PLOCAN: A dedicated infrastructure for autonomous ocean-vehicles base

Carlos Barrera (on behalf PLOCAN Ocean-Vehicles Team)
carlos.barrera@plocan.eu
Outline

- PLOCAN in brief
- Overview on Autonomous Vehicles for Ocean Observation
- Glider Technology
- Glider applications and missions: some examples
- Glider School
Definition:
Unique Scientific and Technology Infrastructure (ICTS) – Committed and Addressed with/to Marine Sciences and Technologies

Main goal:
Design, Construction and Operation of an offshore platform for Research & Innovation in the field of Marine Science and Technologies. Support and service-provider infrastructure to public and private sector initiatives (BlueGrowth)

Main Working lines (not limited):
Marine Renewable Energies and Ocean Observation

Strategy in key words:
Interdisciplinary, large projects, innovation oriented, testing and demonstration, clustering local R&D, international alliance, tailored infrastructures and services, leverage funds, public and political support.
PLOCAN - LOCATION
PLOCAN – VISION AND STRUCTURE

Plataforma Oceánica de Canarias
Oceanic Platform of the Canary Islands

Science and Technology for Ocean Sustainability

Operations Service
Multipurpose Offshore Platform
Test Site
Hosting Service
Data Supply Service

La plataforma de investigación científica PLOCAN es una plataforma científica diseñada para fomentar la investigación marina en el archipiélago de Canarias. Se ha creado con el objetivo de promover el uso de la plataforma para investigaciones científicas de alta calidad en diversas disciplinas, incluyendo oceanografía, biología marina, ingeniería marina y geología marina. La plataforma cuenta con instalaciones modernas y equipadas con tecnología avanzada, permitiendo a los científicos realizar experimentos y observaciones en el mar de una manera eficiente y precisa. En la plataforma se realizan estudios de investigación en diferentes áreas, como la conservación de la biodiversidad marina, la energía renovable marina y el fenómeno del cambio climático, entre otros. La plataforma es un recurso valioso para la comunidad científica mundial, permitiendo a los científicos realizar investigaciones en un entorno controlado y en condiciones naturales para obtener resultados precisos y válidos.
TEST-SITE FACILITY
INTEGRATED OBSERVATORY

1. ESTOC - OCEAN DEEP OBSERVATORY
2. TESTBED COASTAL OBSERVATORY
3. EXTENDED OBSERVATORY
OBSERVATORY - FACILITY

CANIGO – FP4
ANIMATE – FP5
MERSEA – FP6
EuroSITES – FP7
FixO₃ – FP7
GROOM – FP7
AtlantOS – H2020
EMSOLEV – H2020
EuroSEA – H2020
EMSO-ERIC
JERICOCO ERIC

1994-2020
• Seasonal mission – Endurance line **since 2011**
• 200 Nm path distance
• 3 weeks duration
• SW parameters sampled: conductivity, temperature, dissolved oxygen, turbidity and chlorophyll-a
• Partnership with IEO (RAPROCAN line support)
FLEET

- Slocum glider G3 (1000 m.)
  CTD, DO, TURB and FLU
- Slocum glider G2 (1000 m.)
  CTD, DO, TURB and FLU
- Seaglider M1 (1000 m.)
  CTD, DO, TURB and FLU.
- Seaglider M6 (6000 m.)
  CTD, DO, TURB and FLU.
- SeaExplorer (700 m.)
  CTD, DO, TURB, FLU and HC
- Wave Glider (SV2)
  CTD, DO, MET and PAM + 1 CAM
- Wave Glider (SV3)
  CTD, DO, MET and ADCP + 5 CAM
- Sailbuoy
  CTD, DO, MET, TUR, FLU and HC

FACILITIES

- Wet and Dry lab (200 m²)
- Dedicated benches and tooling
- Ballasting area (fresh and target water)
- Storage area
- Control room
- Teaching and meeting rooms
- Transport VAN
- Boats

ACTIVITIES

- Mission planning and performance.
- Maintenance.
- Subsystem integration and testing.
- Piloting.
- Training.
- Deployment/Recovery maneuvers.

