

ANNUAL REPORT 2016

PLATAFORMA OCEÁNICA DE CANARIAS

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1. PLOCAN

PLOCAN is an Outstanding Scientific-Technical Infrastructure (ICTS, in Spanish) belonging to the Ministry of Economy and Competitiveness' ICTS Map. The Map fosters operational and strategic co-ordination of the infrastructures belonging to the same thematic area and the international expansion and opening up of the ICTS to the international scientific and technological community by actively participating in a range of different infrastructures belonging to the ESFRI road map and other Pan-European initiatives.

a. THE MISSION

PLOCAN's mission is to propitiate scientific and technological development and innovation of excellence in the marine and maritime field by accelerating the time to market of its results and products and by facilitating economic growth and employment by offering efficient access to the ocean at increasing depths in an environmentally-sustainable manner

b. THE VISION

The vision is to be one of the most efficient infrastructures in the international context in the field of marine-maritime science and technology, acting as a meeting point and catalyst between public and private R+D+i.

c. OBJECTIVES

PLOCAN's general objective is to provide the scientific-technological community with the most efficient conditions and resources in the international context to engage in observations, experiences and trials at increasing depths on the oceanic platform and its surrounding area. The specific elements to such ends are:

- ▶ An international benchmark test bed with an off-shore platform
- ▶ A submarine vehicle and instrument base
- ▶ A scientific-technical environment of excellence



Illustration 1. PLOCAN on the ICTS map



Illustration 2. Platform moored at the Nelson Mandela Dock

- A highly-specialised training centre
- An organisational model

2. INFRASTRUCTURES AND FACILITIES

The marine-maritime and land-based facilities and infrastructures available to PLOCAN for attaining its objectives and for the actions implemented in 2016 in the area of each of them are as follows:

a. OFF-SHORE PLATFORM

The final stage of building the platform was completed in the course of 2016 at the Nelson Mandela Dock of Puerto de la Luz and Las Palmas (leaving only the finishing touches that started once the structure was moored on the test bed). The outstanding concrete work was done in the first quarter of the year, which was completed at the end of March. The last concrete work was part of the last stage of the protective wall or shoulders. The platform shoulders were designed to make the most of the surface area available on the platform, while at the same time, carrying out their main, essential function of offering protection from the waves.

That is why the platform has protective walls and three sides, as shown in illustration 3.

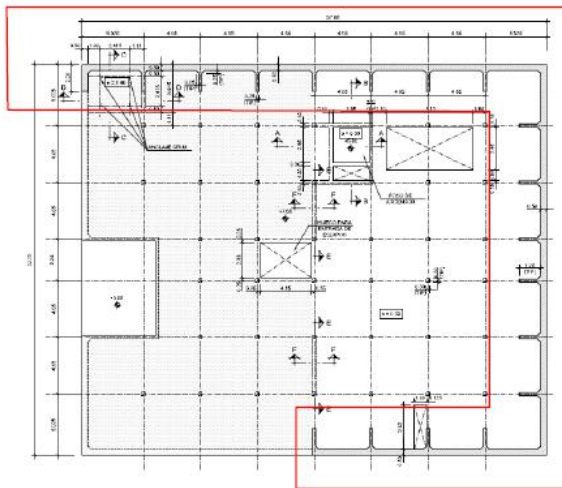


Illustration 3. Alignment of the protective wall

This section of the wall rises to 16m above sea-level, as this is where it provides support for the beams that form the metal structure of the building. Another slab of concrete was laid on top of it, taking the total height to 17.8m above sea-level. Originally, the coping was going to be pre-fabricated, but in the end, it was made on site.

Work started on assembling the metallic structure in mid-January, starting from the pillars that rise up from the concrete deck at 7m above sea-level. The metal beams were anchored to these pillars using bolt and plate joints. This structure continues up to the highest point of the structure, the helipad at 33.43m above sea-level.



Illustration 4. Close-up of the construction of the breakwater at 17.8 m above sea-level

To make the assembly work easier, the designers opted for the simplest possible joints and the easiest to handle. That is why the sections of the pillars are in general, open profile “I” beams to which the girders that comprise the metal framework are attached with joints screwed on with plates and welded. A concrete roof is then laid on top of this at each floor, with composite decking and a raised technical floor from which the ceiling will be hung.

Illustration 5 shows the progress of the structural work over the year. This part of the building houses the following areas:

First floor

Situated 16.97m above sea-level, it houses laboratories, classrooms and “public” use spaces, all divided into three zones:

- ▶ One around the communications core, comprising a service package (sick-bay, toilets and warehouse)
- ▶ A broad intermediate zone, where the laboratories are housed in an open-plan hall
- ▶ A back zone with the largest rooms, which are multi-purpose rooms used as classrooms, meeting rooms, dissemination, etc.

