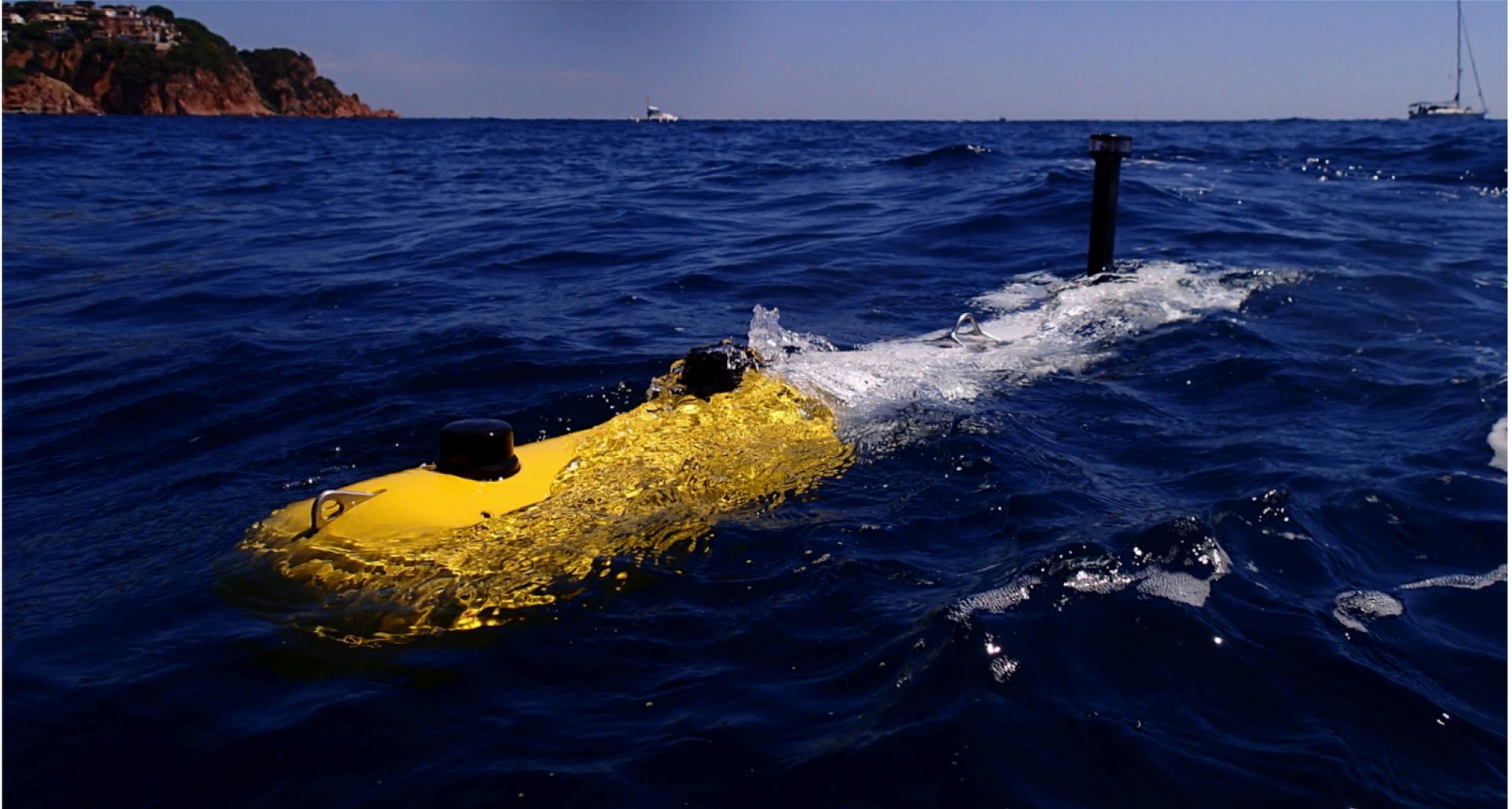


# SPARUS II AUV: “Sea hands-on training”



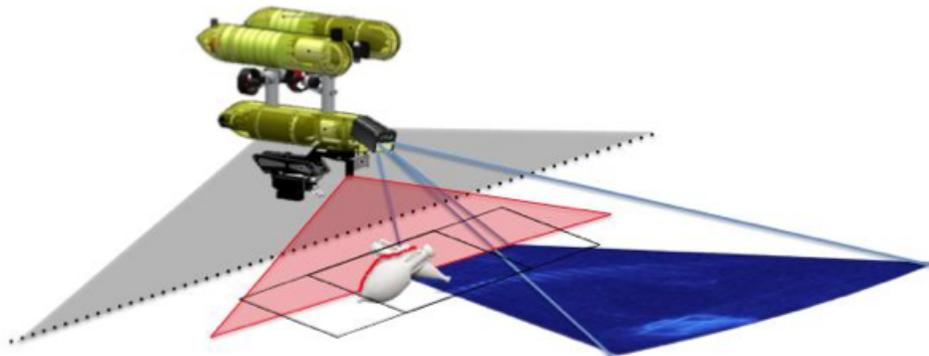
Marc Carreras, Narcís Palomeras,  
Natàlia Hurtós and Carles Candela

Strongmar project  
Almada (Portugal), July 4<sup>th</sup>-7<sup>th</sup> 2016

# GIRONA UNDERWATER VISION AND ROBOTICS LAB

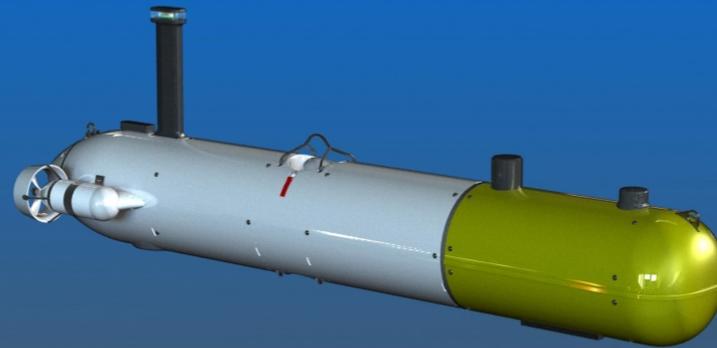


- Senior staff:
  - Pere Ridao
  - Rafael Garcia
  - Marc Carreras
- Postdoc staff:
  - David Ribas
  - Nuno Gracias
  - Narcís Palomeras
  - Angelos Mallios
  - Natàlia Hurtós
  - Ricard Campos
  - Ricard Prados
- Technical & administrative staff:
  - Lluís Magí
  - Carles Candela
  - Joseta Roca
  - Mireia Frigola
  - Anna Ferrarons
- 10-15 PhD & undergraduate students
- Research topics:
  - Hovering AUV design
  - Mapping (2D, 3D, Photo, Acoustic)
  - Image processing
  - Intelligent behaviour
  - Intervention AUVs