PARTNERSHIP

- Joining R&D projects with private and public entities.
- Support activities into specific programs and initiatives.
- Glider School.
- Prototype testing.

VIMAS - BASE FOR UNMANNED OCEAN SYSTEMS

Gliderport
Overview on Autonomous Vehicles for Ocean Observation
Cutting-edge technology in order to quantitatively and qualitatively increase marine observations in an efficient and sustainable way.
AUTONOMOUS OCEAN-VEHICLES

ROV

AUV

ASV

GLIDERS
A ROV system (Remote Operated Vehicle) is an unmanned, motor-powered underwater robot, connected to a control unit on the surface by means of an umbilical cable through which power, commands and signals are provided. Through the umbilical cable the data from the ROV video cameras, the data from the measurement and control sensors are also transmitted to the surface control unit.

ROVS can carry a wide variety of manipulator arms, tools and sensors to perform work in the depths, or simply a video camera to capture images of the seabed. Once in the ROV the electrical energy is divided and distributed among its different components. However, in applications that require high power, most of the electrical energy is used to drive a high power electrical motor which in turn drives a hydraulic pump. The hydraulic pump is used to power equipment such as thrusters, torque tools, and manipulator arms.

Most ROVs are equipped with at least one video camera and lights. Additional equipment is commonly added to expand the capabilities of the vehicle. These may include sonars, magnetometers, photographic cameras, a manipulator arm, cutting tool, sampling systems, and instruments for measuring parameters. An ROV can be operated "in free flight" in which the vehicle is operated through the umbilical (Tether) to the surface control unit or it can be operated from a suspended platform as a "garage“ call TMS through the umbilical. The garage is lowered from the ship.

Both techniques have their pros and cons, but work in very deep operations is usually done with TMS techniques.
There are five main classes of ROV, depending on their application and use:

- **Class 1**: Observation Vehicles (survey)
- **Class 2**: Observation Vehicles with load capacity.
- **Class 3**: Work class vehicles
- **Class 4**: Towed Towing Vehicles
- **Class 5**: Specialized vehicles (trenchers and dredgers)

ROV systems range from simple camera rigs to large complex machines capable of performing a wide variety of specialized tasks relating to oil & gas, submarine cables, search and rescue, science, etc.

A basic ROV system will comprise of the following modules:

- Vehicle.
- Launch and Recovery System (LARS).
- Umbilical.
- Power supply unit.
- A console for control.
- Monitor.
- Most importantly - the ROV team.

Technological development in the ROV industry has accelerated and today they can perform numerous tasks in many fields. Their tasks range from simple inspection of subsea structures to complex subsea operations linked to a wide number of sectors.

While the oil and gas industry uses the majority of ROVs; other applications include oceanography, research, underwater archeology, inspections, search and rescue, etc.

Rov
An AUV (Autonomous Underwater Vehicle) is a member of the family known today as underwater drones, which includes all types of mobile platform or unmanned vehicle with the ability to operate under the surface of the sea at different depths so autonomous, whose propulsion is based on engines.

Generally speaking, it is an underwater robot, like ROVs, but with the main difference being that it does not have an umbilical cable, which gives it different capabilities that in turn translate into the type of application and use, very other than an ROV.

Although today they come in various shapes and sizes, most AUVs respond to a torpedo shape, and are made-up with the following main subsystem-components:

- Housing.
- Propulsion.
- Power (usually lithium batteries)
- Payload (navigation, positioning and scientific sensors).
- Control and processing.
- Communication.

The first AUV was designed and built in the USA in the late 1950s by the APL / University of Washington as a prototype within the framework of the SPURV project "Special Purpose Underwater Research Vehicle".

The main reason and need, and therefore application, of the development of AUV technology has been the military field until recently, where applications in fields such as marine research, commercial (oil & gas), hobby, illegal activities, rescue and salvage, etc. addressed for uw-survey, S&R and mapping, among environmental monitoring.

