

Bioglider : an integrated glider solution to improve environmental knowledge

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A H2020 ERA-NET Cofund MarTERA project

01/04/2021 – 31/12/2023

<https://bioglider.eu>

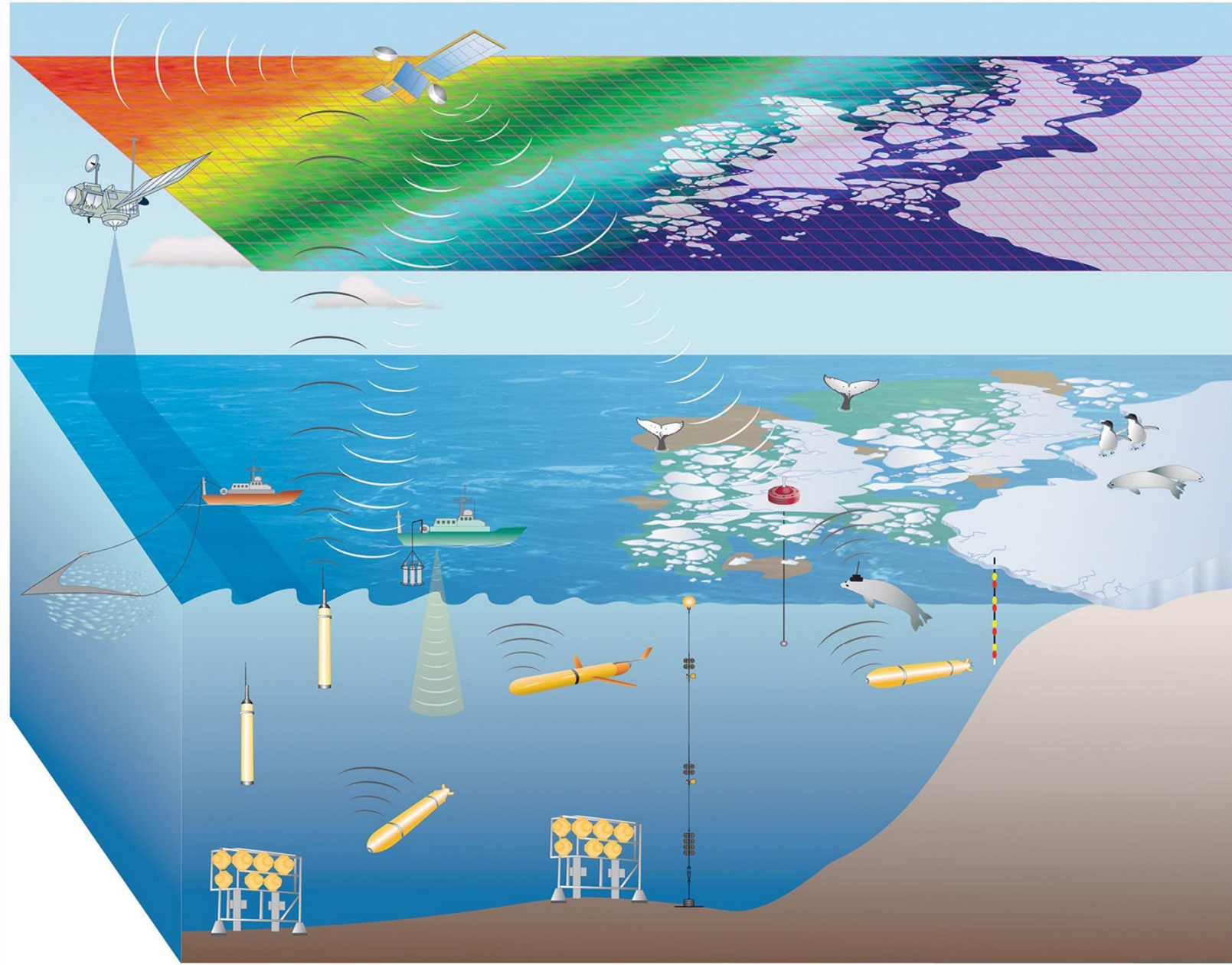
Why BIOGLIDER ?

Frontier Research in marine ecology, Ocean Observing Systems for GOOS, EOOS, MSFD, CFP, SDG14 (Conserve and sustainably use the oceans, seas and marine resources)

→ need for improved biological observations in the Seas & Oceans.

- Development of platforms and sensors to measure **biological parameters** and related EOVS
- The challenge of marine automated and **real time** biological observations