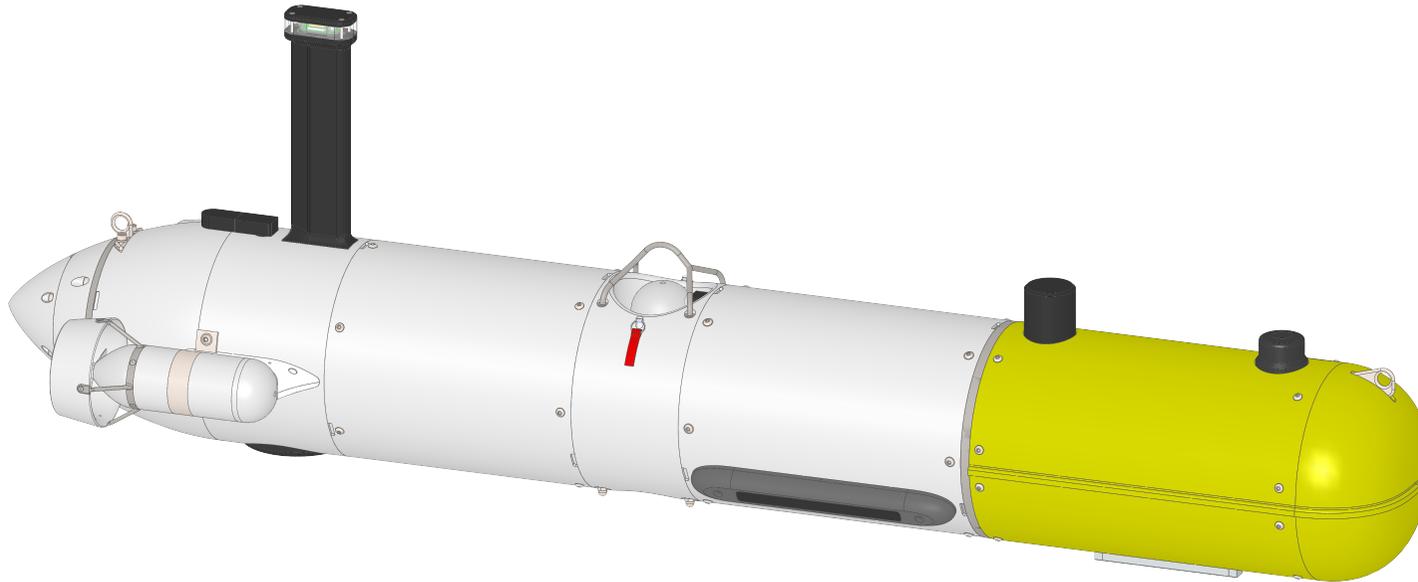
# SPARUS II AUV

[cirs.udg.edu](http://cirs.udg.edu)





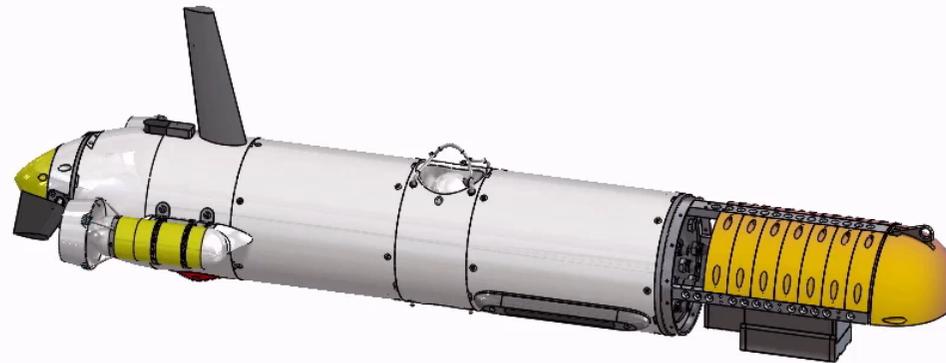
## Basic specifications



- Weight in air: 52 kg
- Length: 1.6 meters
- Width: 460 mm
- Hull diameter: 230 mm
- Maximum depth: 200 meters
- Maximum velocity: 4 knots
- Autonomy: 6-10 hours



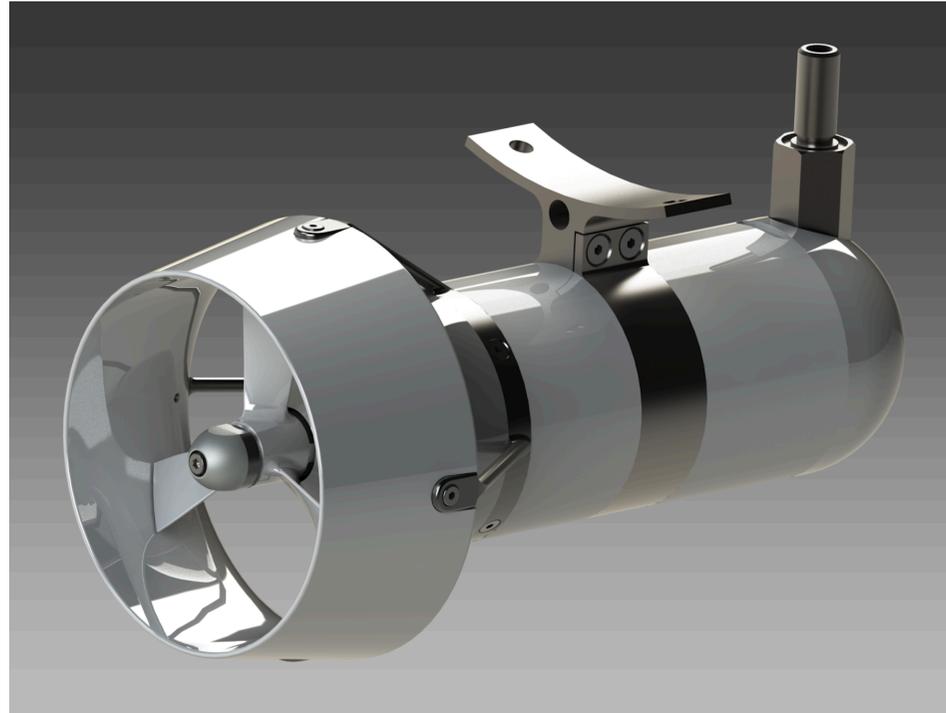
## Mechanical design



- Modular torpedo-shape body
- Open module in front for payload
- Closed modules for electronics, batteries, processing, communications, actuators and navigation sensors.
- Central module contains most part of equipment



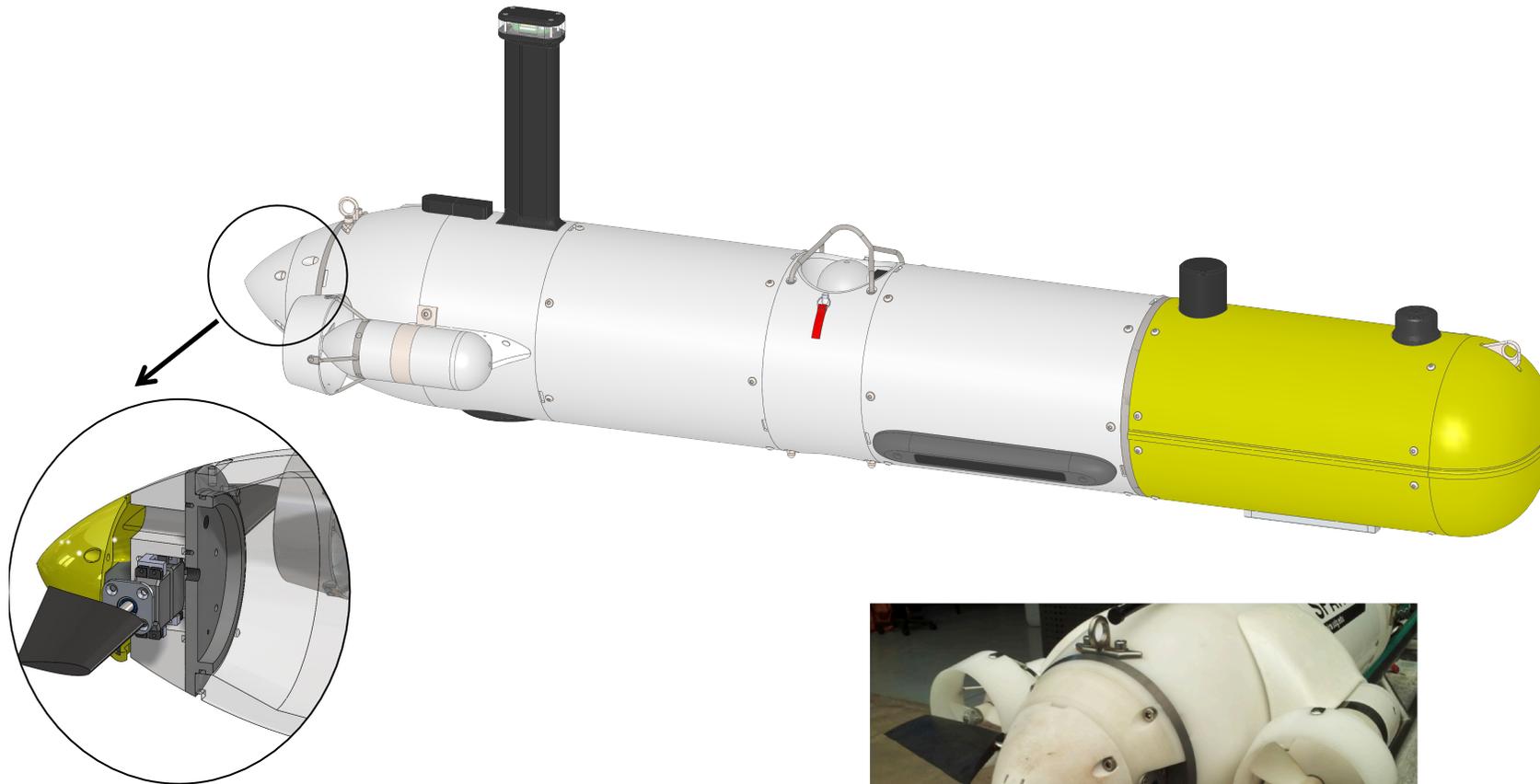
## Thrusters



- Brushless DC motor + RS-485 sensor-less driver
- Magnetic coupling
- 3 blade Kaplan propeller with duct designed for SPARUS II AUV
- High efficiency: 75 Newton at 250 Watt