There are different AUV models, according to needs and use thereof, classified into four main categories:

- Hand-held: up to 40 kilos and 10-12 hours autonomy.
- Lightweight: up to 200 kilos and 20-24 hours of autonomy.
- Medium: up to 1.5 tons and 40 hours of autonomy.
- Heavy: up to 10 tons and 40-60 hours of autonomy.
The USV (from English, Unmanned Surface Vehicles) or ASV (from English, Autonomous Surface Vehicles) are unmanned autonomous marine vehicles designed to operate only on the ocean surface, and whose propulsion system is normally based on propellers or jets, powered from accumulators that in some cases can be rechargeable through renewable energy sources such as photovoltaic and wind.

Like most autonomous marine vehicles, there are different models in terms of shape, dimensions and performance, although all of them are made up of the same number of subsystems, such as:

- Floating body.
- Sensor module (navigation, positioning and scientific)
- Control and processing module.
- Telemetry module (RF, GSM, WIMAX, Satellite)

It is of utmost importance for its proper piloting and remote management, to have a robust bidirectional communication system and precise GPS positioning.

Its applications, although very diverse, are focused on three main areas: military, industrial and scientific. In the first case, they are highly sophisticated systems destined for high-risk missions for people or support for border control. In the case of industrial applications, ASVs are mainly used for water quality monitoring, prospecting or marine engineering work. Finally, applications in the scientific field include monitoring of protected areas, cetacean monitoring, oceanography, water quality, etc.

MANNED SUBMERSIBLES – Scientific

Manned Submersibles are vehicles designed to operate under water, and with applications normally related to the inspection and exploration of the seabed, both professional and recreational. After the design and construction of the first manned submersible by D. Bushnell in 1775, today there is an extensive list of models designed and put into operation.

Its principle of operation is based on water ballasting and on three different technologies:

• Atmospheric pressure: The pressure inside the submersible is maintained independent (atmospheric pressure) from the outside pressure. This technology is used for deep and very deep operations.

• Ambient pressure: The interior and exterior of the submersible are at the same pressure.

• Wet submersibles: Vehicle with or without a covered cabin, where in both cases the water flows into the pilot / s cabin. It is the technology for recreational applications with submersibles, normally

Historically, submersibles have been linked to major milestones, including reaching the deepest point in the ocean or the discovery of the Titanic.

There are currently about thirty manned submersibles around the world, with different capacities in terms of mainly the maximum depth to which they can descend and the number of crew members, among which are:

1. Italy Bathycape Trieste – 11,000 m
2. Deepsea Challenger – 11,000 m
3. Jiaolong – 7,500 m
4. DSV Shinkai 6500 – 6,500 m
5. Konsul – 6,500 m
6. MIR – 6,000 m
7. Nautil – 6,000 m
8. DSV Alvin – 4,500 m

Spain has the ICTINEU3 manned submersible, with a depth of 1,300 meters and three crew members, intended mainly for scientific-informative activities.
MANNED SUBMERSIBLES – Scientific
MANNED SUBMERSIBLES – Scientific
La empresa estadounidense DeepFlight es el referente mundial en diseño, fabricación y comercialización de sumergibles tripulados de uso recreativo.

Existen diferentes modelos de sumergible, mono y biplaza, con capacidad para realizar inmersiones a varias decenas de metros de profundidad.

Mas información en https://www.deepflight.com/
Ocean Gliders
OCEAN VEHICLES – Gliders

80’s
Ship-based

2000
Autonomous

2010
Autonomous + Remotely piloted
OCEAN VEHICLES – Gliders

• UNMANNED VEHICLES
• AUTONOMOUS
• UNTETHERED
• REMOTELY PILOTED
• MODULAR
• EASY TO HANDLE
• GATHER AND PROVIDE N.R.T. DATA
• PROFILERS (buoyancy driven)
• SURFACE (wind or waves)
• SINGLE or FLEET O/M
• TRANSECT / VIRTUAL MOORING / STATION KEEPING
• SCIENCE AND NAVIGATION PAYLOADS
• FROM HOURS TO MONTHS 24/7 OPERATION
• RELIABLE
• INNOVATIVE
• SUSTAINABLE
• COST-EFFECTIVE
• …
Gliders (gliders) are autonomous unmanned (but remotely piloted) underwater vehicles developed to carry out measurements of EOVs of water column both in coastal and oceanic zones up to maximum depths of 1000 m.

