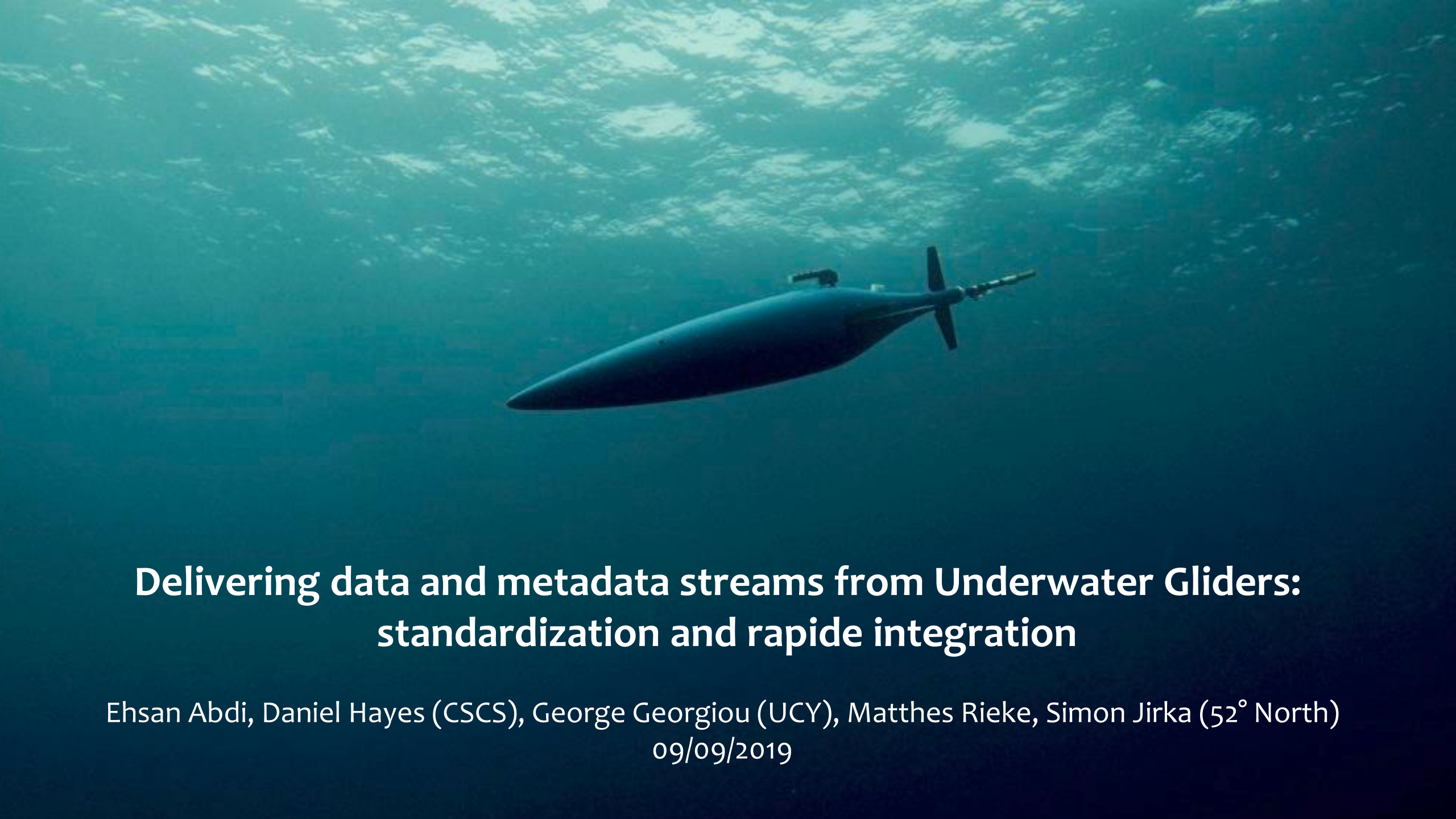


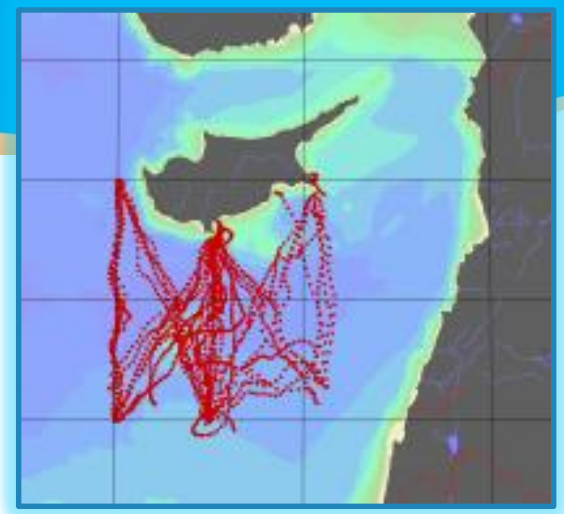
Delivering data and metadata streams from Underwater Gliders: standardization and rapide integration

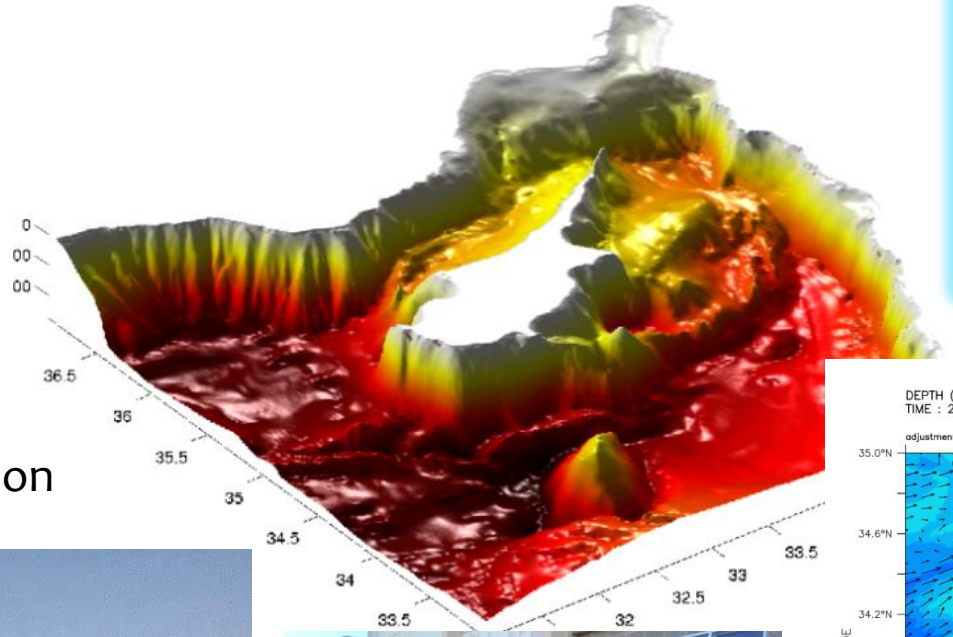
Ehsan Abdi, Daniel Hayes (CSCS), George Georgiou (UCY), Matthes Rieke, Simon Jirka (52° North)