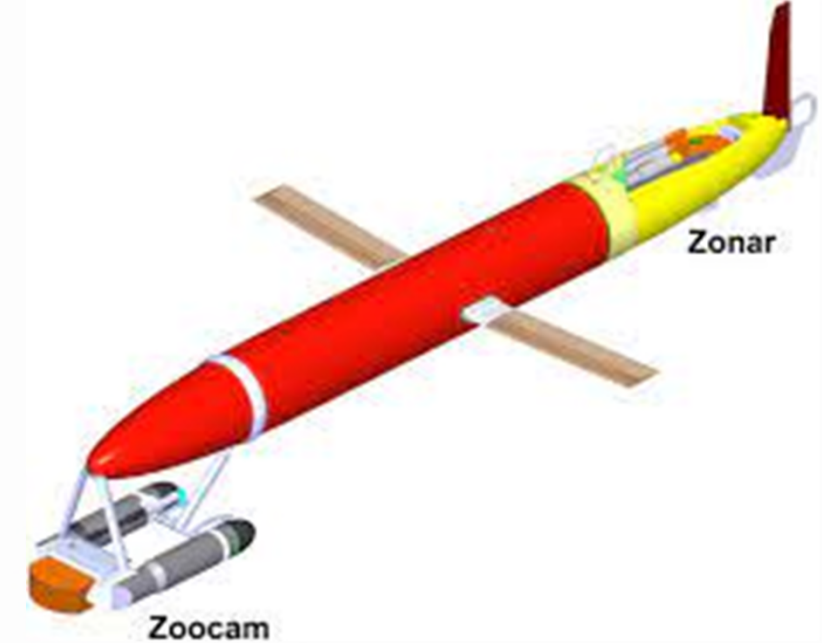
have been the subject of several white papers since OceanObs'09.



Newman et al. : Delivering Sustained, Coordinated, and Integrated Observations of the Southern Ocean for Global Impact . DOI=10.3389/fmars.2019.00433

Why BIOGLIDER ?

- The Scripps ZooGlider (Ohman et al. 2019)
 - “Pure” research instrument
 - No foreseeable commercialization
- The Scripps glider messenger (Send et al, 2013)
- Similar technological bricks available in Europe at high TRL
- As a legacy of the H2020 BRIDGES project

**BRIDGES**

Objectives

1. Develop a commercially available payload of UVP 6 & EK80
2. Available on 3 main glider models : Huntington Seaglider, Alseamar SeaExplorer, Teledyne Slocum
3. Provide scientific validation of the system



Huntington Seaglider



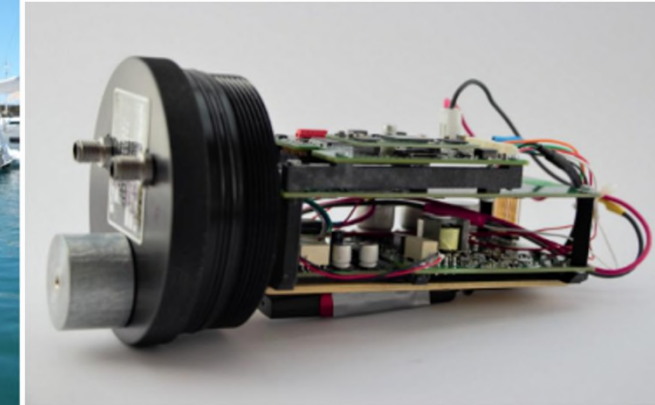
Alseamar SeaExplorer



Teledyne Slocum

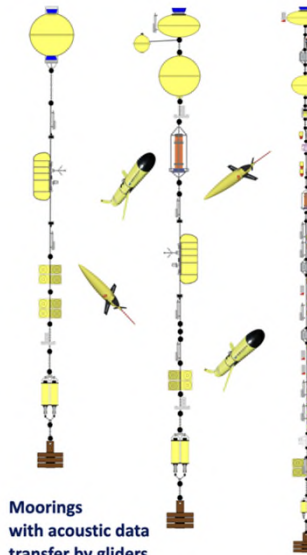


UVP6



WBT mini (EK80)

4. Capacity to retrieve data from moorings (data messenger or data mule) or to transmit data to a gateway



Moorings with acoustic data transfer by gliders

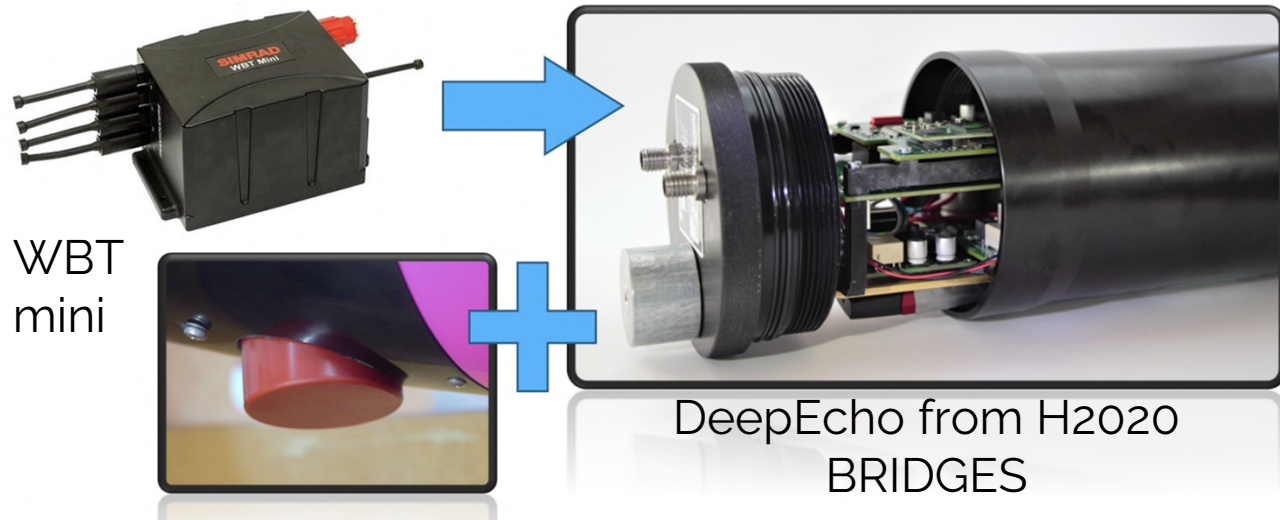
- For OOSs and Research : Akvaplan Niva, and Sorbonne Université as end users
- And for industrial applications :
 - Fisheries
 - Oil and Gas sectors

Who is in BIOGLIDER ?