Second floor

Situated 20.47m above sea-level, it houses the galley, dining room, lounges and rest areas; in general, a more “private” area, also divided into three zones:

- ▶ Around the core, with the lounge-rest zone connecting directly with the dining room, but separate from it to allow for better sound-proofing.
- ▶ An intermediate zone, with the galley and self-service dining room for 40 people.
- ▶ Central gangway giving access to the different rest areas, organised for 15 people, 3 individual zones and 6 double ones, each with a full bathroom.

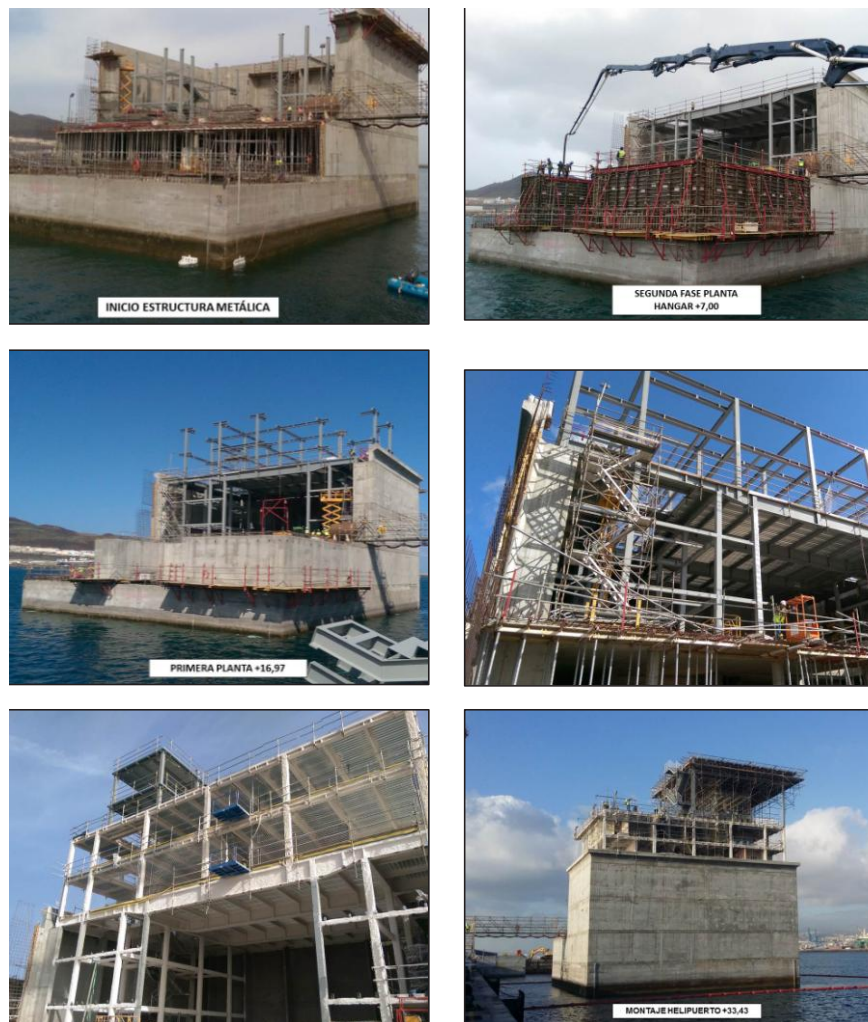


Illustration 5. Progress of the building works in the course of 2016

Technical mezzanine floor

Situated 23.97m above sea-level, housing the climate control equipment, solar panels, aerial towers and the access stairs to the helipad

Control centre

This is situated 27.12m above sea-level, raised above the deck, the stairwell and utility ducts. Access is from the building staircase, separated into its own staircase at deck level to guarantee security. It is rectangular, open-plan and has glass walls from floor to ceiling all around. It houses all the platform control systems.

Helipad

The platform is situated over the bridge to optimise space. The helipad is in-line with the guidelines about obstacle-free sectors on helipads and it has all the equipment, visual aids and protection systems specified in the regulations. It is situated 33.43m above sea-level.

Access to the helipad is via a metal staircase from the deck-level of the building, in the east zone, as the main access stairway. On the other side, in the west zone, there is a second access stairway (a fixed ladder). Both stairways form part of the building's metal structure system.