## Horizontal fins



- Pitch stabilisation and control
- Roll stabilisation





## Payload



- Internal area for electronics
- External area for equipment, together with aluminium structure, syntactic foam and ABS skin.
- Underwater connectors with Ethernet and RS232 interface and I2/24V
- Front hook for deployment and towing

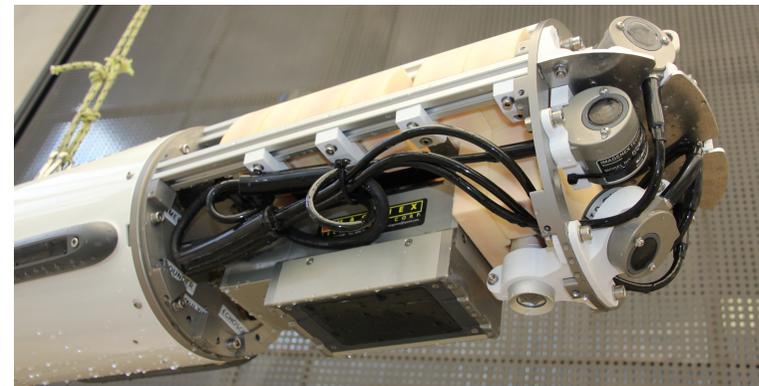
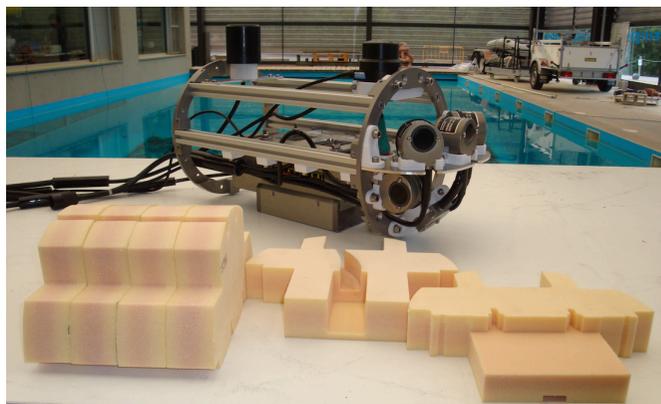
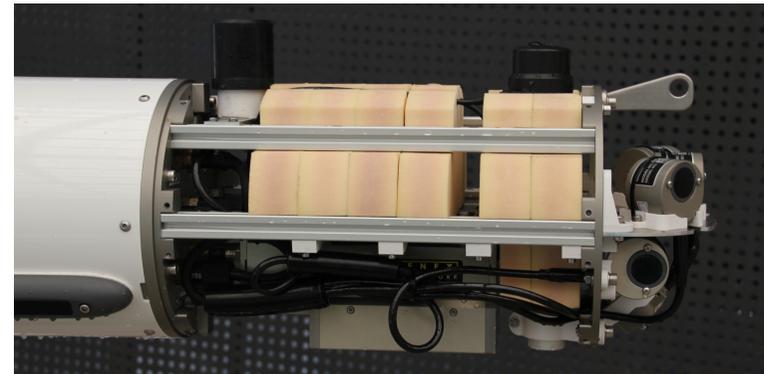
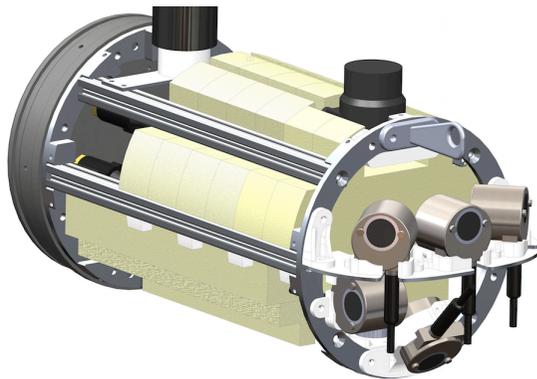
# SPARUS II AUV

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Acoustic and visual  
payload

- Imagenex Delta T Multibeam
- Imagenex Sidescan Sonar
- 5x Imagenex Echosounders
- Tritech Micron Sonar
- Video camera
- Evologics modem



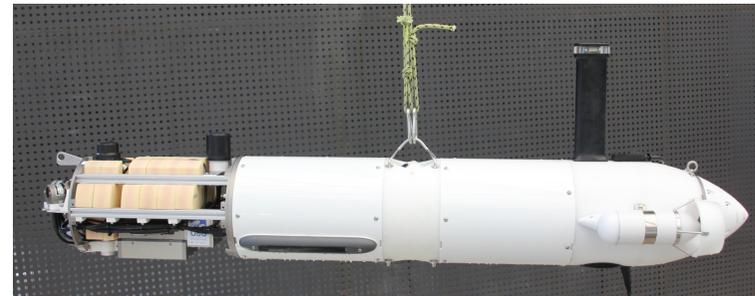
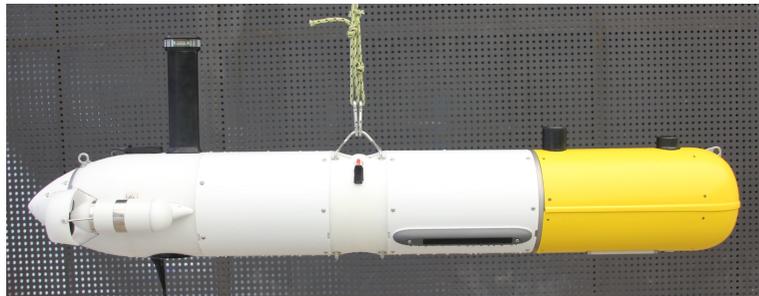
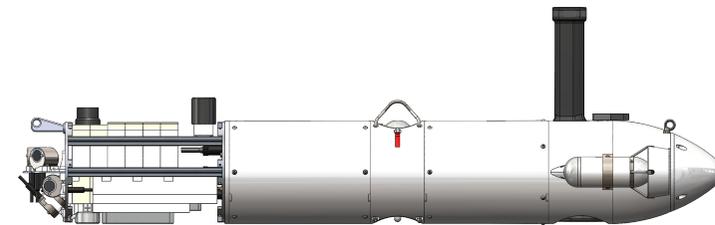
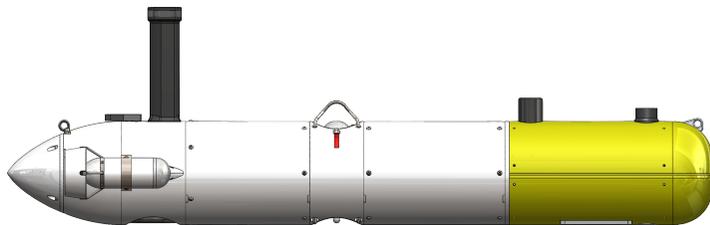
# SPARUS II AUV