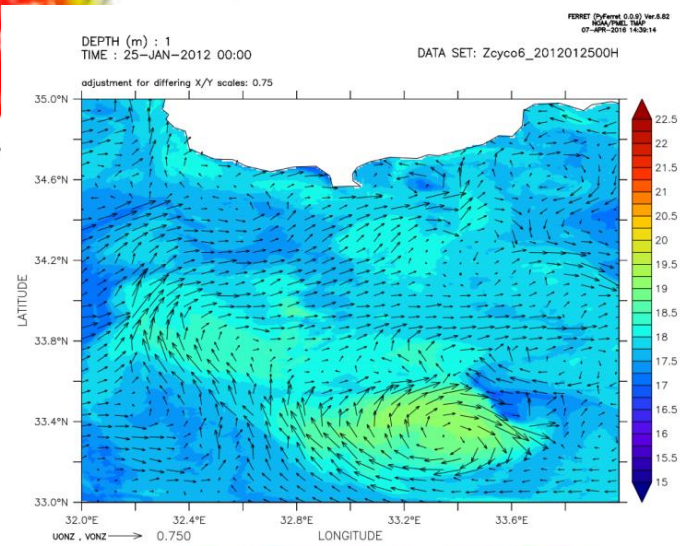
09/09/2019

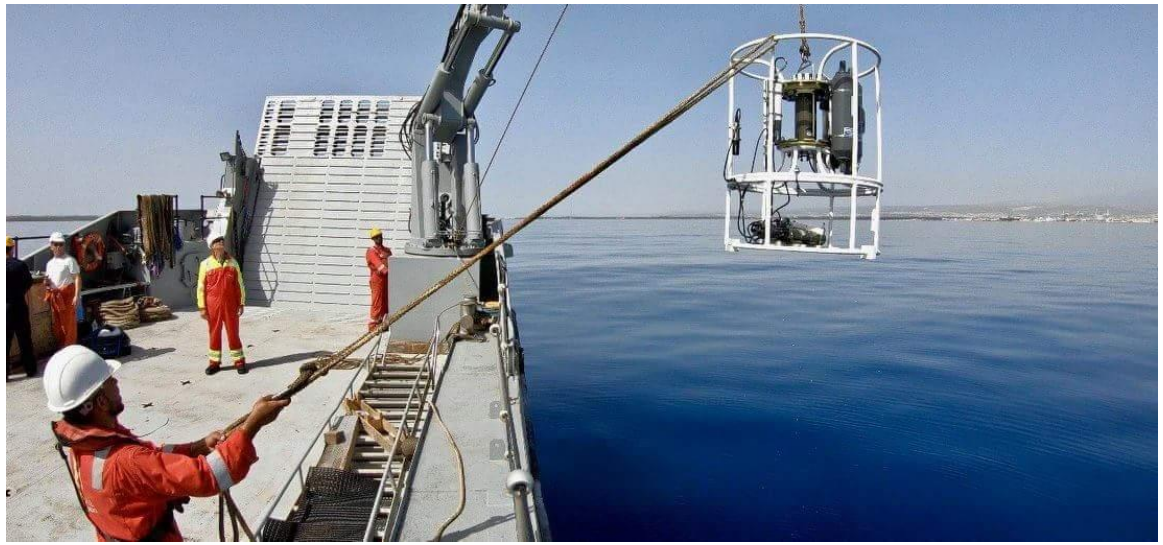
Quick Profile

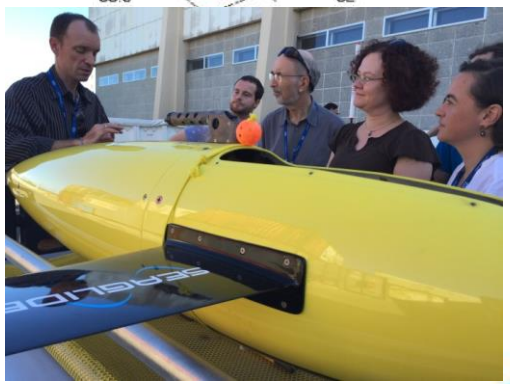
- Physical Oceanography
- Glider operation and analysis
- Training and demonstration
- Glider refurbishment (also on-site)
- Mission planning and sensor integration











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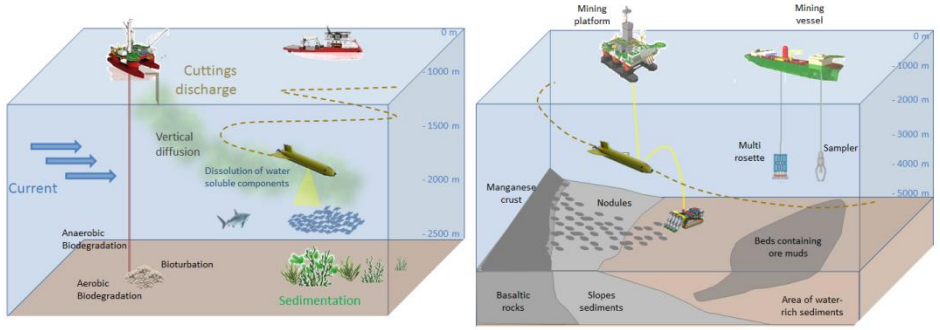
BRIDGES

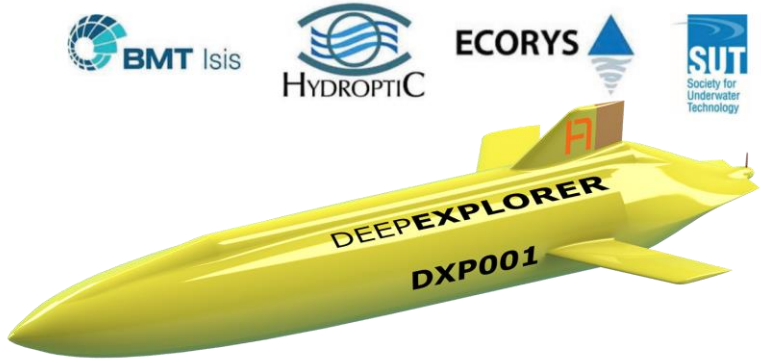
Bringing together Research and Industry for the Development of Glider Environmental Services

19 project partners from 9 countries, including 6 European SMEs
4 year project (2015–2019)
Coordinated by Laurent Mortier of ARMINES, France

Development and at-sea qualification of two deep-sea autonomous gliders (to 5000m depth)
Multi-mission vehicles providing services for:

- Fundamental research
- Long-term environmental monitoring (Copernicus, MSFD)
- Offshore industry (Oil and Gas, Sea Mining)





Synergy between environmental protection, monitoring and offshore industries
Long-term and cost-effective exploration and monitoring in extreme environmental condition

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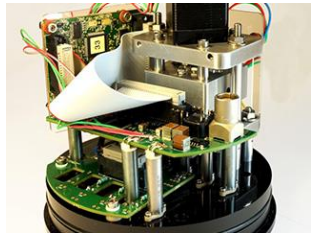
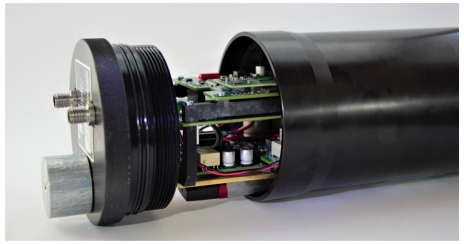
BRINGING TOGETHER RESEARCH AND INDUSTRY FOR THE DEVELOPMENT OF GLIDER ENVIRONMENTAL SERVICES