ENSTA-Paris	FR	Academic	Coord. / UWA communications
HYDROPTIC	FR	SME (tech)	Tech. optic / TRL
Sorbonne Université	FR	Academic	Optic / Field ex.
Akvaplan Niva	NO	Research Priv. Non profit	Science optic & acoustic / Field ex.
Kongsberg Maritime	NO	LE	Tech. Acoustic / TRL
Institute of Marine Research	NO	Research	Science acoustic
Officina Baltica	PO	SME (spin off univ.)	Tech. Acoustic comm.
IOPAN	PO	Research	Science acoustic comm. / Field ex.
Cyprus Subsea Consulting and Services	CY	<i>SME (tech+service)</i>	<i>Tech. Integration / Data managment</i>

External support from ConocoPhillips Norway

EK80 - Echosounder integration

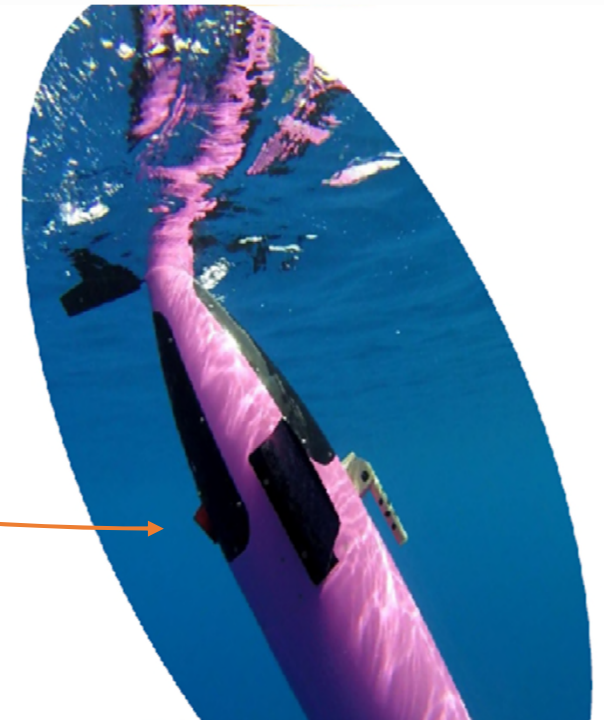
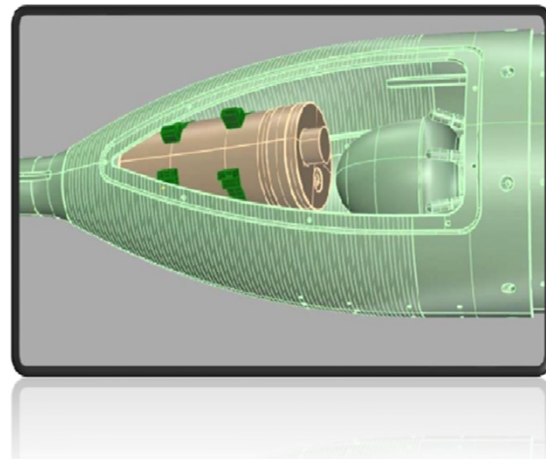


- **Kongsberg Seaglider**

- Autonomous mode (no RT)
- Real life test in May 2022 & October 2022
- Testing of an improved version in Aug. 2023,