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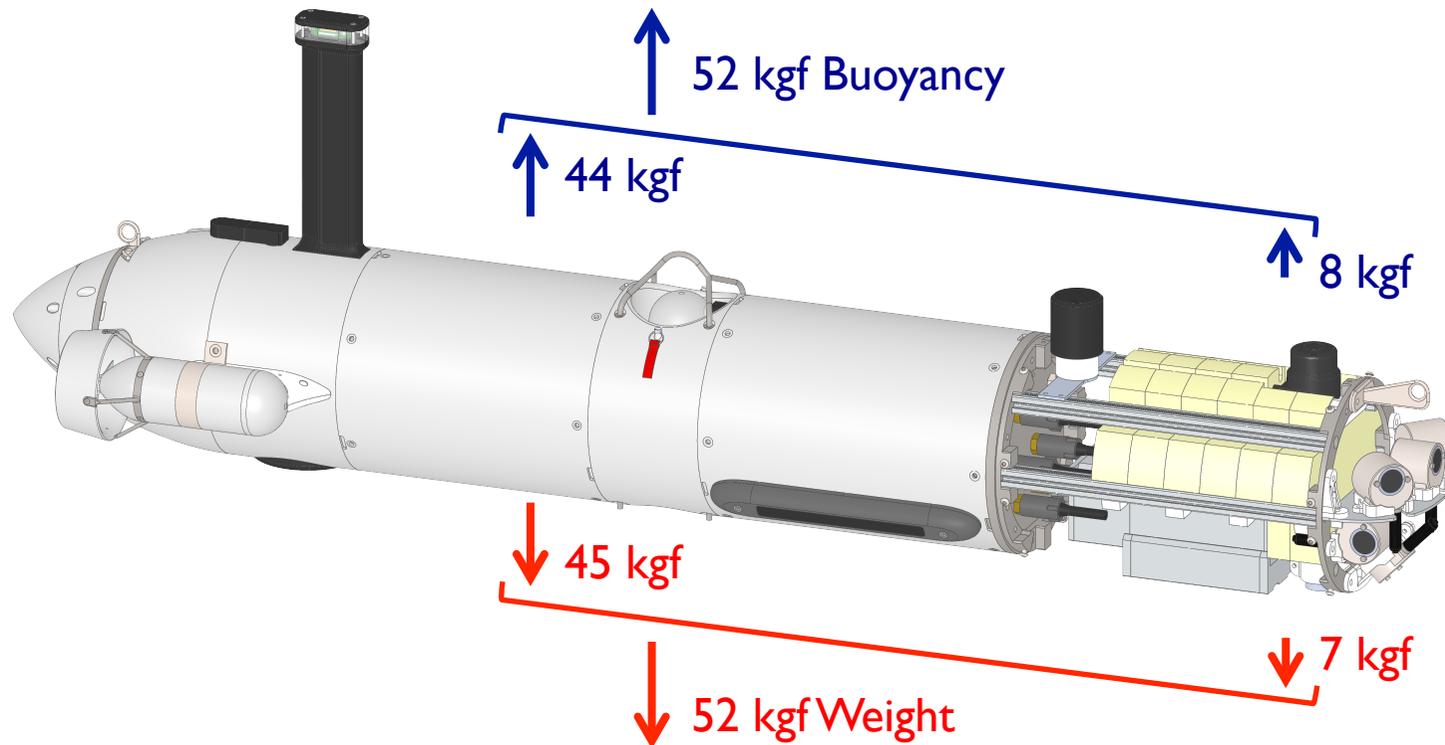
Acoustic and visual  
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- Imagenex Delta T Multibeam
- Imagenex Sidescan Sonar
- 5x Imagenex Echosounders
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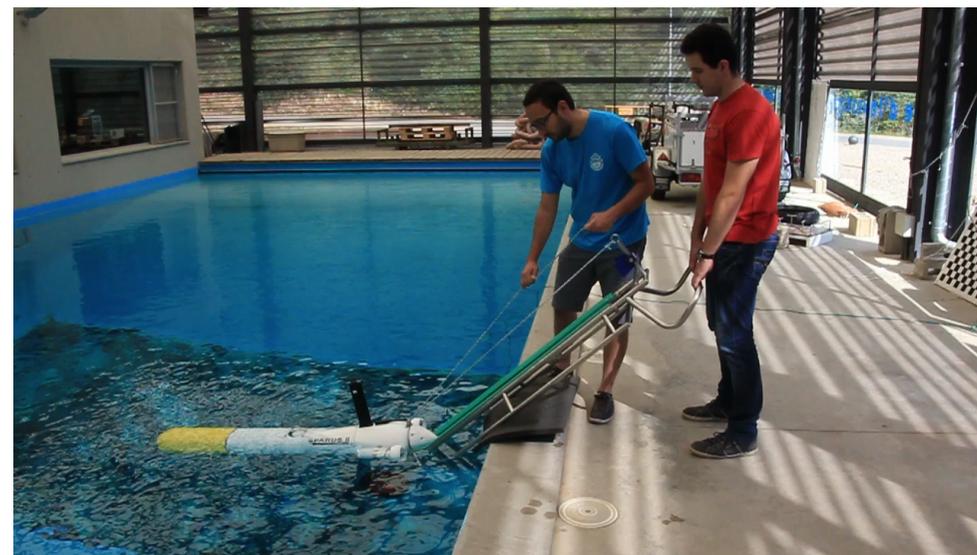
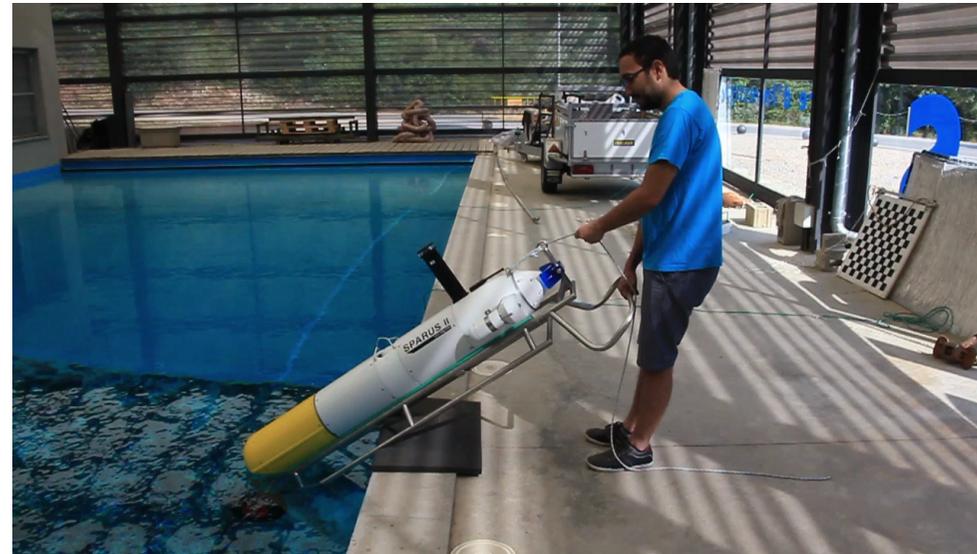
## Trimming