BRIDGES



Lab on a Chip

- Nitrate
- Phosphate
- Silicate
- Ammonia



Scientific Broadband Echo-sounder

UVP6 Camera

Water Sampler

Passive Acoustics

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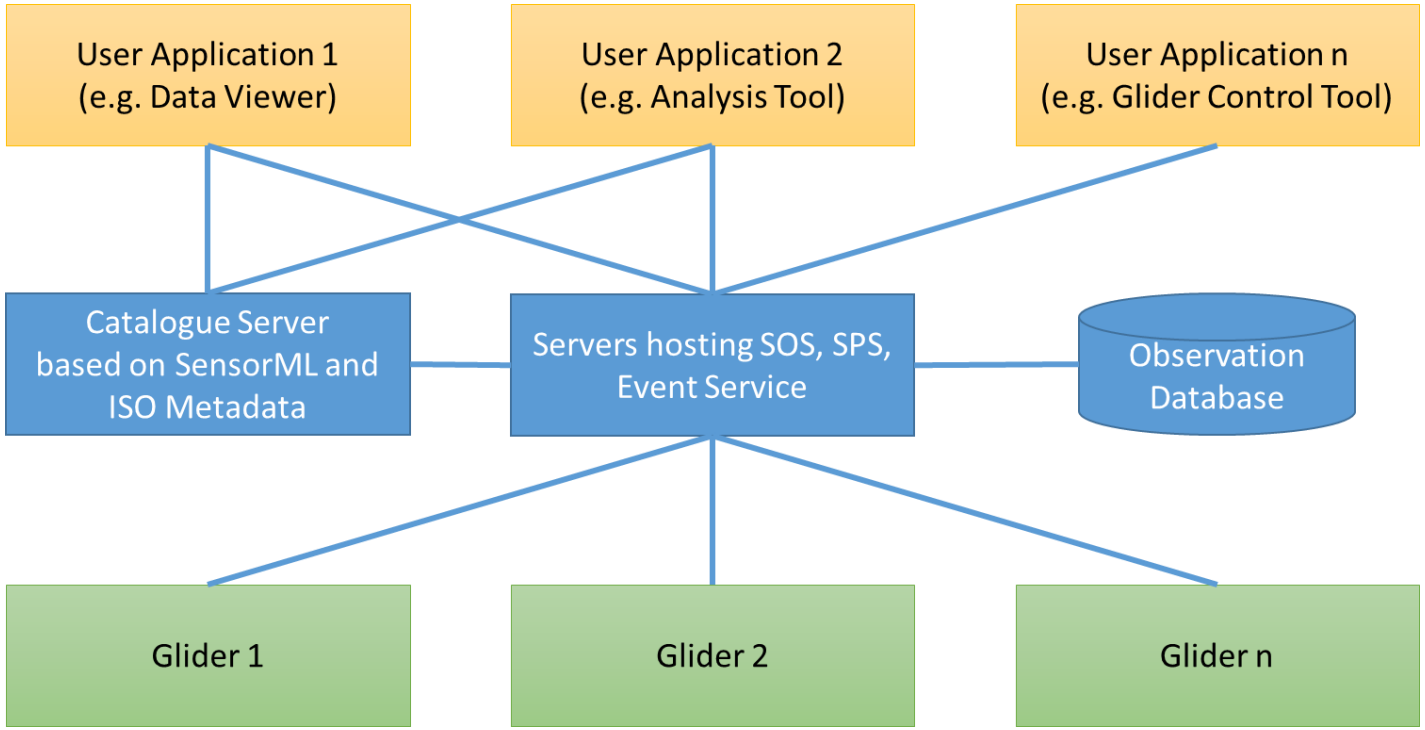
Data Interoperability

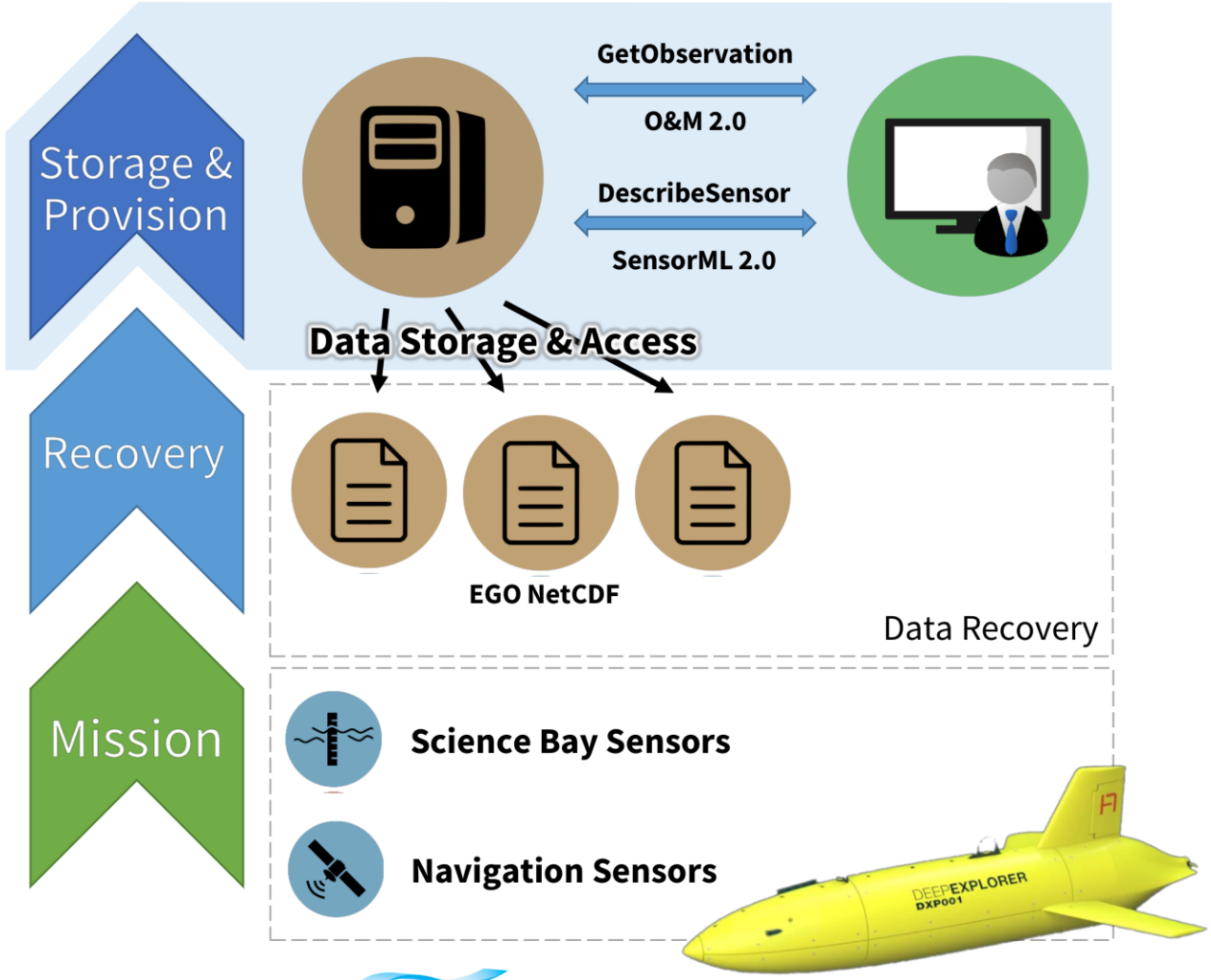
- Sensor Web enables the **interoperable access**
  - Specific filtering possible
- Catalogues that interact with SOS instance allow the **discovery of data** of interest
- Vocabularies increase the **Semantic Interoperability and interpretation**

Implementation:

1. Middle layer (blue) = proposed Sensor Web architecture
2. User applications interact with these, on any standards conforming system