Work was also completed this year on all the architectural finishing work aimed at:

- ▶ Guaranteeing the platform's resistance to adverse environmental conditions
- ▶ Providing quick and easy implementation
- ▶ Facilitating maintenance, cleaning and replacement tasks, without interfering in the normal operations of the building

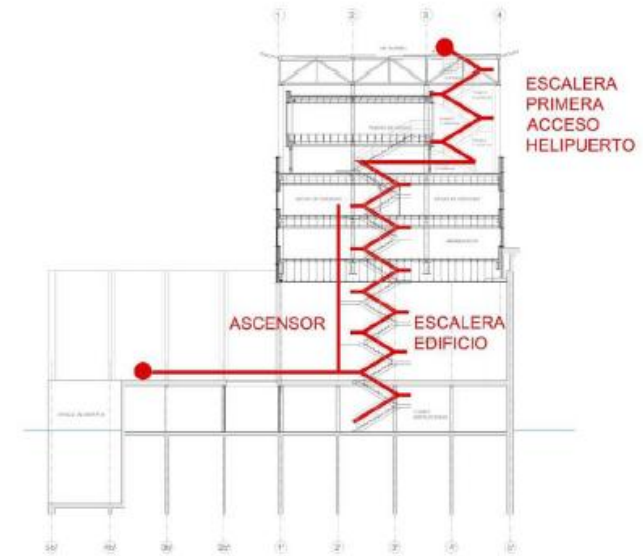
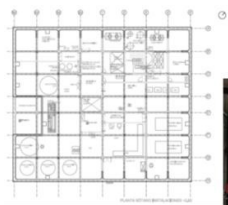
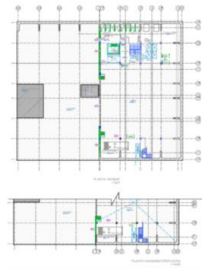


Illustration 6. Communication core, stairways



Planta sótano



Planta principal-hangar



Entreplanta técnica



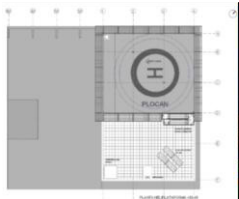
Planta primera



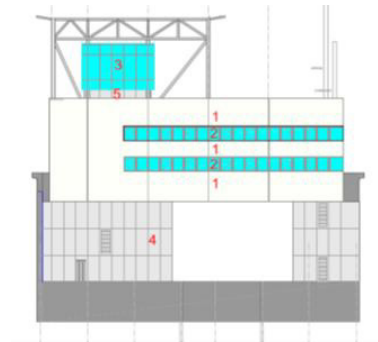
Planta segunda



Centro de control



Helipuerto



The building envelope is defined as the volume comprised of different rectangular bodies in which the pieces fit together following the same 1.2m module system that comprises the lay-out of all the floors, so that each floor is a replica of all the ones above and below it:

Illustration 7. Platform closures



- ▶ Modular facade: Building, comprised of: opaque zone with light panels in aluminium finish (1) and glass-walled zones, transparent curtain wall (2)
- ▶ Curtain wall: Bridge. Transparent glass all around (3)
- ▶ Prefabricated GRC panels. Hangar deck (4) and technical Mezzanine floor (5)

The platform project plans include all the installations necessary for it to operate independently. This work started in February and was completed by the end of the year. These installations are as follows:

- ▶ Electricity installation
- ▶ Lighting installation
- ▶ Special installations
 - ✓ Voice and data installation
 - ✓ CCTV installation
 - ✓ Access control installation
 - ✓ Public address installation
- ▶ Maritime communications installations
 - ✓ Tetra system
 - ✓ Broad band Ethernet Radio link
 - ✓ AIS system
 - ✓ Satellite communications system
- ▶ Climate control installation
- ▶ Solar thermal installation
- ▶ Plumbing installation
- ▶ Water catchment and treatment installation
 - ✓ Sea-water supply
 - ✓ Water treatment
 - ✓ Sea water catchment
 - ✓ Water purification

- ✓ Grey water treatment
- ✓ Black water treatment
- ✓ Separation of hydrocarbons from rain water
- ▶ Installation of water supply and drains
- ▶ Fire-fighting installation
- ▶ Compressed air installation
- ▶ Vacuum pump installation
- ▶ Waste management installation



Illustration 8. Marine crane and jetty structure



Illustration 9. Gantry crane



Illustration 10. Reverse osmosis plant



Illustration 11. Fire-fighting tank



Illustration 12. Sea water tanks



Illustration 13. Main distribution board



Illustration 14. Diesel oil tanks



Illustration 15. Generators

All these systems were fully installed in the course of 2016, along with the pertinent equipment, some of which can be seen in the illustrations above.

The final bed on which the platform rests was fully completed in early September. It was built by dumping the materials it was made of directly on to the site.



Illustration 16. Dredger NAVAL SEGUNDO



Illustration 17. SPLIT BARGE dredger

The final construction phase consists of re-floating the structure, then transporting it to its final location and mooring it there.