# SPARUS II AUV



Trolley, deployment  
and recovery



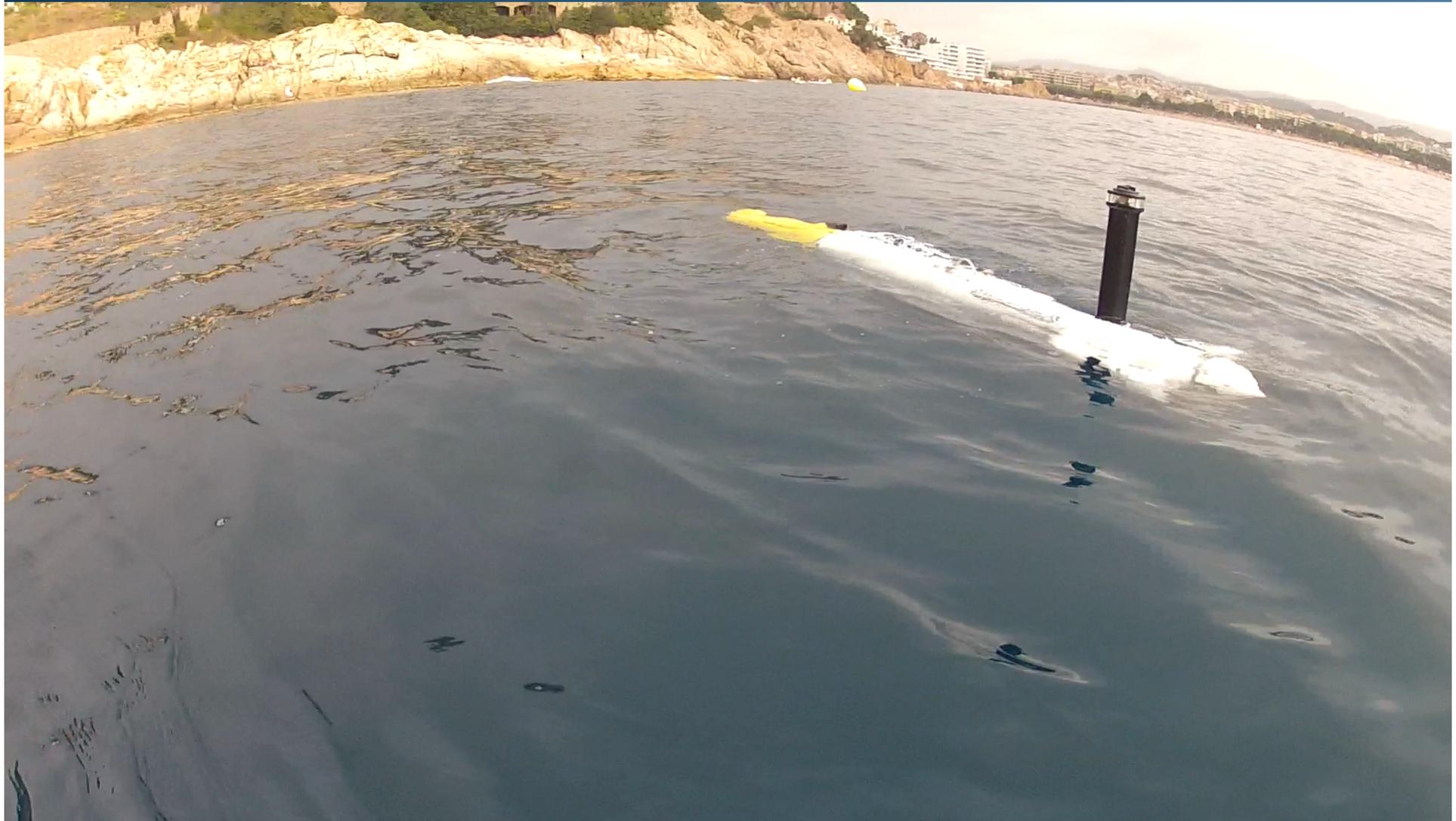
# Basic operation

[cirs.udg.edu](http://cirs.udg.edu)



# Photo-mosaicing

[cirs.udg.edu](http://cirs.udg.edu)





## euRathlon

The **E**uropean **R**obotics **A**thlon:  
La Spezia (Italy), September 2014  
Piombino (Italy), September 2015

[www.eurathlon.eu](http://www.eurathlon.eu)



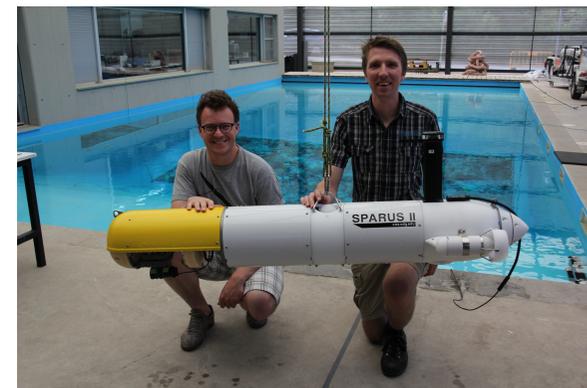
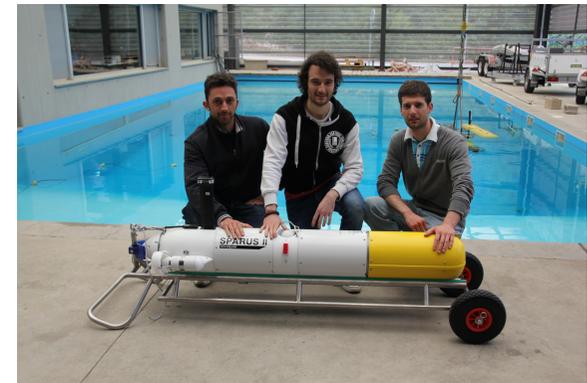
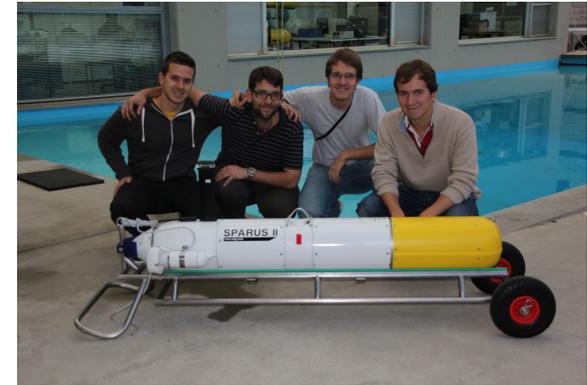
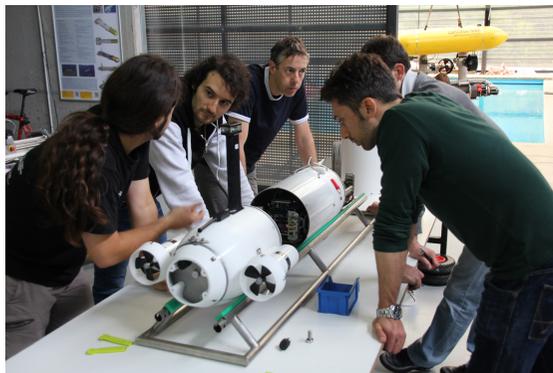
# euRathlon competition

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Training course in Girona:

- Operation
- Hardware
- Software
- Sensor integration



# euRathlon competition

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# euRathlon

La Spezia (Italy)