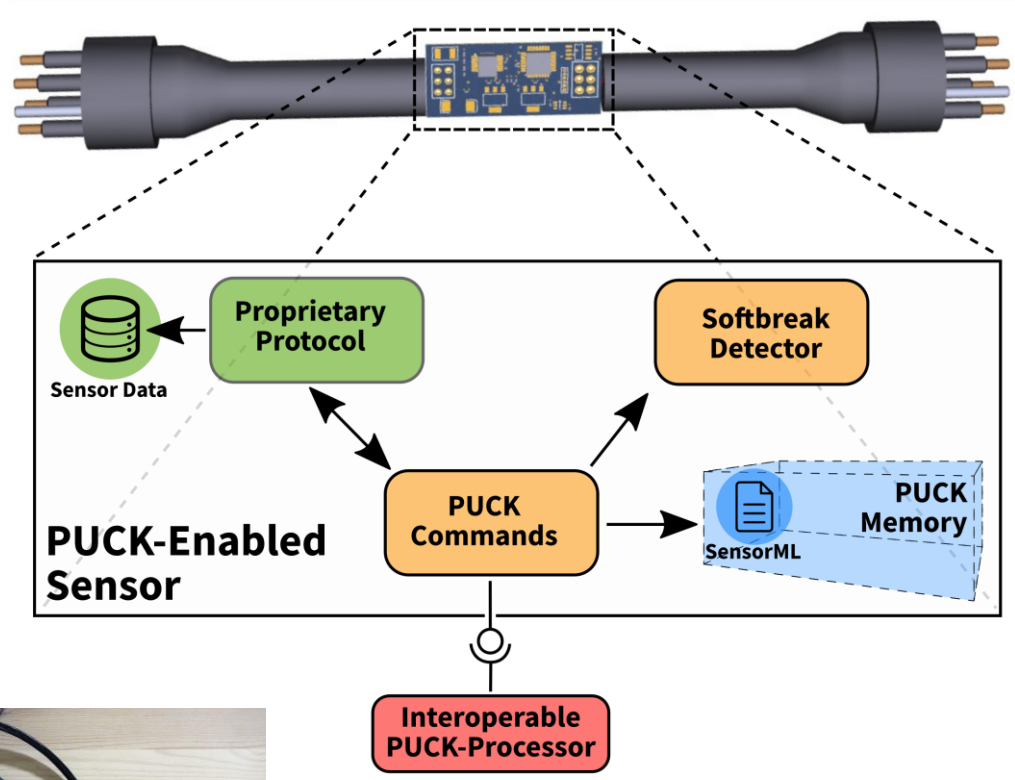
Interporeable Discovery and Access



- Based on the existing data acquisition and recovery mechanisms
- EGO NetCDF files are ingested into SOS
- → SOS methods can be used to retrieve data
  - Filtering on specific parameters (e.g. the Feature)
  - NetCDF is referenced (via downloadable location) → allows the **re-use of existing processing solutions**

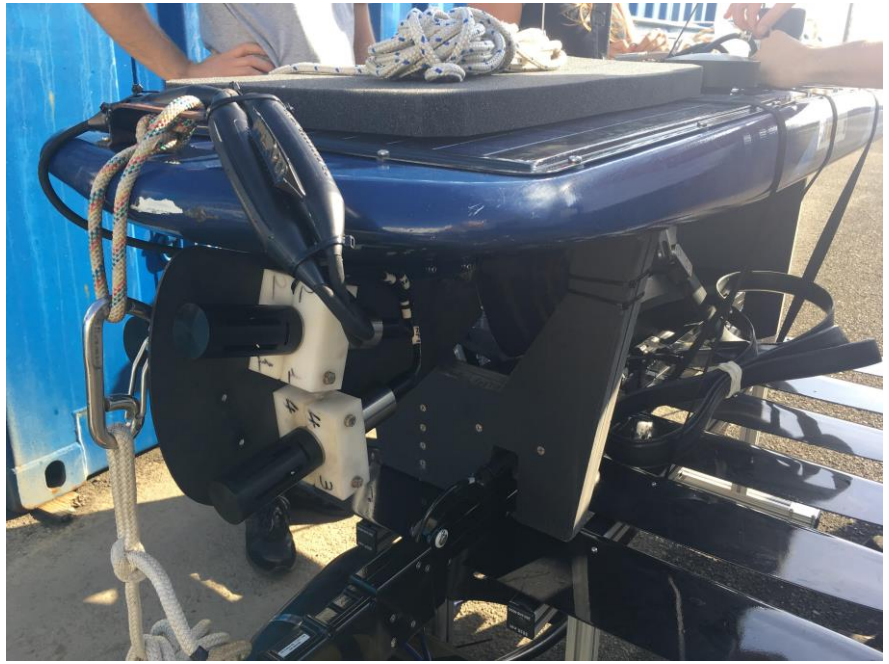
SMART Cable

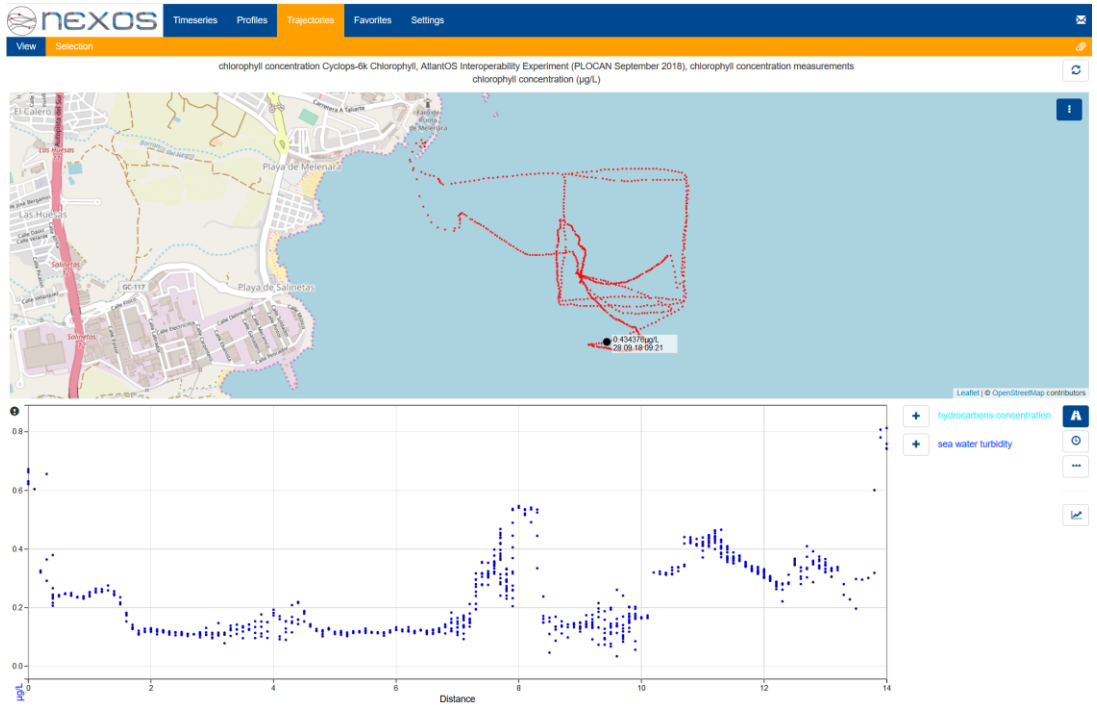
- Extremely low power (20mW when active)
- Pressure tolerant (down to 6000m)
- Consists of voltage regulators, a Microcontroller, memory unit, ADC, etc.
- Implements the lower layer of SWE (PUCK protocol)