The infrastructure comprises 56 internal cells, divided into 6 sets, which are used as ballast tanks. Flow tubes 4.5m from the base of the shaft interconnect all the cells in each set. They are also connected with the exterior via a remotely-controlled valve to make operations easier. Initially, the plan was to re-float the platform by pumping water out of the 6 sets of cells in a calculated manner until it reached the programmed draft. This is the differential de-ballasting procedure used to get the platform to float. Leaks detected between the cells delayed the mooring manoeuvre as it made it necessary to install a supplementary structure made up of eight stabilisers fixed to a metal structure hanging from and anchored to the platform.

Prior to the manoeuvre, two strong anchor points were fitted to the stern (area of the testing tank) for the main lead tug and another two on the bow (area of the building) for the escort tugs and for the mooring operations. Once the lines to the tugs were made fast, the structure was towed by the stern following a pre-defined route. The escort tugs helped to keep the platform on the desired course and they also provided assistance in the stopping and in final positioning manoeuvres.



Illustration 18. Fitting the stabiliser structure

Once the final approach had been made, the positioning of the platform started, based on a combination of two cable-chain mooring lines on the land side (south) operated from two tugs connected by the bow on the ocean side (north) of the platform, and two mooring lines attached to the stern. All the anchorages had been placed at their final location prior to starting the manoeuvre.

After positioning the rig, the mooring procedure started by pumping water back into the cells as ballast (the inverse procedure to the floating procedure) according a pre-determined plan and monitoring all the operational parameters, until the structure finally rested on the bed.

All these manoeuvres were carefully planned in advance to determine the minimum sea conditions necessary for performing the manoeuvre safely, all the details of the operation and all possible contingencies.

The structure was re-floated on the 28th of November and towing started on the night of the 29th of November. The rig reached its final location in the early hours of the 30th of November and was finally and safely moored by the end of that same day.

Several of the contracts associated with file L-CO-DC-1/2010, Drafting Plans and Execution of Works on the Canary Island Oceanic Platform were implemented in 2016. At the beginning of the year, while the metallic structure was being assembled, the technical assistance contract came into effect. In March, when the reinforced concrete structure had been completed, the technical works supervision and survey contracts were also completed, and the works supervision and laboratory contracts for comparative testing that had been in effect since 2015, continued throughout 2016.

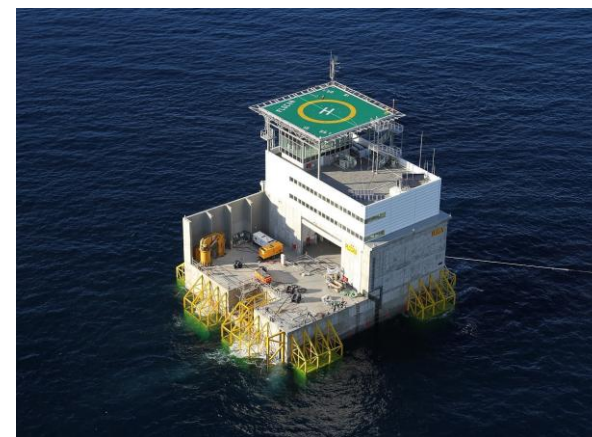


Illustration 19. Photo of the platform after mooring



Illustration 20. Photo of the mooring operation

b. ON-SHORE OFFICES

The on-shore offices, provided by the Canary Island Autonomous Region, are situated in Taliarte (Telde, Gran Canaria) in the former facilities of the Canary Island Institute of Marine Sciences, next to the Port of Taliarte, about 8km from Gran Canaria Airport and about 20 km from the city of Las Palmas de Gran Canaria and the Port of La Luz and de Las Palmas. The facilities have meeting rooms, assembly halls, workshops, operation control room, submarine vehicle workshop (LT1), calibration tank for submarine vehicles, laboratories (dry and wet), training rooms, offices and multi-purpose halls.



Illustration 21. On-shore offices and Taliarte docks

The **glider laboratory** covers an area of 120m² and can house between eight and ten units at one time. It is used for maintenance, accommodation and training activities. There is a wet laboratory next to it for calibrating the gliders, equipped with a sea-water tank and a hoist for handling them.

The **operation control room** measures 80m² and can hold forty people, ten of them at computer work stations. It is equipped with hard and software tools to monitor, supervise and display, in real time, the information provided by the different observation platforms in operation at any time.

The centre has an **oceanographic instrument workshop** and an **electronics workshop**. The two workshops are next to each other on-site. They cover an area of approximately 200m². The instrumentation workshop is for activities concerning the oceanographic buoys (assembly and fitting of meteorological and oceanographic sensors, installation of electronic control systems, etc) that require a large work space because of their dimensions.

