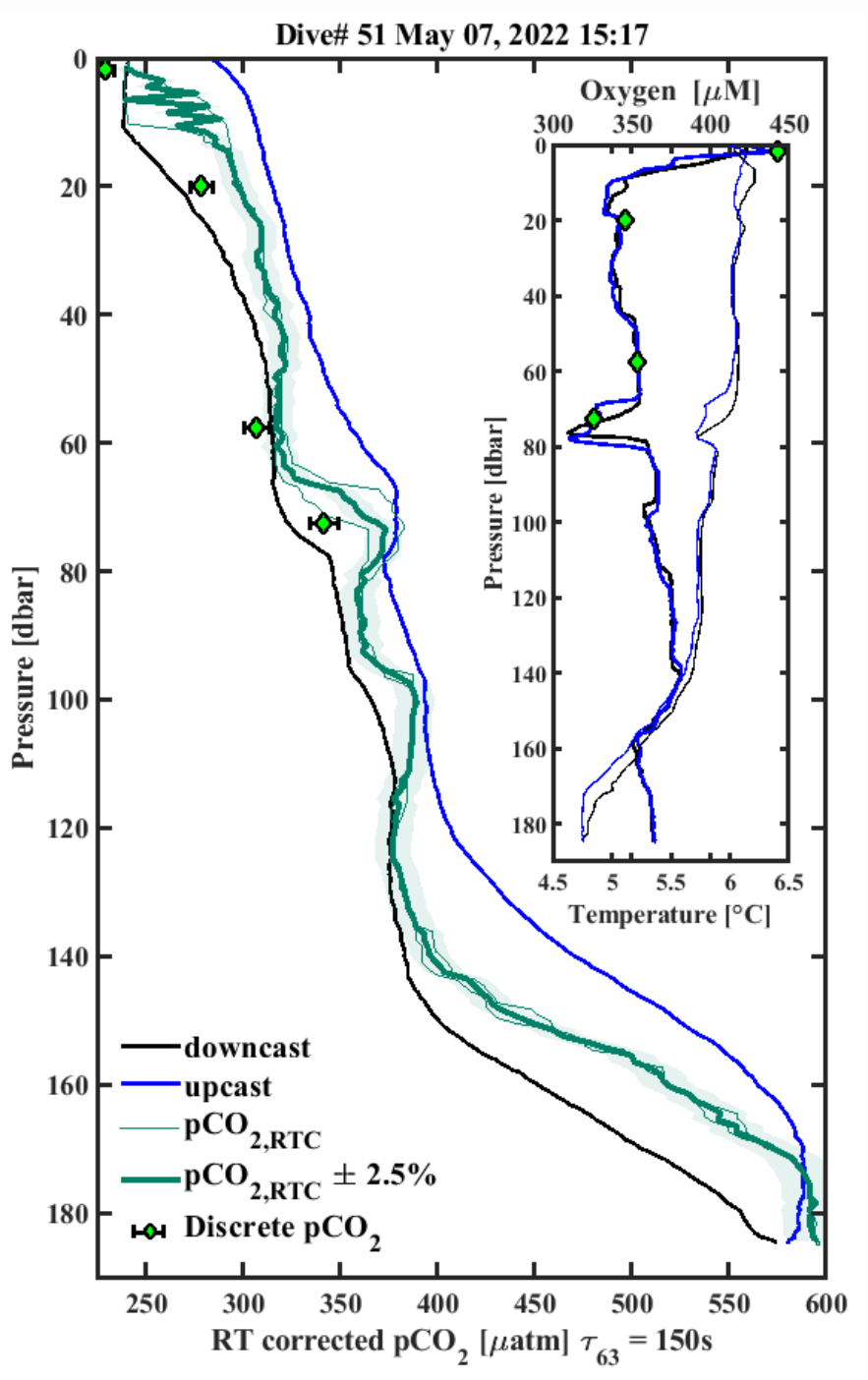
HYDROPTIC

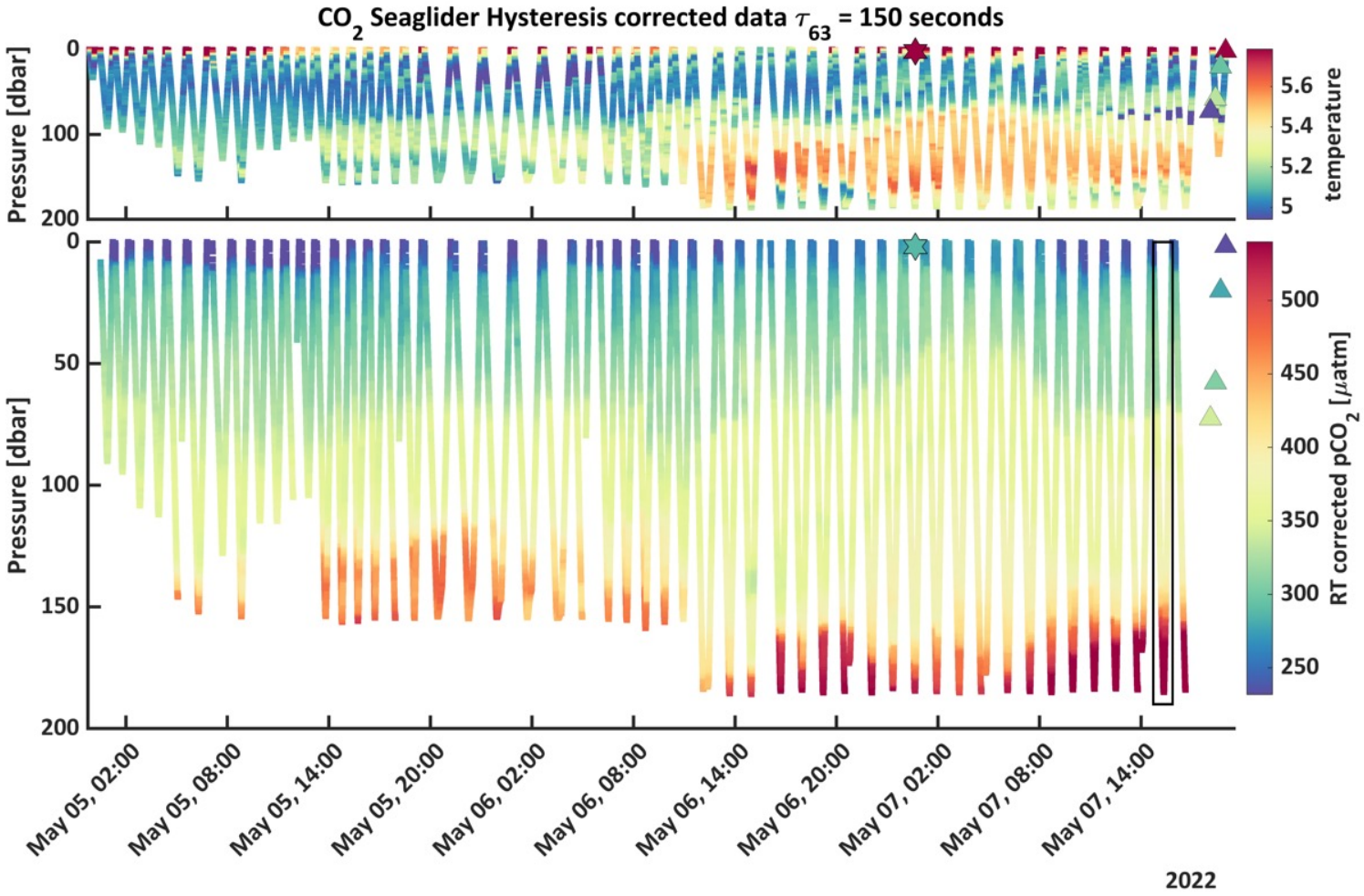
pCO2, pCH4

- Seaglider with SIRMA and HydroC
- Technical trials 11/21 (CY), scientific trials 4/22, 2/23, 5/23 (AL)
- First time a sensor of this size, weight, power installed at the nose of a glider
- Possibility of designing a complex mission with zeroing at the user-defined depth or dive segment
- Flexibility for real-time data setup as desired by scientists (averaging over depth, reducing the number parameters)



NSF IARC NOPP National Oceanographic Partnership Program JENA ENGINEERING UAF UNIVERSITY OF ALASKA FAIRBANKS CYPRUSUBSEA Consulting and Services C.S.C.S. Limited





CO_2 Seaglider enables autonomous collection of high quality pCO_2 trajectory data

Help increase understanding of the natural variability of CO_2 and regional manifestation of ocean acidification

https://doi.org/10.5194/egusphere-2024-1055
Expanding seawater carbon dioxide and methane measuring capabilities with a Seaglider

Conclusions

- Ocean gliders require significant effort to accept new sensors
  - Seaglider LogDev/Slocum Back Seat Driver help, but sometimes SIRMA™ was needed for control and function
  - Payload space limited: add to nose or create space by extending fairing (SG)

CYPRUSUBSEA
Consulting and Services C.S.C.S. Limited

Thank you!