INTEROPERABILTY EXPERIMENT

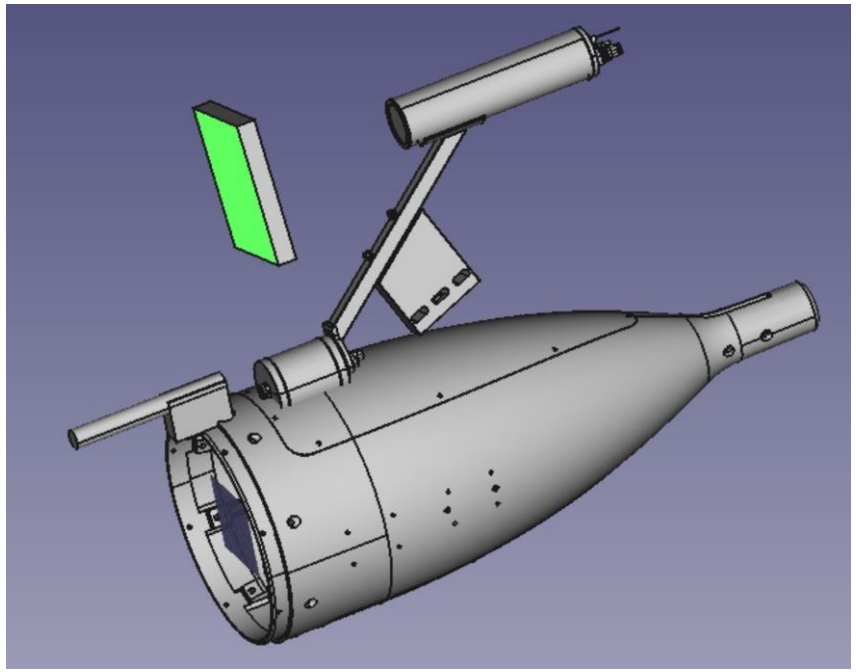
- Joint experiment with AtlantOS in PLOCAN
- Smart Cables were used to integrate three BRIDGES optical sensors on a Waveglider in a plug-and-work fashion





New Sensor Integrations

- UVP6 Camera
  - Frame needs undisturbed flow
  - Integrated on the back hatch of a Seaglider
  - A Smart Cable was used to translate messages and take average of every 10 measurement
  - Near-real-time capability integrated



*This experiment was jointly carried out with UCY

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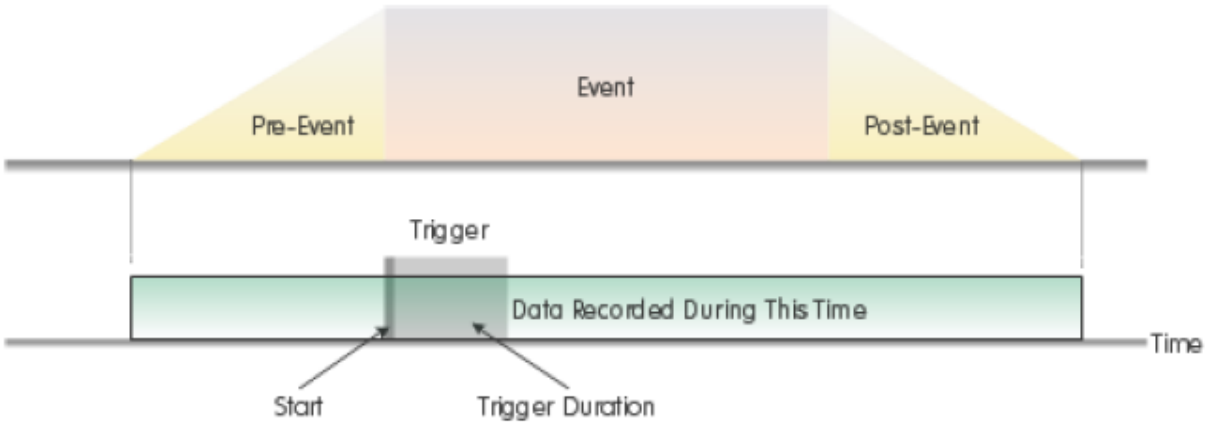
New Sensor Integrations

- icListen HF Hydrophone
  - Near-real-time event detection capability
  - Ethernet to RS-232 interface integrated inside glider hull
  - Analyzes and transmit acoustic spectra



Epoch Settings

Serial #: 1722

Apply | Clear All Triggers | Undo Changes

Enable		Trigger					Record			
		Frequency (Hz)		Test	Threshold (dB µPa)	Duration (Wave: up to 63 s) (Spectrum: up to 65 s)	Pre Event	Post Event (s)	Wave	Spectrum
		Min	Max							
1	☑	500	1500	>	90	1	2	2	☑	☑
2	☑	3000	4000	>	70	1	2	2	☐	☐
3	☑	2000	3000	>	80	1	2	2	☐	☐
4	☐			>					☐	☐
5	☐			>					☐	☐

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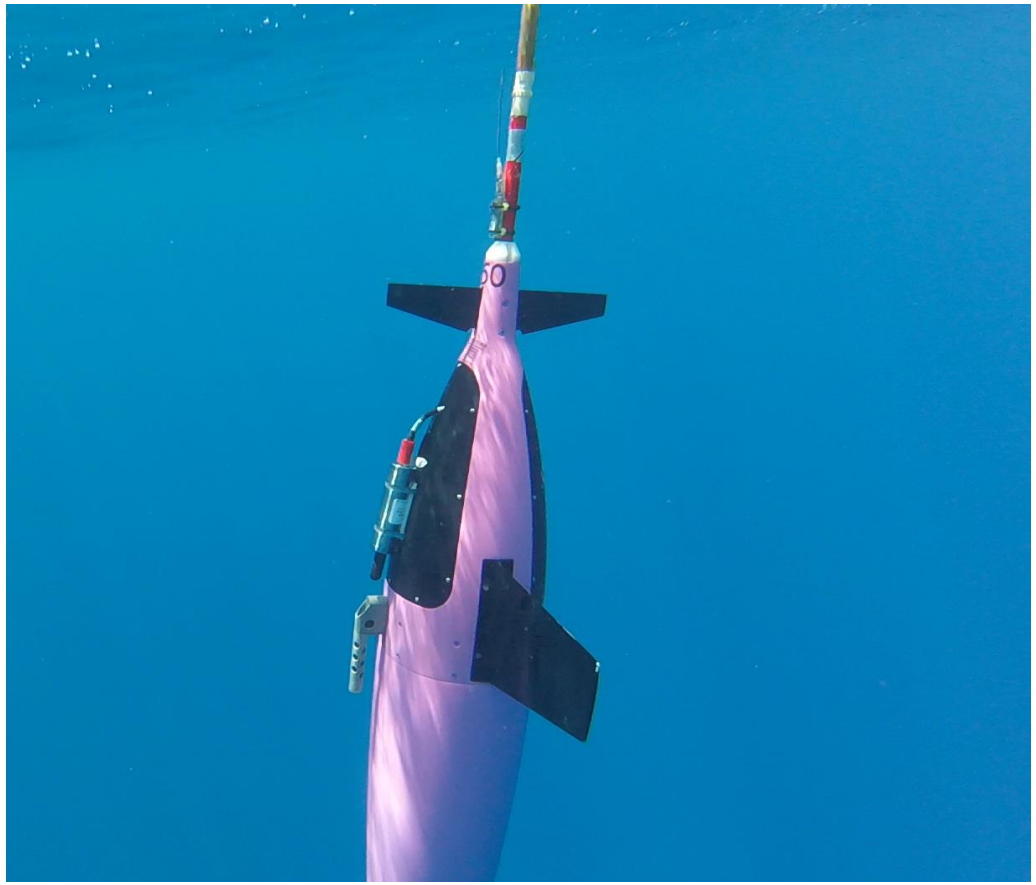