September 29<sup>th</sup> – October 3<sup>rd</sup>, 2014



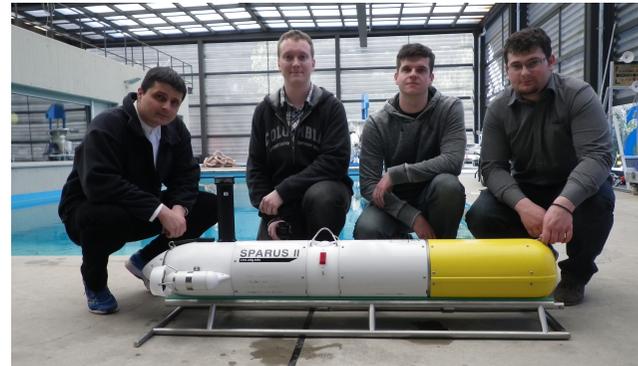
# euRathlon competition

cirs.udg.edu



# euRathlon

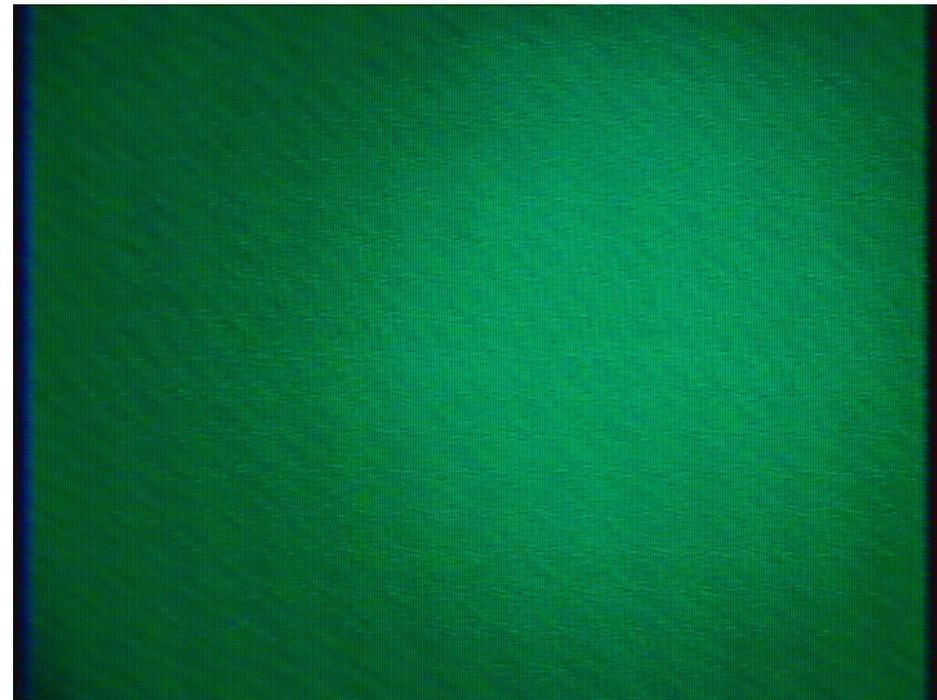
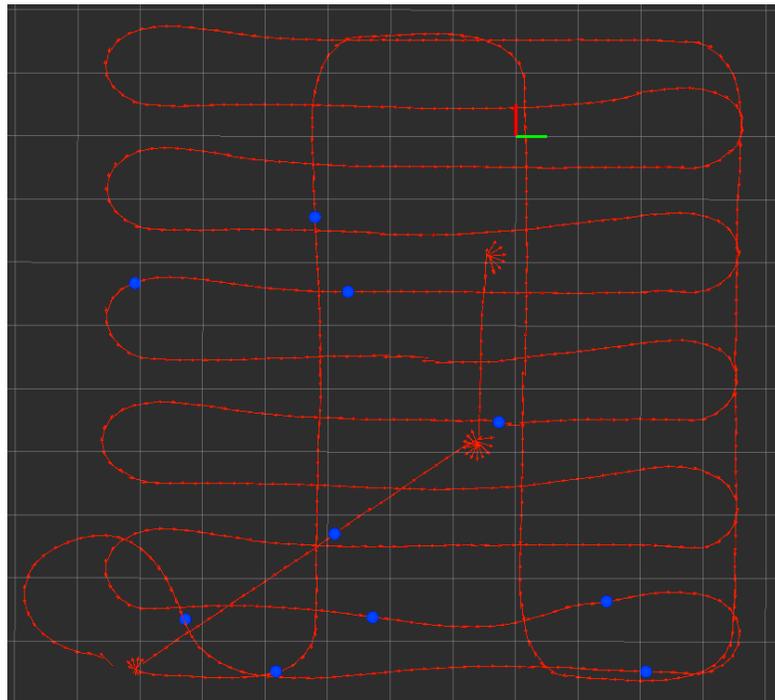
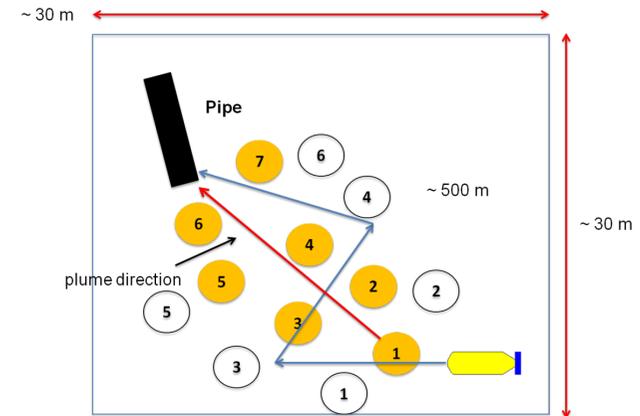
La Spezia (Italy)  
September 17<sup>th</sup> – 25<sup>th</sup>, 2015





## Leak localisation and structure inspection

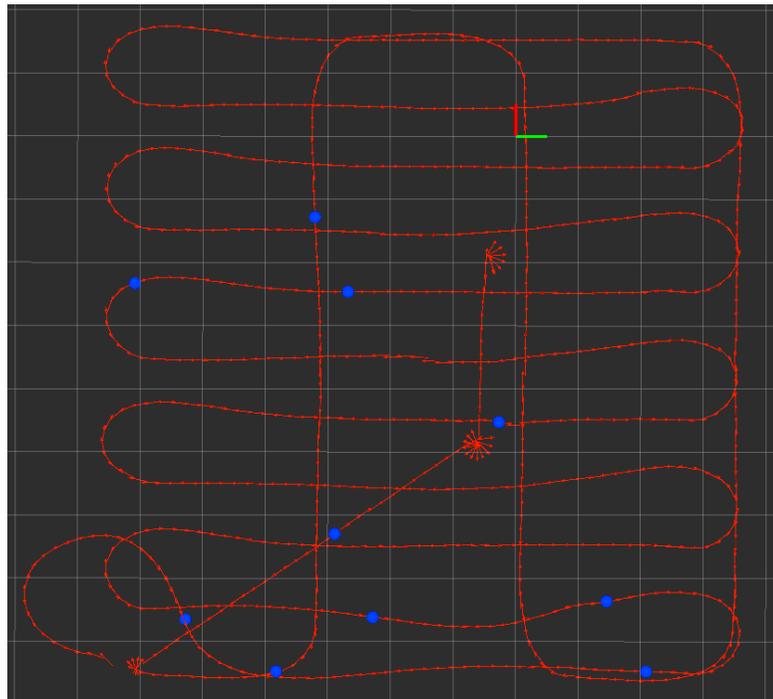
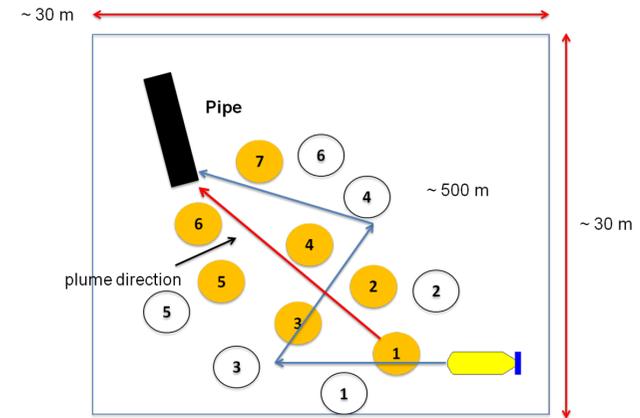
- ✓ Simulated plume was to be followed by mapping/tracking the orange OPIs
- ✓ The underwater structure was to be imaged and mapped and the stopcock identified





## Leak localisation and structure inspection

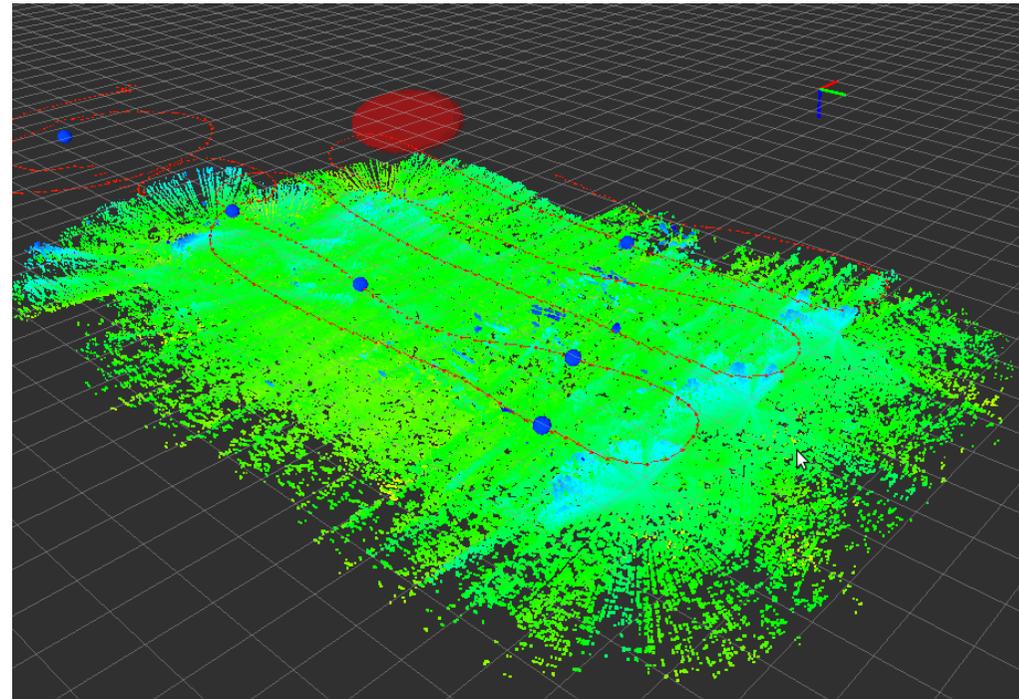
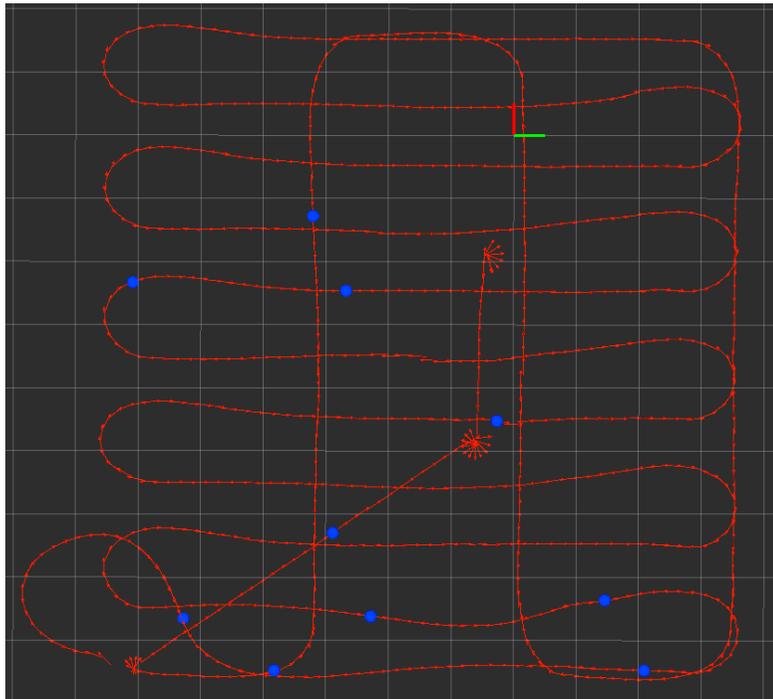
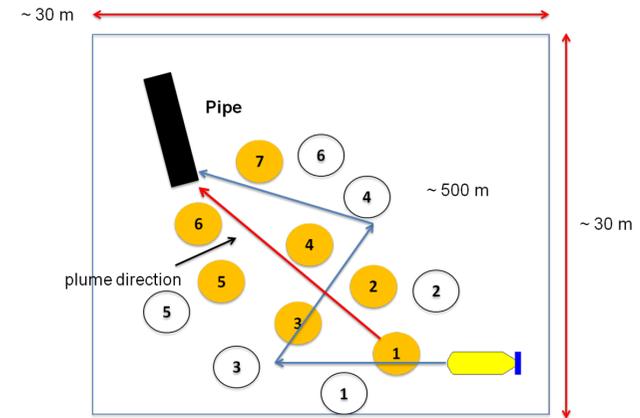
- ✓ Simulated plume was to be followed by mapping/tracking the orange OPIs
- ✓ The underwater structure was to be imaged and mapped and the stopcock identified