The PLOCAN on-shore facility houses the **Marine Maritime ICT Demonstration Centre of Gran Canaria (CDTICMar)**. This infrastructure is an innovative technological solutions project for the marine-maritime communications sector, belonging to the National Network of ICT Demonstration Centres, promoted by the Ministry of Industry, Energy and Tourism (MINETUR), through their Red.es public company, and it is managed by PLOCAN. PLOCAN's intention is to consolidate CDTICMar's position as a national and international reference and meeting point for technological solutions for land-sea communications. CDTICMar offers:

- ▶ A physical space, the facilities and support required for testing marine-maritime sector-related products
- ▶ An education and dissemination platform to conduct practical demonstrations of these products
- ▶ A meeting point between tech companies of the marine-maritime sector to foster co-operation, the transfer of knowledge and innovation among them
- ▶ An air-land-sea connection point with the infrastructure of the Canary Island Oceanic Platform: the test bed, the platform itself and its shore base

The centre is comprised of the following infrastructures:

- ✓ Integral Communications Centre (ICC). This centre acts as a ship-to-shore connection between the PLOCAN infrastructures (test bed, off-shore platform and shore base). It includes satellite communications, WiMAX, TETRA and marine band, adapting to the needs of whoever wishes to use the CDTICMar
- ✓ Data Processing Facility (DPF). This is the site where all the necessary resources are located for processing the information from the CDTICMar. It can provide cloud services and host software on virtual servers
- ✓ Demonstration and Training Support Facility (DTF). This encompasses a dissemination and co-operation environment that acts as a space to organise marine-maritime sector events, training centre, a venue to present commercial products and services linked to the sector and co-working point between companies, universities, public institutions, suppliers and customers.

c. BERTH AND WAREHOUSES

The berth and warehouses are located in the scientific port of Taliarte. The port has an access ramp to the sea to facilitate vehicle testing operations.

d. TEST BED

The test bed is comprised of the public domain maritime-shore area off the north-east coast of Gran Canaria. It covers an area of approximately 23Km², with maximum depths of 600 metres. The general objective of the test bed is to enable companies and research groups to make progress by demonstrating the technologies that they develop, before marketing them. That is why PLOCAN offers them a permanent, characterised and monitored space that in the near future will be connected to the electricity and data grid on-shore.

In the week of the 14th of March, the German Fraunhofer institute – DE Optronics Institute for Systems Technologies and Imaging (IOSB) tested a new autonomous underwater vehicle (AUV) called DeDaVe at the PLOCAN test bed facilities. The prototype AUV, manufactured with German technology, can dive and operate totally autonomously to a maximum depth of 6,000 metres and it can be fitted with sensors and equipment to tackle different kinds of missions and applications in the fields of oceanography, hydrography, geo-physics, search and location, among other important functions.

A multi-disciplinary team of technicians from Germany conducted this mission in the PLOCAN facilities, both on-shore and in the waters of its test bed off the coast of Telde. The main objective of the trials is to validate the capacities and performance of the device in deep waters, which is necessary to be able to market it in the near future. Fraunhofer-IOSB is a world-wide benchmark institution focusing on the research and development of innovative concepts, methods and systems for industry, small and medium-sized enterprises and public-sector customers.

A series of actions have been implemented in this area in 2016, aimed at the environmental characterisation and monitoring described below:

Three missions have been run in the proximities of the test bed, aimed at monitoring marine physical and chemical conditions using unmanned autonomous vehicles. Moreover, a remotely-operated vehicle (ROV) was used to film the bedding foundations on which the PLOCAN multi-purpose platform rests.

Observations have been taken from ships and fixed platforms, including:

- ▶ Two hydrographic campaigns from an oceanographic vessel
- ▶ The installation of an ODAS oceanographic buoy for monitoring meteorological and marine parameters in real time
- ▶ Installation of two acoustic current metres (ADCP) to measure currents and wave action
- ▶ Installation of a hydrophone to measure the submarine noise associated with the installation of the platform
- ▶ Installation of a surveillance radar to monitor sea traffic
- ▶ Development of an on-line geographic information system

Finally, characterisation and environmental assessment actions that have been carried out as part of three specific projects:

- ✓ IECOM/REDSUB Project
 - Bionomic mapping of the distribution of the *Avrainvillea Canariensis* alga
- ✓ ELICAN Project
 - An environmental assessment study to be filed with the environmental agency
- ✓ WIP10+ Project
 - Environmental assessment



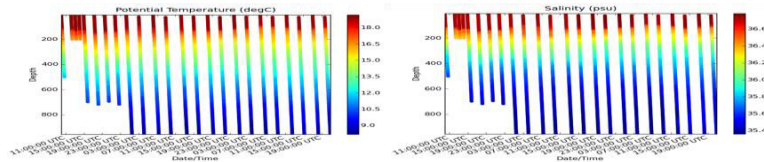


Illustration 25. Temperature and salinity profiles from the March mission

Mission 3: November 2016. ESTOC2016_2

The objective of this mission was to sail from the test bed area to the ESTOC station. This was done between the 15th and the 20th of November, covering a distance of 153km

Filming under water using a remotely operated vehicle (ROV)

The bed on which the PLOCAN multi-purpose platform rests was filmed under water at a depth of 30 metres in November, using a PLOCAN ROV.