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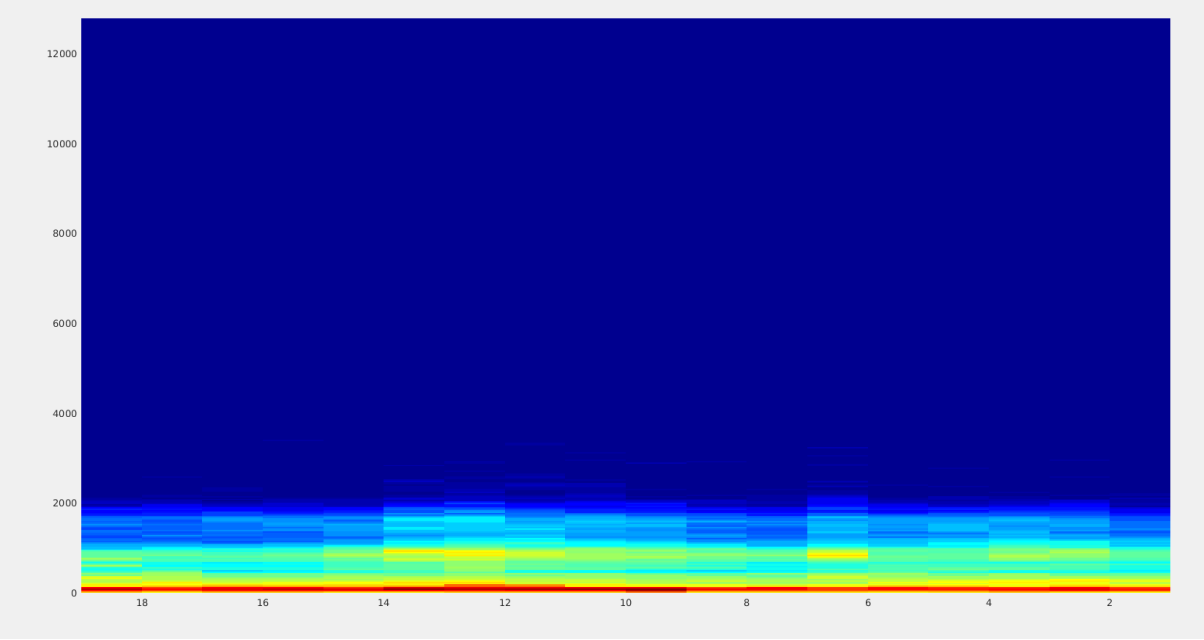
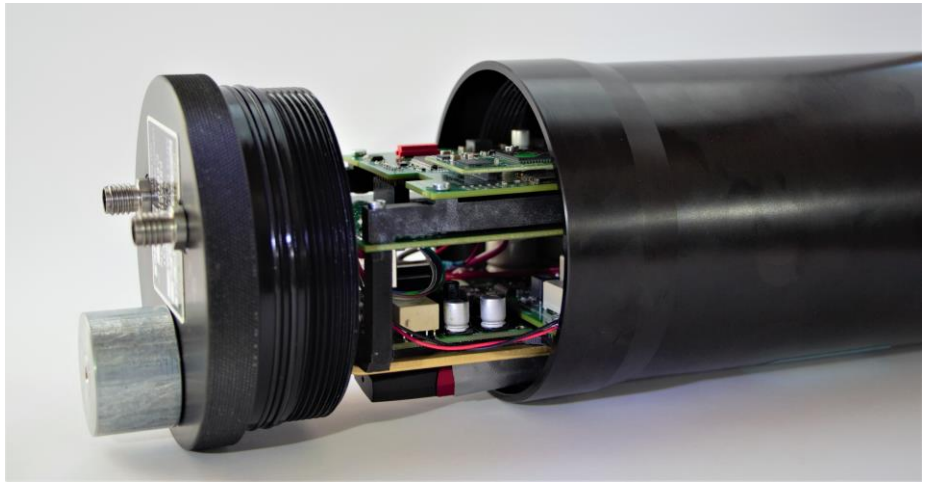



```
$HUMID,50.78
$INTERNAL_PRESSURE,13.3388
$TCM_TEMP,25.00
$XPDR_PINGS,0
$HP_EVENTS,epoch_stat:3,4,0,0,0
$24V_AH,22.98,63.856
$10V_AH,10.02,46.898
$FG_AHR_24Vo,0.000
$FG_AHR_10Vo,0.000
```

```
File Details:
File Type   Spectrum
File Version    5
Start Date  2019-08-09
Start Time  07:12:43
Time Zone   UTC
Author  icListen HF #1722
Starting Sample 12107776

Device Details:
Device  icListen HF
Model   SB35-ETH-12V
S/N 1722
FW Release  36.1
Firmware    v2.2.08
HW Release  6

Setup:
dB Ref re 1V    -120
dB Ref re 1uPa  48
Sample Rate [S/s]   32000
FFT Size    1024
Bin Width [Hz]  31.25
Window Function Hann
Overlap [%] 50.000000
Power Calculation   Mean
Accumulations   32

Data:
Time    Comment Temperature [C] Humidity [%]    Sequence #  Data Points 0   31.25   62.5    93.75   125 156.25
07:12:43        22.1    25.3    739 410 7   8   12  15  17  19  18  16  14  15  21  21  14  12  9   15  16  12
07:12:43        22.1    25.3    740 410 15  13  12  13  15  18  18  15  15  14  20  21  14  9   9   13  17  13
07:12:44        22.1    25.3    741 410 14  22  27  30  31  30  26  24  22  23  27  26  21  21  19  27  30  23
07:12:44        22.1    25.3    742 410 11  18  21  23  24  23  20  17  19  18  22  22  20  19  18  19  17  13
07:12:45        22.1    25.3    743 410 35  37  44  50  53  58  58  56  57  63  66  63  64  64  61  63  59  59
07:12:45        22.1    25.3    744 410 12  26  34  40  48  53  51  44  42  47  50  46  47  52  51  51  46  44
07:12:46        22.1    25.3    745 410 19  26  31  35  38  41  41  41  40  42  41  43  46  42  43  41  40  40
07:12:46        22.1    25.3    746 410 30  39  44  47  52  56  55  53  54  56  60  59  56  56  54  53  53  52
07:12:47        22.1    25.3    747 410 10  13  21  27  32  37  37  33  31  30  31  30  26  28  27  22  22  21
07:12:47        22.1    25.3    748 410 9   17  27  33  38  41  38  35  37  39  38  37  33  32  32  32  32  30
07:12:48        22.1    25.3    749 410 41  46  48  50  56  57  56  56  55  55  55  53  51  51  49  48  50  48
07:12:49        22.1    25.3    750 410 33  38  43  46  54  57  55  52  51  51  49  47  47  47  46  45  46  46
07:12:49        22.1    25.3    751 410 18  20  25  27  25  25  24  23  25  24  21  19  20  20  16  19  18  12
07:12:50        22.1    25.3    752 410 24  28  35  41  49  53  54  53  50  46  44  45  46  45  45  43  41  39
07:12:50        22.1    25.3    752 410 24  28  35  41  49  53  54  53  50  46  44  45  46  45  45  43  41  39
```