## Leak localisation and structure inspection

- ✓ Simulated plume was to be followed by mapping/tracking the orange OPIs
- ✓ The underwater structure was to be imaged and mapped and the stopcock identified



# Motion planning

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# Motion planning

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## Online view planning for mapping unknown underwater structures

Real experiments

Student:  
Eduard Vidal Garcia

Supervisor:  
Dr. Marc Carreras Pérez



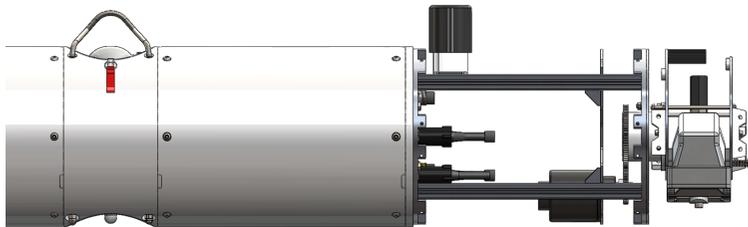
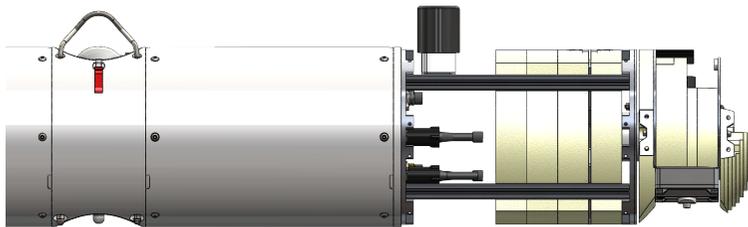
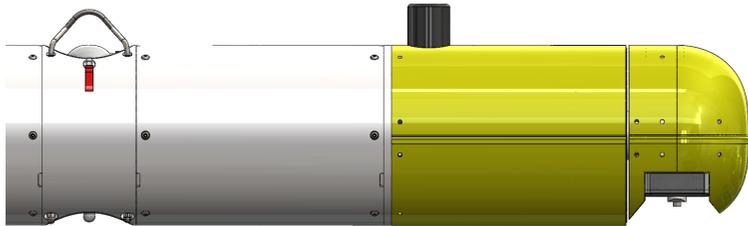
# Multi-vehicle & 3D seabed mapping

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## Rotational Stereo Camera payload

- BumbleBee 2 camera
- Rotational actuator
- Imagenex Sidescan
- Evologics modem



# Multi-vehicle & 3D seabed mapping

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MORPH | Faial Trials | September 2014

# Multi-vehicle & 3D seabed mapping

cirs.udg.edu

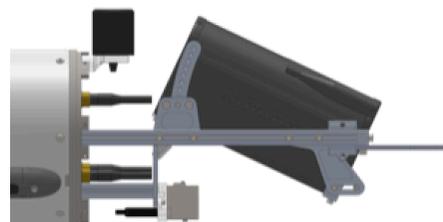
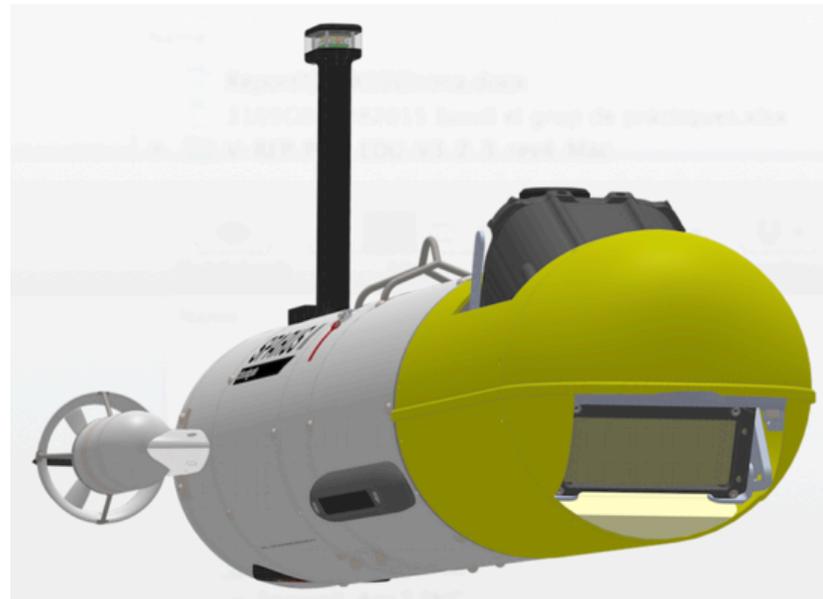
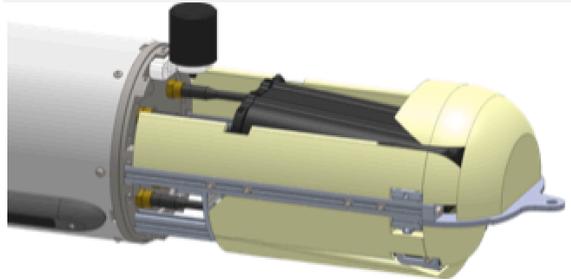
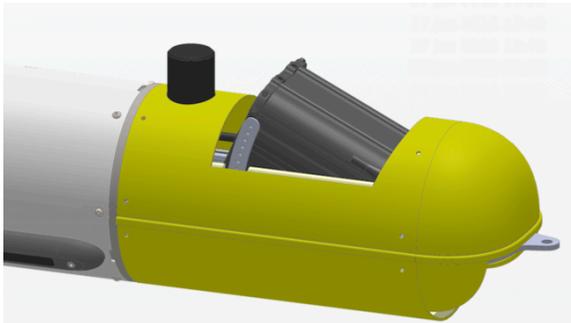