Born from an original idea by Stommel in 1989, the first test with a prototype unit was carried out in 1992 in Woods Hole (MA, USA). Subsequently, and after a period of trials and learning, the year 2002 is considered as the moment when this type of devices were consolidated within the scientific community and government agencies as cutting-edge operational tools in oceanography. In the case of Europe, the first glider for scientific purposes was put into operation in 2003.

Designed as a very low consumption platform capable of being configured on demand with a specific sensor payload, its operating principle (and propulsion) is based on the density parameter. Its body is structured in two compartments: its front three-quarters subjected to vacuum pressure) and the rest in contact with the surrounding water.

The pressurized compartment houses the set of processing and control systems, power (alkaline or lithium batteries), as well as part of the sensors and telemetry, and in some cases a mineral oil pump as part of the ballast system that allows the glider to vary its angle of navigation (pitch) relative to the ocean surface.

The non-pressurized compartment is composed of a bladder, which inflates and deflates with air from inside the glider, which allows it to increase or decrease its volume (the glider maintains a constant mass), so its density varies and this allows to generate vertical movements, which thanks to a pair of lateral wings and the transfer of oil in the front part of its body, generates the gliding movement through the water column, both for descent (deflated bladder) and ascent (bladder swollen)
OCEAN VEHICLES – Gliders

\[ \rho = \frac{m}{V} \]

Swim bladder muscles relax, gets bigger, fish is lighter, floats up.

Bladder muscles tighten, gets smaller, floats less until fish hovers weightless.

Muscles tighten, bladder small, fish sinks.
OCEAN VEHICLES – Gliders
OCEAN VEHICLES – Gliders

- Soft fins
- Pressure resistant hull
- Fairing
- Payload section
- Vehicle section
- Foldable mast
- Drop weight
- Gps Radio Iridium
- Navigation electronics
- Ballast
- Batteries
- Moving mass mechanism
- Dry payload
- Wet payload

RCSA
AOCEN
Commercial in confidence
### Ocean Vehicles – Gliders

<table>
<thead>
<tr>
<th></th>
<th>SeaExplorer</th>
<th>Seaglider</th>
<th>Spray</th>
<th>Slocum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wingspan</td>
<td>56.5 cm</td>
<td>100 cm</td>
<td>110 cm</td>
<td>120 cm</td>
</tr>
<tr>
<td>Volume change</td>
<td>1.0L</td>
<td>0.84L</td>
<td>0.9L</td>
<td>0.45L</td>
</tr>
<tr>
<td>Nominal Speed</td>
<td>0.5 m/s</td>
<td>0.25 m/s</td>
<td>0.25 to 0.35 m/s</td>
<td>0.3 to 0.4 m/s</td>
</tr>
<tr>
<td>Dimensions</td>
<td>L=290cm Diam=24cm</td>
<td>L=330cm Diam=30cm</td>
<td>L=200cm Diam=20cm</td>
<td>L=215cm Diam=21cm</td>
</tr>
<tr>
<td>Mass</td>
<td>59 kg</td>
<td>52 kg</td>
<td>Mass=52 kg</td>
<td>Mass=52 kg</td>
</tr>
<tr>
<td>Ballast Efficiency</td>
<td>60 (25%) eff. @ 700 (100) dbar</td>
<td>40 (8%) eff. @ 1000 (100) dbar</td>
<td>50 (20%) eff. @ 1000 (100) dbar</td>
<td>50% eff. @ 200 dbar</td>
</tr>
<tr>
<td>Payload capacity</td>
<td>Dry section: 5.5Kg + Wet section: Up to 3Kg</td>
<td>4Kg</td>
<td>2.5Kg</td>
<td>3 to 4 Kg</td>
</tr>
<tr>
<td>Puck ports</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Operating</td>
<td>700 m</td>
<td>1000 m</td>
<td>1000-1500 m</td>
<td>200 m or 1000 m</td>
</tr>
<tr>
<td>Batteries</td>
<td>8.6MJ, Rechargeable</td>
<td>10MJ, Primary Lithium</td>
<td>13MJ, Primary lithium</td>
<td>8MJ Primary alkaline or Lithium</td>
</tr>
<tr>
<td>Refueling cost</td>
<td>Free</td>
<td>1375$</td>
<td>2850$</td>
<td>~1000$ (Alkaline) to ~10000$ (Lithium)</td>
</tr>
<tr>
<td>Origin</td>
<td>Europe (France)</td>
<td>US</td>
<td>US</td>
<td>US</td>
</tr>
</tbody>
</table>