Mission 2: March 2016. ESTOC2016_1

The objective of this mission was to sail from the test bed area to the ESTOC station. This was done between the 2nd and the 14th of March, covering a total distance of 80km.

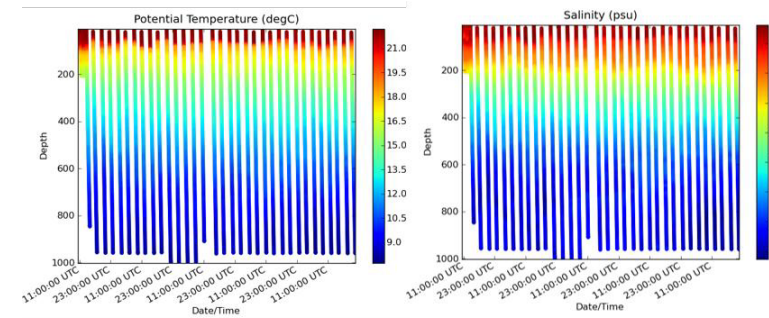


Illustration 26. Temperature and salinity profiles measured on the November mission

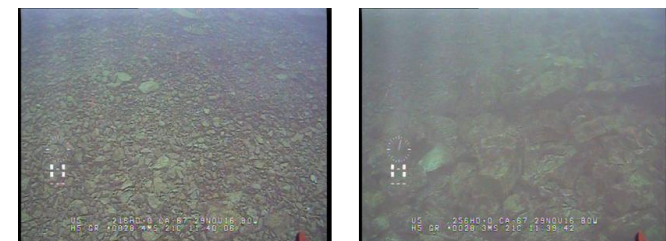


Illustration 27. Filming the bed at a Depth of 30 metres

CHARACTERISATION USING SHIPS AND FIXED PLATFORMS

Hydrographic campaigns from ships

Two hydrographic campaigns were run during the year, aimed at monitoring the quality of the water mass at the test bed. These samples were taken to coincide with the samples taken from the ESTOC observatory to make the most of the time that the oceanographic vessel Ángeles Alvariño from the Spanish Oceanographic Institute (IEO) was available in February and October. Samples were taken at five points in this campaign, to measure temperature, salinity, oxygen, chlorophyll, pH, turbidity, nutrients, heavy metals and hydrocarbons.

ODAS oceanographic buoy

An ODAS oceanographic buoy was installed in September to monitor marine and meteorological parameters on the test bed in real time. This buoy is moored at a depth of 32 metres.

The data from the buoy are received daily on the PLOCAN servers and can be seen on the web site (<http://siboy.plocan.eu/>)

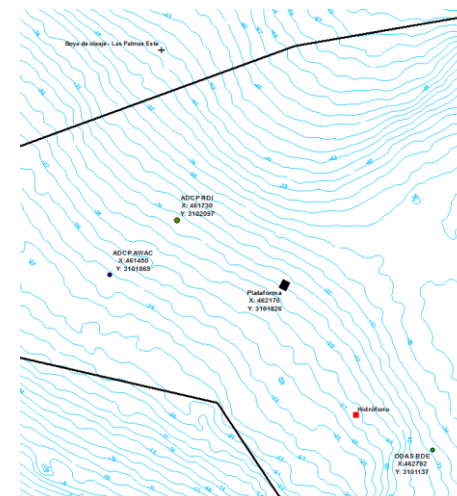


Illustration 28. Location of the observation devices deployed in 2016



Illustration 29. Photo of the ODAS buoy

Observing marine currents and waves

Marine currents and waves are monitored with an ADCP (*Acoustic Doppler Current Profiler*) current metre and a directional wave buoy. The table below shows the information:

Table 1. Marine current and wave observation devices

Device	Parameter	Agency managing the device and the data	Viewing in real time
Triaxys directional wave buoy (Las Palmas Este)	Wave action (height, period and direction)	Puertos del Estado	Puertos del Estado web site
Acoustic current metre (ADPC)	Waves and marine currents	PLOCAN	-