# Acoustic mosaicing



Soundmetrics ARIS  
3000 FLS payload

- Aris 3000
- Evologics modem
- Imagenex Echosounder
- Imagenex Sidescan

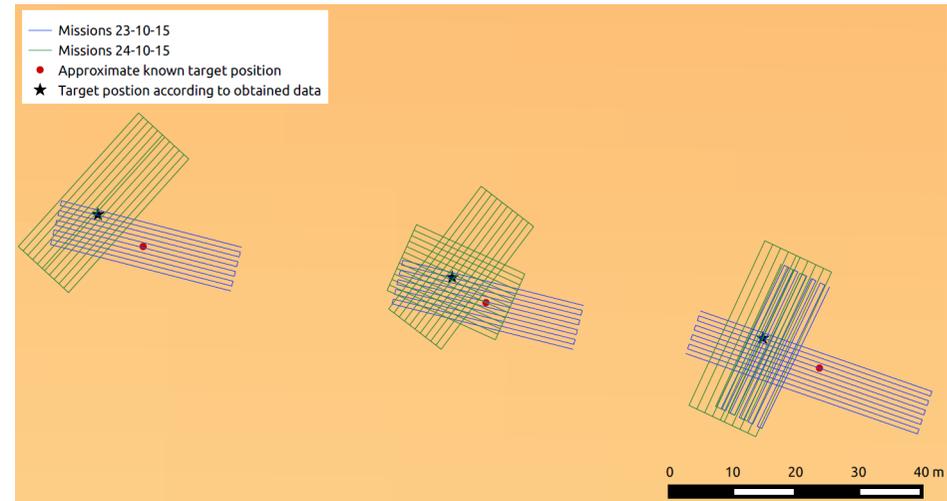
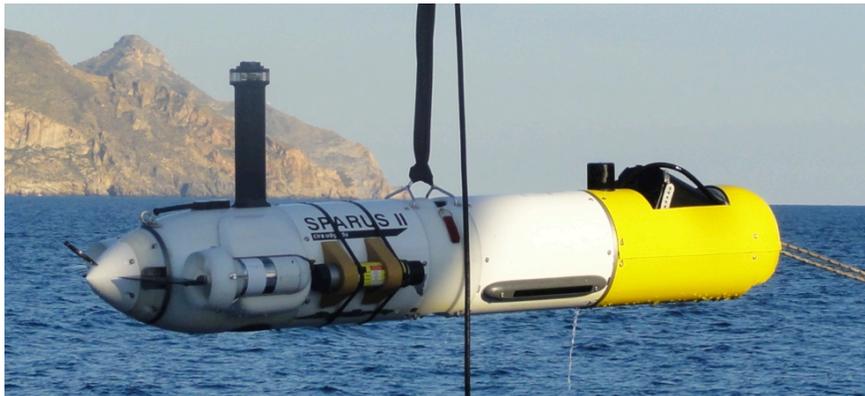


# Acoustic mosaicing



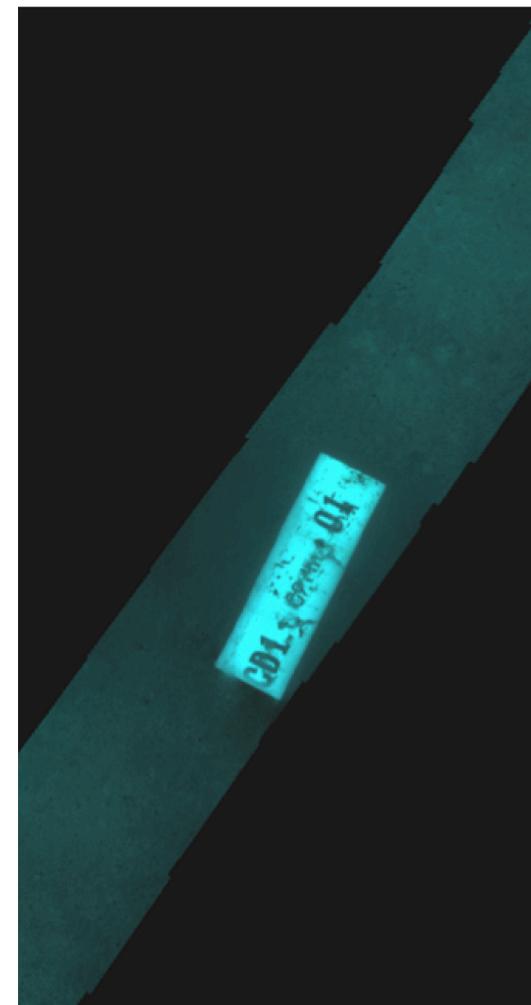
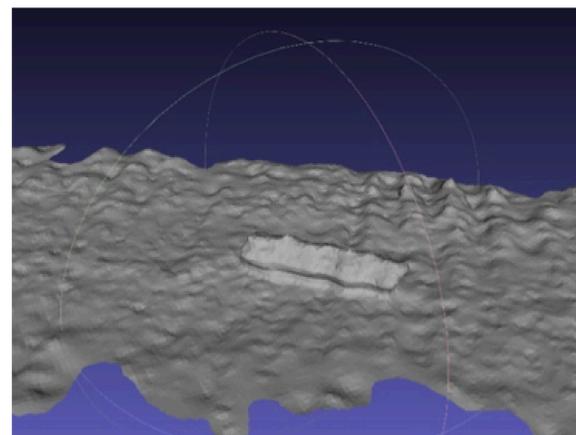
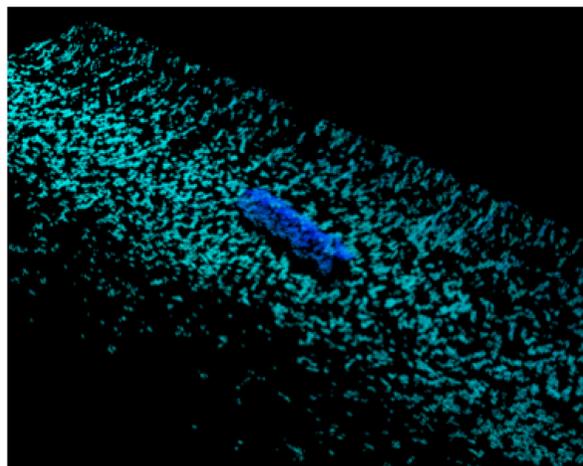
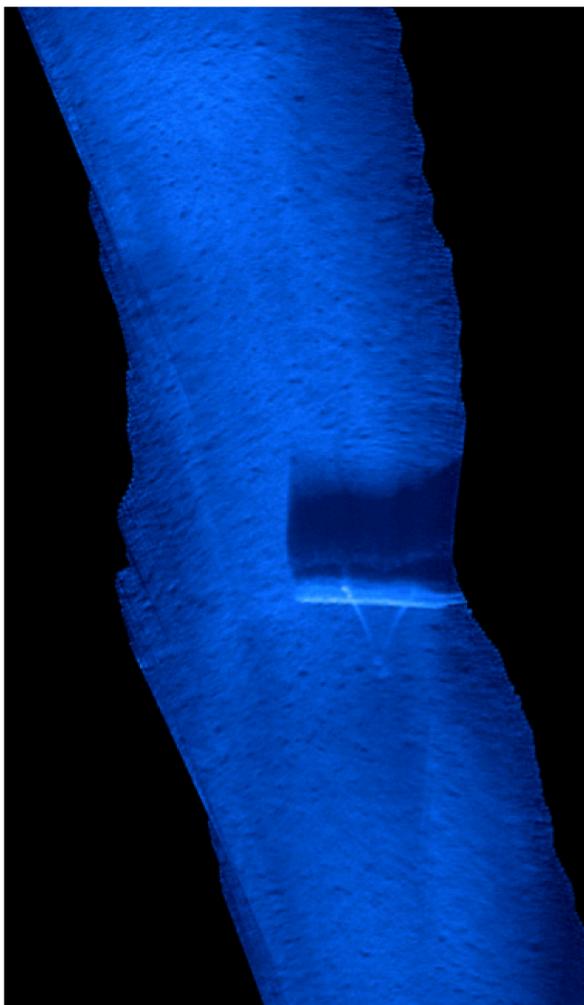
Soundmetrics ARIS  
3000 FLS payload

- Aris 3000
- Evologics modem
- Imagenex Echosounder
- Imagenex Sidescan



# Acoustic mosaicing

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# Acoustic mosaicing

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