*Discontinued in 2013*
OCEAN VEHICLES – Gliders
OCEAN VEHICLES – Gliders
OCEAN VEHICLES – Gliders
OCEAN VEHICLES – Gliders
OCEAN VEHICLES – Gliders

- Float
- Sub
- 7m
- Floats
- Subs
- 7m
OCEAN VEHICLES – Gliders
El Autonaut es un vehículo autónomo de superficie planeador (de ahí que se le considere glider) formado por un solo cuerpo/casco en forma de piragua, que aprovecha el movimiento de las olas como fuente de energía para su propulsión a través de un ingenioso sistema de fuelle mecánico fijado en la popa, y que se activa según su posición respecto de la ola en cada momento.

OCEAN VEHICLES – Gliders
El **Saildrone** es un vehículo autónomo de superficie, planeador (de ahí que se le considere *glider*), que aprovecha la fuerza de empuje que el viento genera sobre su vela como fuente de energía para su propulsión. Se trata de una plataforma en forma de catamarán de última generación, con amplia capacidad de carga útil configurable a demanda según necesidades del usuario, con la única limitación de espacio/peso y consumo. Surgido a partir de los últimos avances en diseño y tecnología de materiales aplicados en el diseño de embarcaciones a vela de competición, el Saildrone puede cubrir grandes distancias en el océano tomando datos meteorológicos y oceanográficos de interés de una forma eficiente y sostenible.

Mas información en [www.saildrone.com](http://www.saildrone.com)
ACOUSTICS

Ocean Sonics
SA Instrumentation
RTSys
Biosonics
LRI
SMID Technologies
Teledyne Marine
OTN

POLLUTANTS

Turner
Seabird/Wetlabs
Chelsea Technologies
YSI
Kongsberg/Contros
Franatech
Trios

PHY-BIO-CHEM

Seabird
AADI
Satlantic
AML
RDI/NORTEK
Valeport
Rockland Scientific
Rinko
Idronaut

OCEAN VEHICLES – Gliders – Sensor Payload
GROOM: Gliders for Research, Ocean Observation and Management

The main aim of the GROOM project is to design between 2011 and 2014 an European infrastructure for applied research based on the use of gliders such as marine observation tools able to provide valuable information to different socio-economic sectors. GROOM’s mission is to define in a scientific, technological and organizational way the European glider capacity required to maintain the appropriate and required levels for a sustainable marine observation.

- 4-years (EU-FP-7 INFRA 2011)
- 9 EU-countries
- 20 partners
- Design-study project for a further Glider Research Infrastructure in Europe.
- Gliderport concept
Gliders

The EuroGOOS Gliders Task Team represents the European voice of the global glider community. It is tasked to develop a glider component in the Global Ocean Observing System, GOOS, with international partners from USA, Australia, South Africa, Mexico, Peru, Chile, and others.