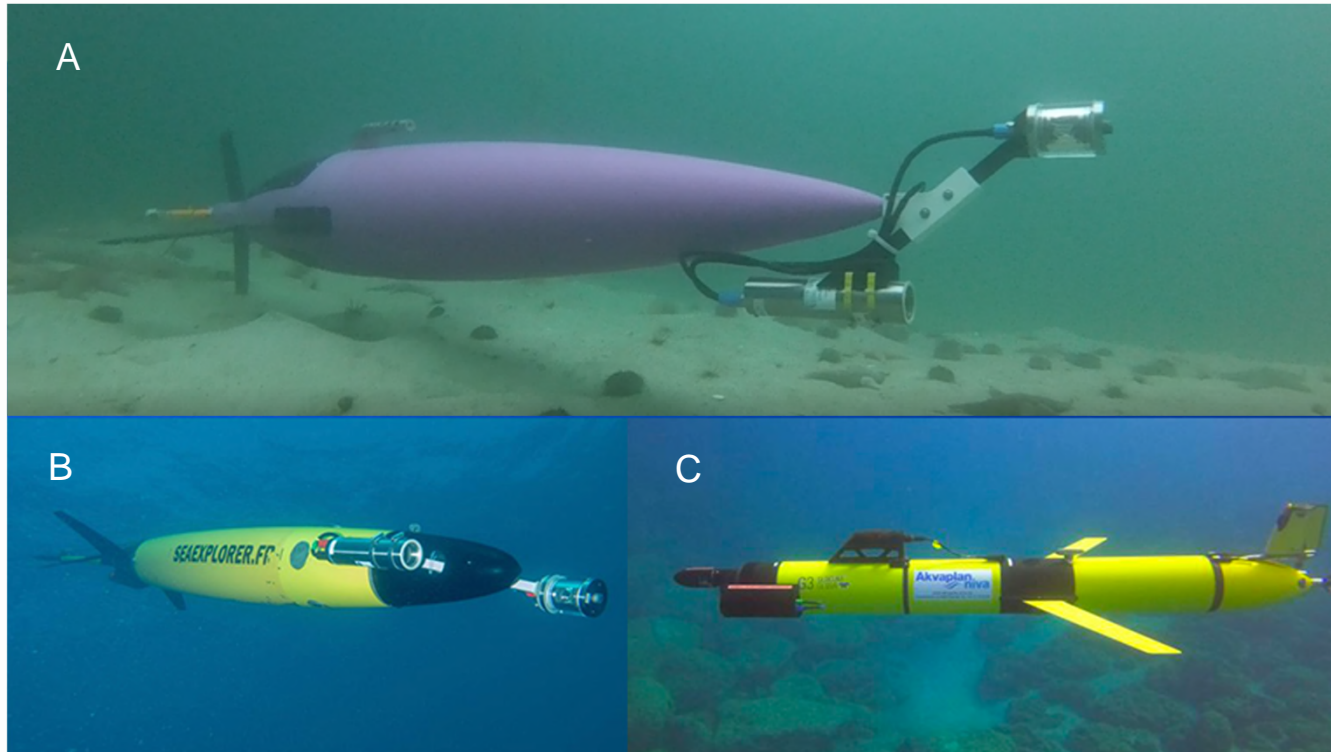
- **Teledyne Slocum**

- EK80 Integration
- in progress on
- the G2 version



2 PhD (IMR, AKN, Norway)
1 Post-doc (UiT, Norway)

UVP6 - Imaging device integration



A) Seaglider

First tests in May 2021
Scientific deployment in May 2022/Oct. 22 & Aug, 23,

B) SeaExplorer

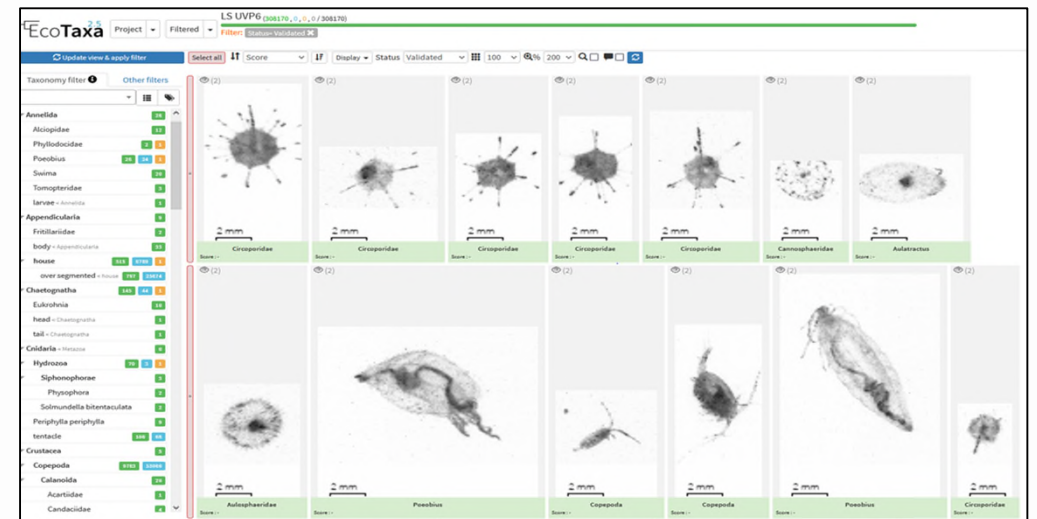
Already integrated after
H2020 BRIDGES

C) Slocum

First tests in January 2023 on the G3 version
Work in progress on the G2.