New Sensor Integrations

- Echosounder
  - Simrad EK80 WBAT mini
  - First scientific wide-band echo-sounder integrated on a glider
  - Modified electronics boards to fit a pressure housing



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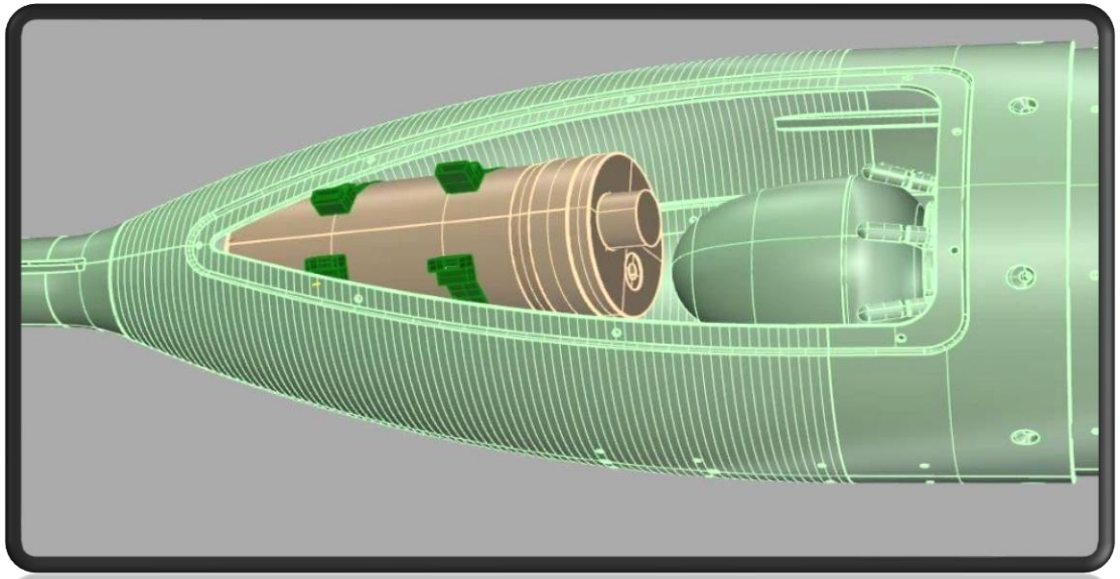