Gliders Task Team works to:

- Promote glider applications through liaison between providers and users, providing expert advice;
- Share success stories and jointly address difficulties;
- Maintain and share reference material on glider-related technologies (sensors, protocols, readiness levels and specifications, data management standards and quality control);
- Promote open source tools (data analysis, applications...);
- Foster synergies in science and technology;
- Fill the gaps and look for complementary with other technologies;
- Promote European and regional cooperation and joint projects;
- Contribute to the development of the European Ocean Observing System (EOOS), in the coastal area and in the open ocean.

Gliders Terms Of Reference (316.3 KiB)

Chairs of the Task Team: Carlos Barrera, PLOCAN, Spain, and Pierre Testor, CNRS, France
Slocum G3 Glider

Autonomous Underwater Vehicle

Long Endurance, Proven Performance

Key Features:
- 1-2 man operable
- $\pm 3.5$ $\sigma$ external ballast
- Robust software
- Auto ballast
- Speed control
- Low power consumption modes
- Ice coping capabilities
- 900itc Hydraulic Flight Drive
- Pneumatic Surfacing Drive
- And more...

Benefits:
- Most prolific underwter gliding platform
- Demonstrated multiple ocean basin crossings
- Decades of buoyancy driven system experience
- Custom sensor integrations
- Modular design
El **Deepglider** es un glider perfilador, resultado en 2015 del desarrollo mejorado de la tecnología Seaglider por parte de la Universidad de Washington bajo la dirección de Charlie Eriksen. Se trata del primer glider planeador comercial con capacidad de operación a 6000 metros de profundidad, lo que le confiere poder muestrear el 98% del total de mares y océanos.

Actualmente se comercializa con configuraciones básicas en lo que refiere a su carga útil científica (CTD, oxígeno, clorofila y turbidez).

El Deepexplorer es un glider perfilador profundo, actualmente en desarrollo en el marco del proyecto europeo Bridges H2020, liderado por la empresa ALSEAMAR, y cuyo objetivo principal es el de desarrollo de una unidad profunda con capacidad de operación a 2400 y 5000 metros, según versión. Su arquitectura constructiva y operacional se basa en la tecnología SeaExplorer, comercializada también por ALSEAMAR.

Mas información en http://www.bridges-h2020.eu/
El **Submaran S10** representa el primer vehículo autónomo de superficie híbrido, dado que además de planeador, tiene la capacidad de sumergirse y perfilar la columna de agua hasta 200 metros. Por tanto, su sistema de propulsión híbrido tanto aprovecha la fuerza de empuje que el viento genera sobre su vela, como la generación de diferencias de flotabilidad.

Mas información en [www.oceanaero.us](http://www.oceanaero.us)
**WHAT'S NEXT?**

**MOTH** es un glider perfilador, actualmente en desarrollo por el consorcio alemán ROBEX, y liderado por MARUM. Su diseño innovador, lejos de la habitual forma de torpedo, así como sus capacidades de navegación y comunicación submarina, convierten a MOTH en una significativa mejora tecnológica en el ámbito de los gliders perfiladores.

Mas información en [https://www.marum.de/en/ROBEX.html](https://www.marum.de/en/ROBEX.html)
WHAT’S NEXT?
Examples of glider missions
Glider missions across the Macaronesia

- Seasonal mission – Endurance line since 2012
- 200 Nm path distance
- 3 weeks duration
- SW parameters sampled: conductivity, temperature, dissolved oxygen, turbidity and chlorophyll-a
- Partnership with IEO (RAPROCAN line support)
GLIDER MISSIONS ACROSS THE MACARONESIA

Salinity (psu)

Depth

May 27 2018
May 29 2018
May 31 2018
Jun 02 2018
Jun 04 2018
Jun 06 2018
Jun 08 2018
Jun 10 2018
Jun 12 2018

Date/Time

Potential Temperature (degC)