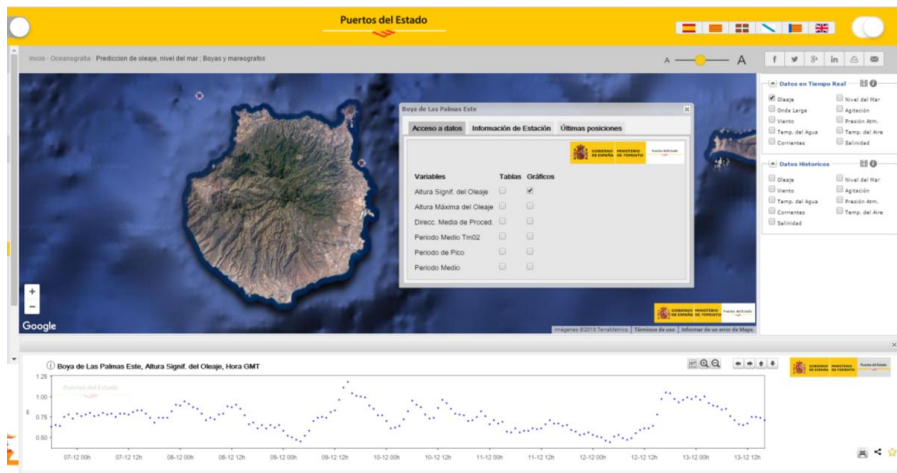


Illustration 30. Viewing the wave action data on the Puertos del Estado web site

The data recorded by the ADCP is stored in the device's internal memory and recovered every 2 months approximately, it is processed and the results are obtained. Two ADCPs were installed during the year, one in October at a depth of 30 metres and the other in November at 25 metres. The section on the environmental surveillance of the test bed provides the information on installing these instruments.

Submarine noise

Submarine noise is monitored by installing hydrophones. One was installed in November that was recovered in December. The data recorded is stored in its internal memory and it is recovered after a period of approximately 30 days, it is processed and the results are obtained. The section on the environmental surveillance of the test bed provides information on installing this instrument.

Radar surveillance system

A surveillance system called VIPICUL was installed in 2016 to monitor maritime traffic within the test bed area. The system is comprised of a radar antenna and a data-processing software package that allows the vessels sailing through the test bed to be viewed in real time. The radar antenna is located on-shore in the offices of EMALSA. PLOCAN has a co-operation agreement with this company to organise scientific and technical activities and to use its facilities.



Illustration 31. VIPICUL radar antenna

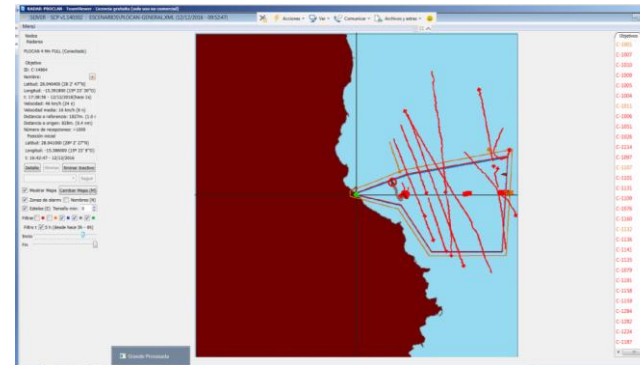


Illustration 32. View of VIPICUL system data

On-line geographic information system (GIS)

Throughout the year, work has been done on developing an on-line geographic information system (GIS) to display environmental information about the test bed on the web site. The viewer being developed currently includes the following information:

- ▶ Bathymetry
- ▶ Biodiversity
- ▶ Geo-physics
- ▶ Marine planning (protected spaces, administrative limits, etc.)
- ▶ Wind resources

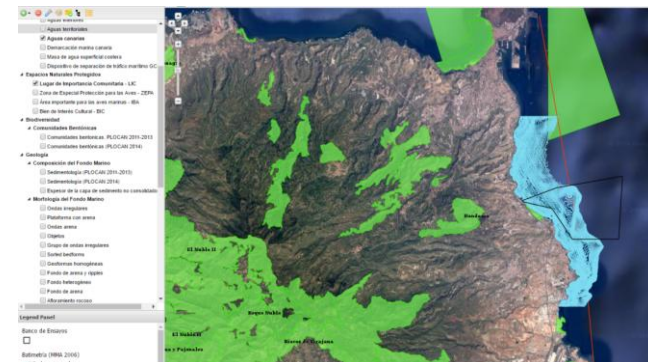


Illustration 33. GIS web site under development

ENVIRONMENTAL SURVEILLANCE

Actions were rolled out in 2016, aimed at monitoring the quality of the water mass (temperature, salinity, pH, oxygen, chlorophyll and turbidity) in the area of the foundation bed during the construction process, and to monitor submarine noise associated with the installation of the platform and the hydrodynamic conditions (wave action and marine currents) during its transportation and installation.