Already more than glider 6000 profiles

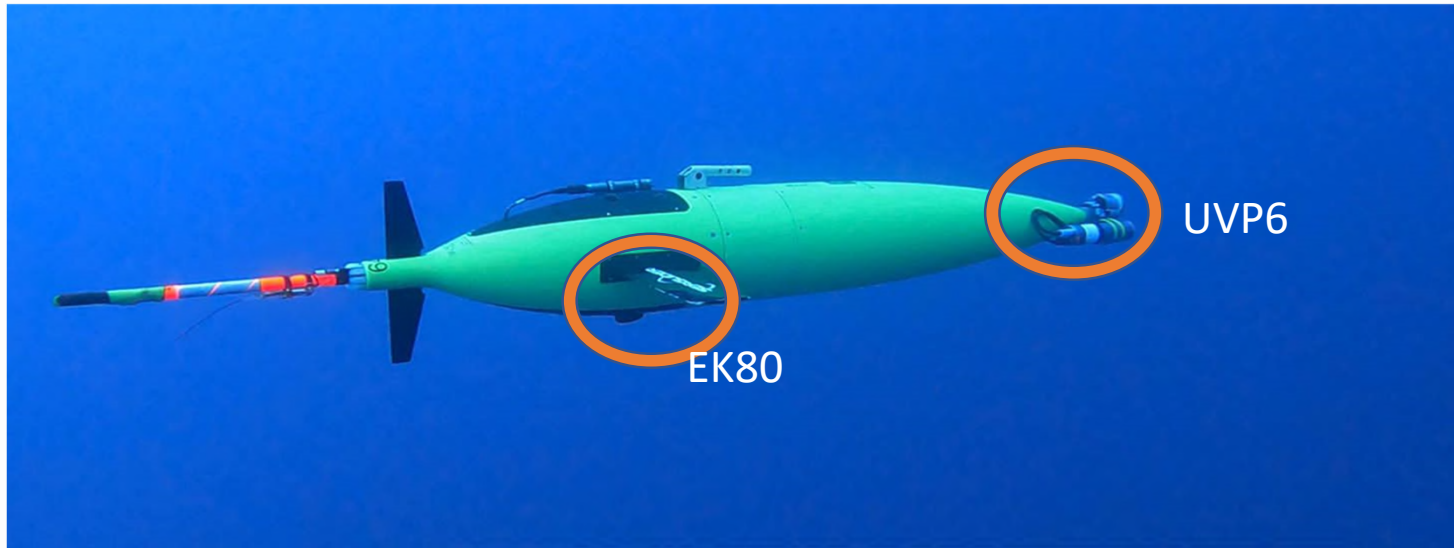
UVPapp improvement (merging, metadata, piloting...)
Matlab tool coding for data preparation for [EcoPart](#)
and [Ecotaxa](#) (Blue cloud)



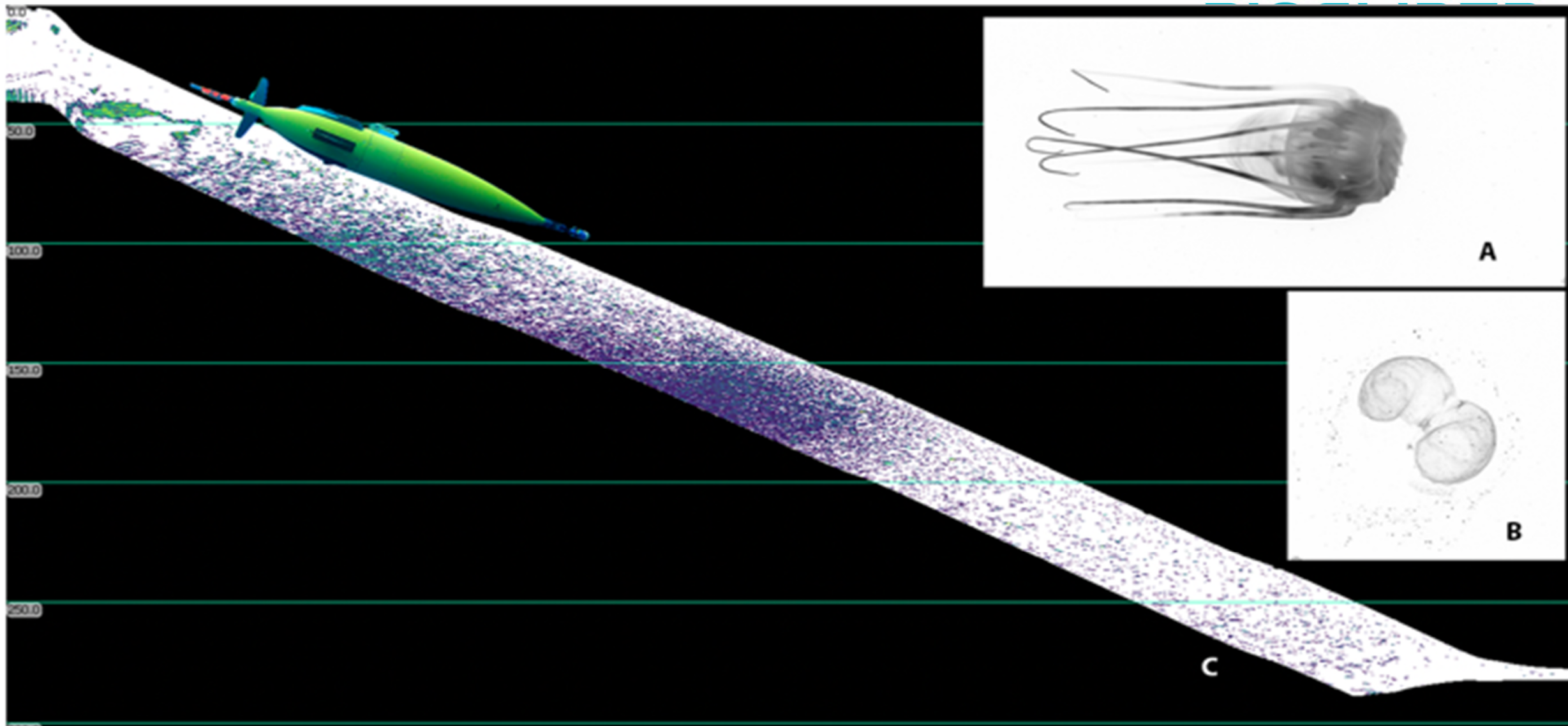
Learning set creation for the automatic classification
of UVP6 images : 650 000 images sorted