Dissolved Oxygen (µM)
- 7 weeks duration (360 dives@1000 m. depth)
- Seawater parameters sampled: CTD, DO, TURB and CHL-A
- Partnership with OOM, IH/Marinha y Armada.
GLIDER MISSIONS ACROSS THE MACARONIESIA
GLIDER MISSIONS ACROSS THE MACARONESIA
GLIDER MISSIONS ACROSS THE MACARONESIA
GLIDER MISSIONS ACROSS THE MACARONESIA

temperature [degC]

oxy [μM]

Practical Salinity from Conductivity [PSS-78]
GLIDER MISSIONS ACROSS THE MACARONESIA

DIAGRAM OF TEMPERATURE-SALINITY AND DISSOLVED OXYGEN

MAIN WATER MASSESS
GLIDER MISSIONS ACROSS THE MACARONESIA

SPATIAL DISTRIBUTION OF HIGHER PROPORTION OF AAIW (27.3-27.4) SIGMA THETA

Dissolved Oxygen (μM)
- 110 to 120
- 120 to 130
- 130 to 140
- 140 to 150
- 150 to 160
- 160 to 170

Longitude West (Degree)
Latitude North (Degree)
GLIDER MISSIONS ACROSS THE MACARONESIA
GLIDER MISSIONS ACROSS THE MACARONESIA
GLIDER MISSIONS ACROSS THE MACARONESIA
GLIDER MISSIONS ACROSS THE MACARONESIA
• Atlantic crossing mission / Challenger-One program.
• 614 days mission / 4925 dives@1000m depth / 12030 kms.
• Deployment: Reykjavik (Iceland) / Recovery: Barbados (Caribbean).
• Refurbishment: Sao Miguel (Açores) and Gran Canaria (Canary Islands).
• Seawater parameters sampled: conductivity, temperature and pressure.
• Partnership with Teledyne Webb Research (USA) and Rutgers University (USA).
The **Challenger One** is an international program initiative where PLOCAN cooperates with Teledyne Marine and Rutgers University in regards a Slocum G2 glider unit, under the name of **Silbo**, that attempts to circumnavigate the North Atlantic basin, for scientific and technological purposes. Deployed in Ireland in May 2017, after 178 days of navigation across the Macaronesia, **Silbo** reached Gran Canaria on November 2017, where after a maintenance and battery replacement was re-deployed in April 2018. On July 2020 **Silbo** reached Cape Cop coast, successfully ending the journey.
GLIDER MISSIONS ACROSS THE MACARONESIA
GLIDER MISSIONS ACROSS THE MACARONESIA
GLIDER MISSIONS ACROSS THE MACARONESIA

Slocum glider G2
Marine Institute
2 weeks
CTD, DO, Chl-a and Turbidity

Wave Glider SV2
PLOCAN
2.5 months
CTD, DO, Meteo and Passive Acoustics
DATA PORTAL

Oceanic Platform of the Canary Islands (PLOCAN)

Research Infrastructure (RI) labeled by the ICTS (Unique Scientific and Technological Infrastructure) Spanish National Roadmap.

PLOCAN is a multipurpose technical-scientific service infrastructure that provides support for research, technological development and innovation in the marine and maritime sectors, available to public and private users. PLOCAN offers both onshore and offshore experimental facilities and laboratories, operational throughout the whole year thanks to the Canary Islands excellent climatic conditions. PLOCAN also brings a broad experience in large national and EU marine/maritime projects.

As part of its activities, PLOCAN manages a variety of Observation Platforms in order to provide a continuous and real-time in-situ monitoring of the ocean. These platforms can be both fixed or mobile, providing information about the ocean surface and/or the water column. Different sensors are placed in PLOCAN Observation Platforms allowing access to physical, biochemical and climatological data.