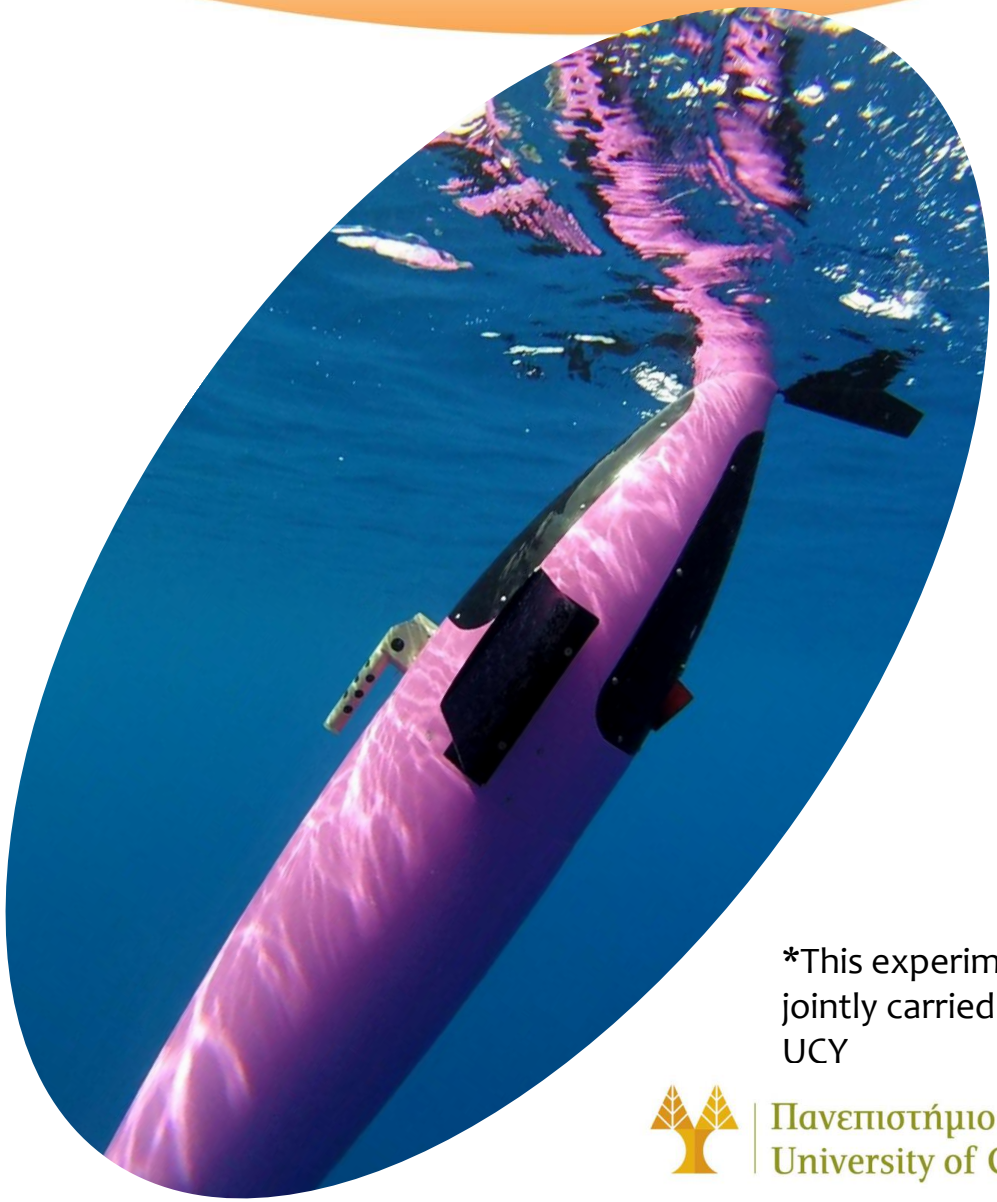

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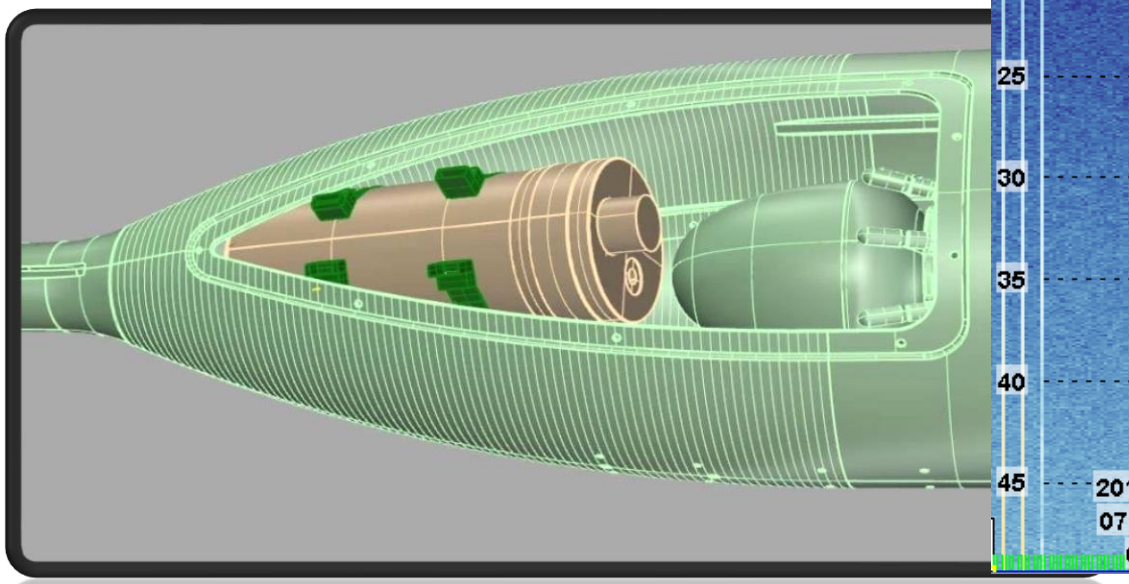
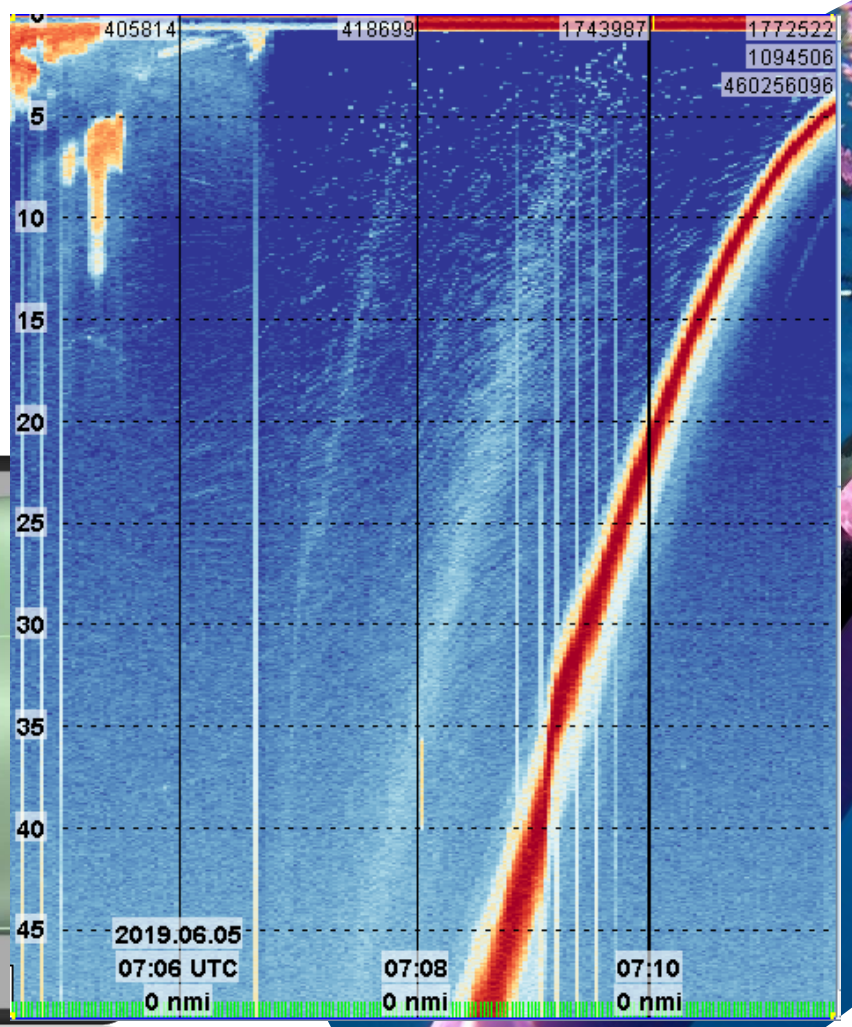
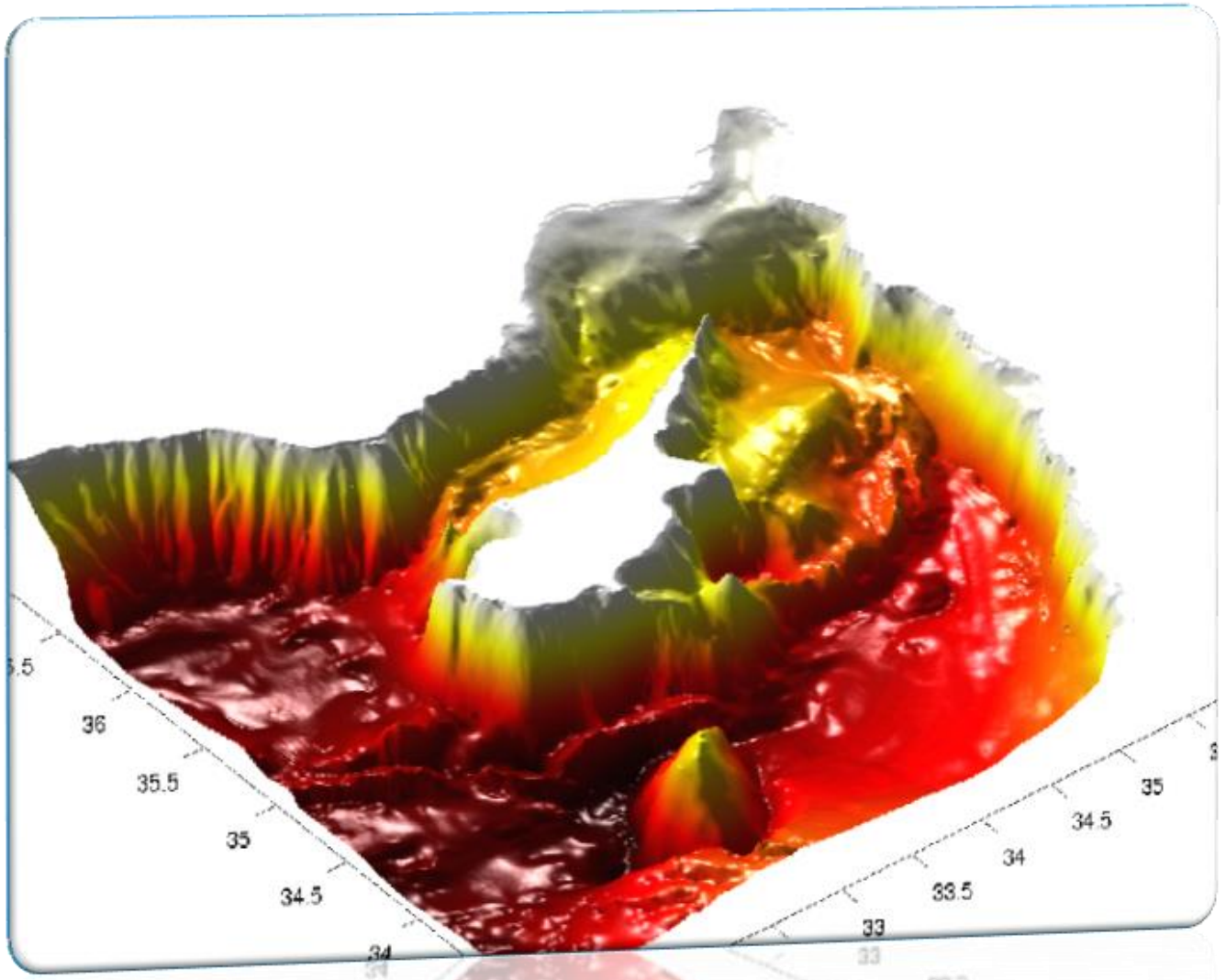




THANK YOU



This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 635359

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