Acoustic and Imaging devices integration

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



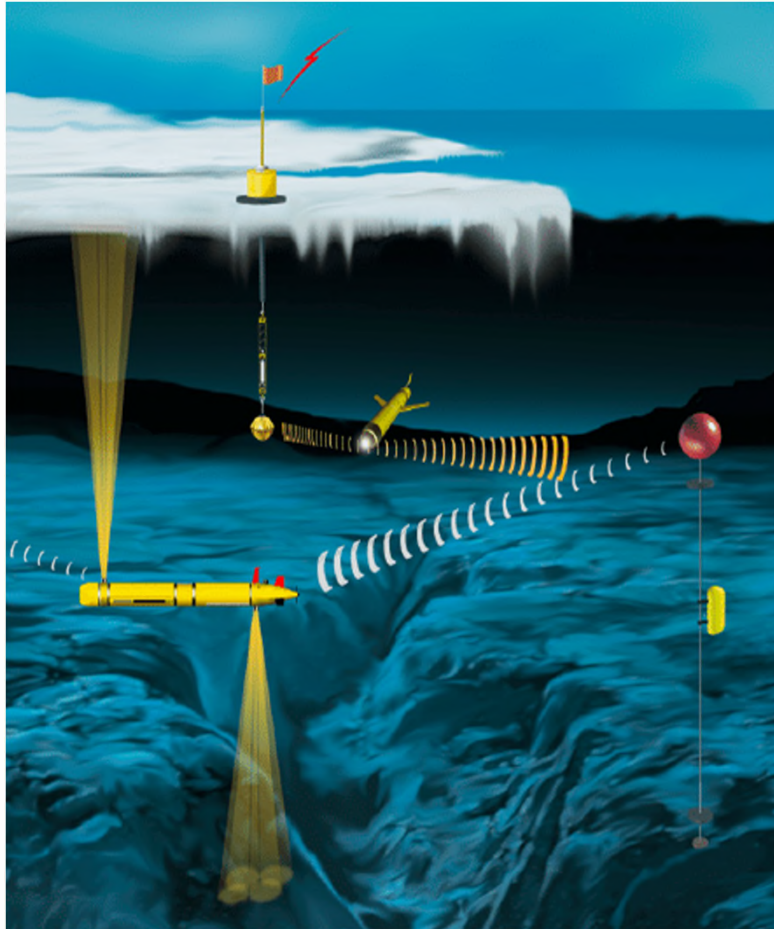
First tests of the full Bioglider solution on Seaglider



An all-in-one platform !

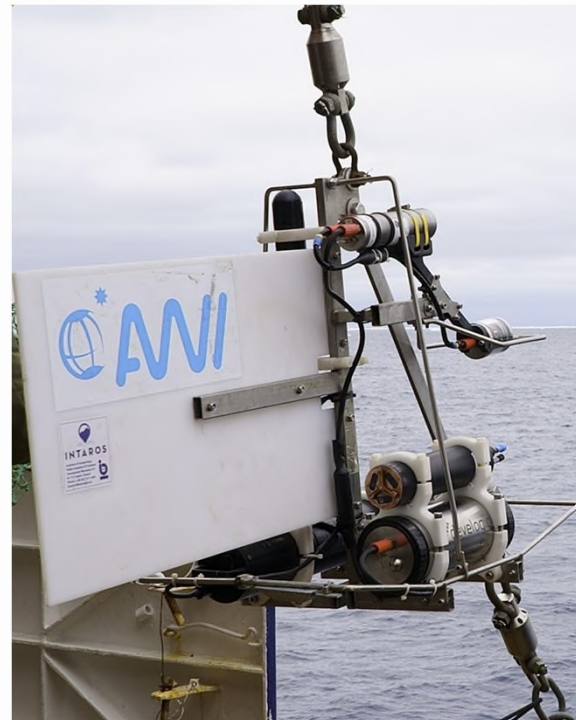
For moderate costs, possibility to launch a non intrusive platform with Physical and Biological sensors on the 0-1000m layer at high spatiotemporal scale!

Why a messenger?



From Freitag, 2013

- Importance of Zooplankton ecology in polar environments including under the ice,
- Difficult to access and retrieve data from moorings with no surface expression (Send et al., 2013)
- Or difficult for the glider to send or receive when navigating under the ice