http://obsplatforms.plocan.eu/
### GLIDERS

<table>
<thead>
<tr>
<th>Name</th>
<th>Model</th>
<th>Manufacturer</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>P201</td>
<td>Slocum Deep G2</td>
<td>Teledyne Webb Research</td>
<td>Out of service</td>
</tr>
<tr>
<td>P202</td>
<td>Slocum Deep G2</td>
<td>Teledyne Webb Research</td>
<td>In lab</td>
</tr>
<tr>
<td>P203</td>
<td>Slocum Deep G3</td>
<td>Teledyne Webb Research</td>
<td>In lab</td>
</tr>
<tr>
<td>P302</td>
<td>SeaGlider M1</td>
<td>Kongsberg Maritime</td>
<td>On mission</td>
</tr>
<tr>
<td>P401</td>
<td>Sea Explorer -</td>
<td>ALSEAMAR-ALCEN</td>
<td>In lab</td>
</tr>
</tbody>
</table>

### USV

<table>
<thead>
<tr>
<th>Name</th>
<th>Model</th>
<th>Manufacturer</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB PLOCAN</td>
<td>Sailbuoy Water Quality Monitor (WQM)</td>
<td>Offshore Sensing AS</td>
<td>In lab</td>
</tr>
<tr>
<td>WG PLOCAN</td>
<td>WaveGlider SV2</td>
<td>Liquid Robotics</td>
<td>In lab</td>
</tr>
</tbody>
</table>

### ROVs

<table>
<thead>
<tr>
<th>Name</th>
<th>Model</th>
<th>Manufacturer</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>BlueROV</td>
<td>BlueROV 2</td>
<td>BlueRobotics</td>
<td>In lab</td>
</tr>
<tr>
<td>ROV SB</td>
<td>Seabotix vLBV950</td>
<td>Teledyne Marine Seabotix</td>
<td>In lab</td>
</tr>
</tbody>
</table>
## Data Portal

### Missions

<table>
<thead>
<tr>
<th>Mission</th>
<th>Vehicle</th>
<th>Start</th>
<th>Last comm</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lisboa_2019</td>
<td>P302</td>
<td>2018-04-02 09:00</td>
<td>2019-06-08 21:44</td>
<td>Active</td>
</tr>
<tr>
<td>MADEIRA_2018</td>
<td>WG</td>
<td>2018-10-16 11:40</td>
<td>2018-11-23 08:30</td>
<td>Completed</td>
</tr>
<tr>
<td>AtlantOS_TEST</td>
<td>WG</td>
<td>2018-09-27 08:00</td>
<td>2018-09-28 12:00</td>
<td>Completed</td>
</tr>
<tr>
<td>MARGET_OCSW</td>
<td>WG</td>
<td>2018-07-23 06:00</td>
<td>2018-07-30 07:57</td>
<td>Completed</td>
</tr>
<tr>
<td>MARGET_2018</td>
<td>SB</td>
<td>2018-04-19 10:00</td>
<td>2018-04-21 06:45</td>
<td>Completed</td>
</tr>
</tbody>
</table>

---

**Supporting Organizations**

- Coriolis: Operational Oceanography
- EMODnet: European Marine Observation and Data Network
Generic view for underwater vehicles

- Slocum
- Seaglider
- SeaExplorer

- Metadata (sensors, related projects, involved institutions, …)
- Full path
- Surfacing information
- Scatter plots (science data)
- Profile plots (science data)
- Image gallery
• Generic view for surface vehicles
  ➢ WaveGlider
  ➢ Sailbuoy

• Full path + vehicle speed
• Path color depending on selected variable (oceanographic and meteorological data)
• Time series dynamic plot
Information for underwater gliders:

- **Surface currents** (Copernicus-IBI and PLOCAN HF Radar)
- **3D mean depth (0 – 1000 m) currents** (Copernicus-IBI)
- **Bathymetry** (EMODnet)
- **Vessel traffic density** (EMODnet)
- **Surface geostrophic velocity** (Copernicus – SALTO/DUACS)
Info for surface vehicles:

- **Surface currents** (Copernicus-IBI)
- **Wind** (NOAA-GFS)
- **Wave height** (Copernicus-IBI)
- **Vessel traffic density** (EMODnet)
Glider School
GLIDER SCHOOL

160 Students - 32 Countries - 19 Companies & 14 Research Institutions Supporting - 10 Editions