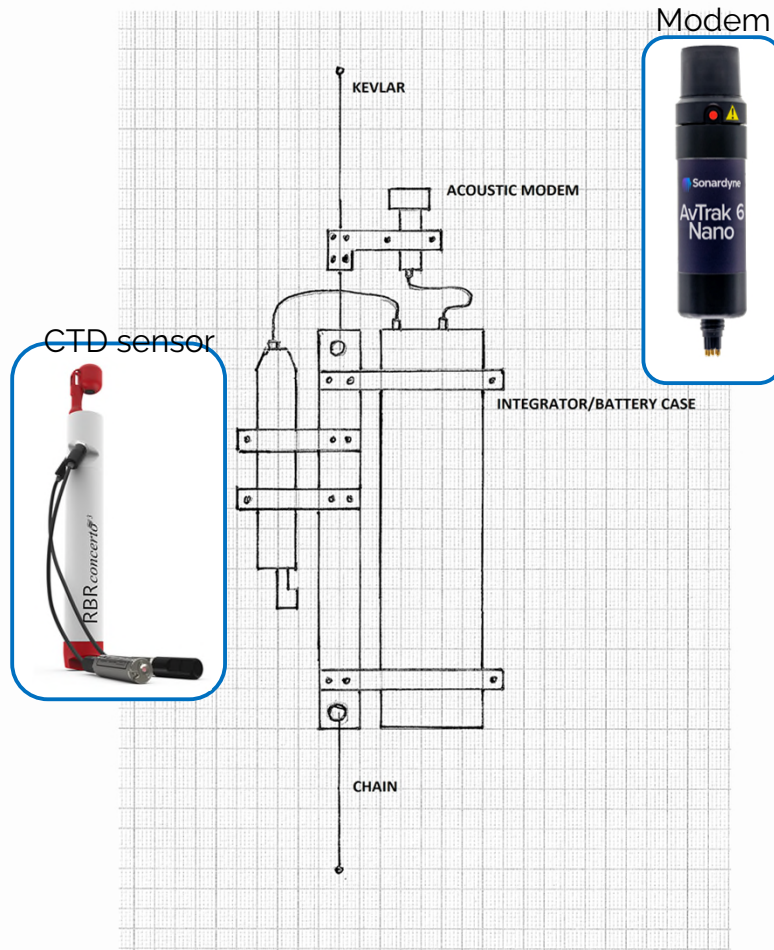


⇒ Preliminary steps for under ice communication in Bioglider :

- Complex sound channels in the Arctic and glider navigation optimization around a fixed point (mooring)
- Test with commercial modems
- Improve transmission rate with modern MIMO transmission algorithms

AWI mooring equipped with an UVP6 moored North of Svalbard

Data telemetry from subsurface moorings



Integrator (on mooring)

- one year of operation with utilizing AC modem low power listening mode
- easy integration of versatile range of sensors (CTDs, ADCPs, etc.)

Data receiver (on glider)

- autonomous Integrator wake-up and data reception
- stand alone mode and/or integration with glider platform operation

Software

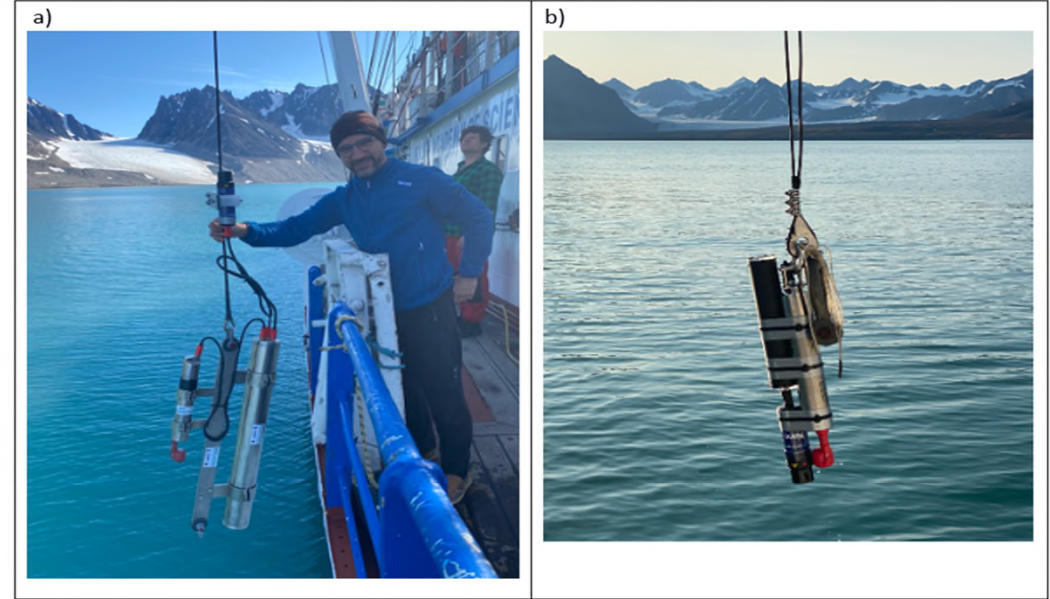
- developed BGP – Bioglider Protocol
- protocol is data agnostic

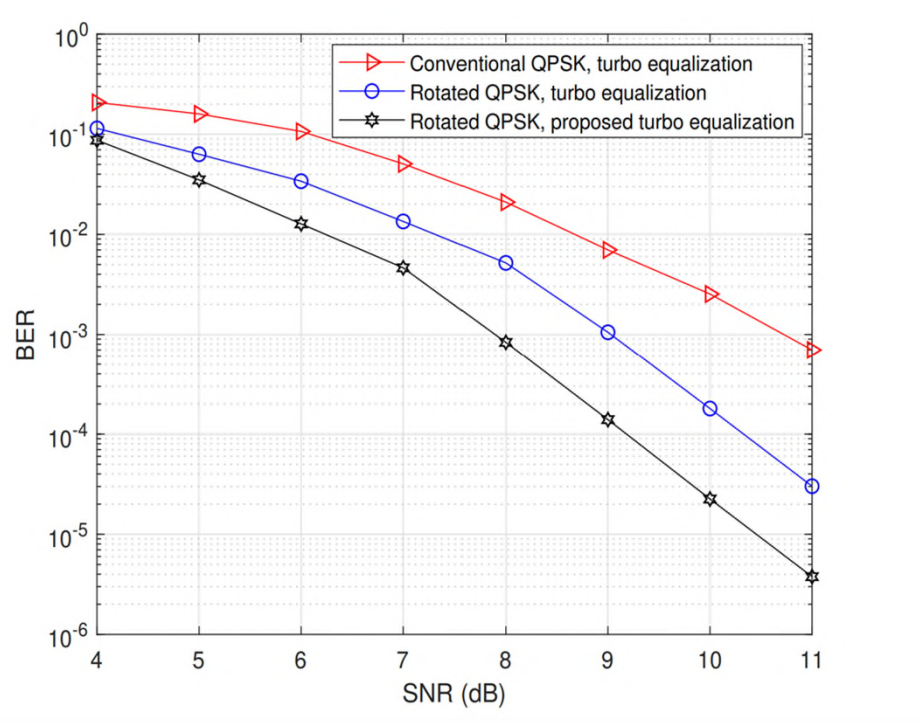
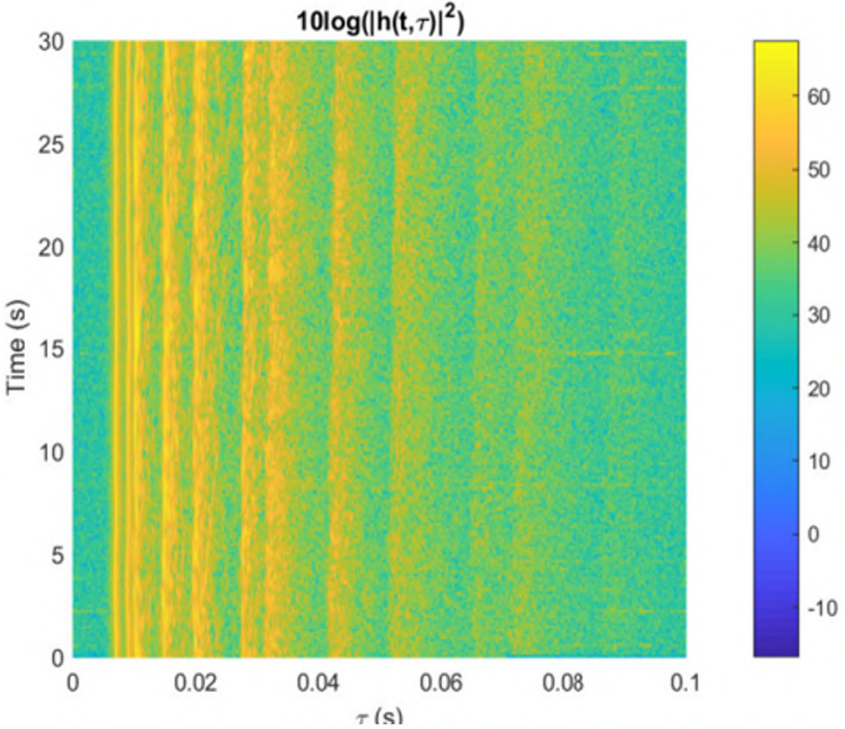
Field work

- First trials spring 2023
- First field tests with glider and mooring summer 2023

Solution part for a subsurface mooring

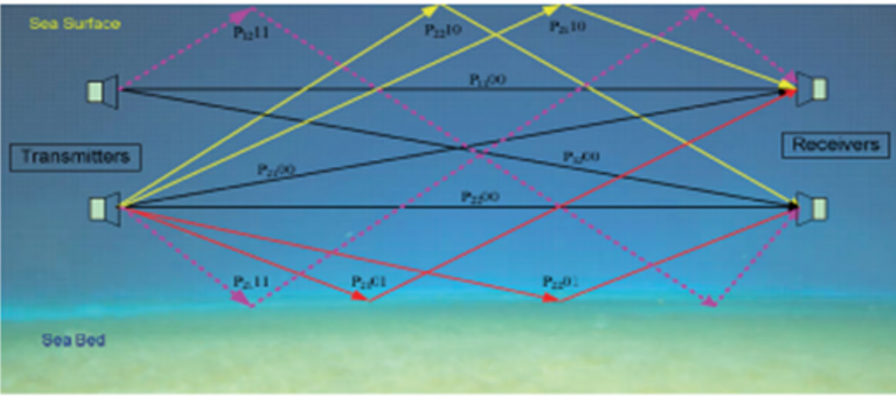
Field tests summer 2023





Faster-than-Nyquist MIMO

1 PhD student (2023/2026)



After Bioglider :

- SBEP proposal by NO to assess the impact of Calanus Finmarchicus harvesting submitted
- GLASMAR “GLiders et Acoustique Sous-marine, Messagers pour l’ARctique” Proposal to the French Defense Agency (subm. 10/2023)
- Deployment of the Sorbonne Université Slocum G2 Bioglider in the MOOSE Observatory (NW Mediterranean) scheduled in 2024



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MARINE ECOSYSTEMS MONITORING

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