The main conclusions drawn are as follows:

- ▶ The process of building the bed did not have a significant impact on the surrounding environment, as the excess turbidity generated was minimal and short-lived
- ▶ The submarine noise results are pending, as the data has yet to be analysed
- ▶ Hydrodynamic conditions were excellent, helping to ensure that the transport of the rig and its installation transpired without incident

The programme of environmental protection measures was drawn up by the joint venture pursuant to its environmental management procedures, guaranteeing compliance with the regulations in effect and bearing in mind the decision of the environmental agency of the 22nd of May 2013 that concluded that the project did not have to undergo an environmental assessment as it did not fall within any of the circumstances envisaged in the regulations. However, PLOCAN decided to accept the environmental surveillance plan proposed in the environmental document and to put it into practise progressively and to adjust it to whatever activities were engaged in at any one time.

Monitoring the foundation bedding

The bedding layer on which the platform rests is made up of a core of breakwater stones weighing between 50kg and 100kg and two upper layers of gravel with diameters of between 20mm and 70mm. The material for the breakwater and the 40-70 gravel comes from the Roque Ceniciento quarry (M. D. Las Palmas de Gran Canaria) with all the pertinent quality certificates. The 20-40 gravel comes from the quarry in Juan Grande (M. D. San Bartolomé de Tirajana, Gran Canaria), also with the pertinent quality certificates, highlighting the fact that this material contains 0.1% fine grade material. The bedding layer was built bearing in mind the considerations set out in the environmental document, including the following:

- ▶ The selected material had to contain a minimum percentage of fine grade material to prevent scattering and increasing turbidity in the area. This material is made up of large breakwater stones and gravel with a diameter of between 20mm and 70mm.
- ▶ The material had to be dropped and the bedding layer built exactly in the grid square defined and characterised in the environmental study.

PLOCAN used its own resources to monitor the dumping of the material and saw evidence of the low levels of turbidity caused at the dump site, thus corroborating the conclusions of the simulations run in the environmental study beforehand. To such end, they took profiles with a multi-parametric probe to measure the turbidity throughout the water column. Once the stones that form the core of the breakwater had been dumped in place, PLOCAN commissioned underwater filming to check its status. The gravel layer was then put in place and a second underwater video was taken of the area around the bedding layer to check the state of the seabed.

The summary of the water quality sampling conducted by PLOCAN around the bedding layer of the foundations is as follows:

Table 2. Water quality sampling summary

Date	Promotor	Vessel
15-April-2016	PLOCAN	PLOCAN 1
19-April-2016	PLOCAN	PLOCAN 1
10-May-2016	PLOCAN	PLOCAN 1
13-May 2016	PLOCAN	PLOCAN 1
19-September-2016	PLOCAN	PLOCAN 1
30-November-2016	PLOCAN	PLOCAN 1

Photos show the bedding layer on the seabed:



Monitoring submarine noise

A hydrophone was installed at a depth of 23m in November to measure the submarine noise of the platform installation operation. It was installed 600m from the platform mooring point in order not to interfere in the manoeuvres of the platform. The equipment was recovered in 2016 and the only task remaining is to analyse the data.

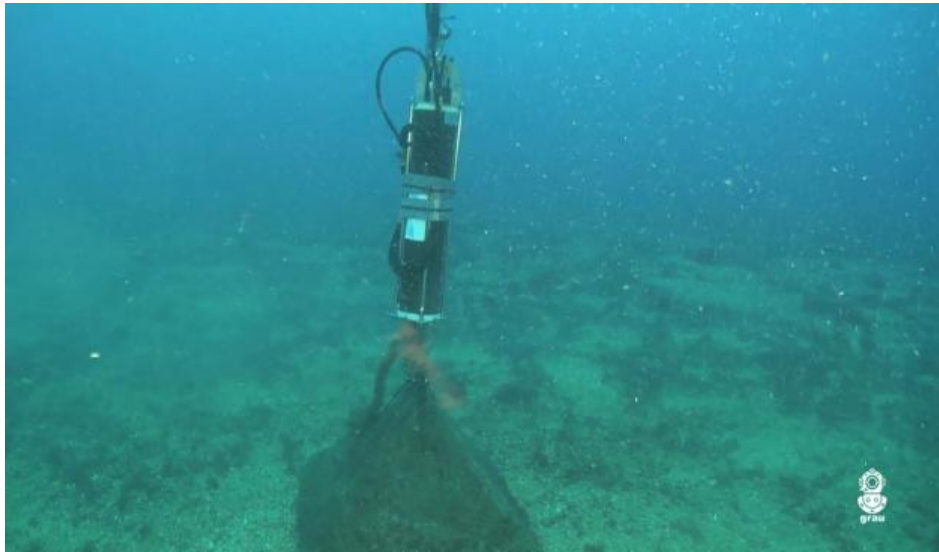


Illustration 34. Hydrophone installation

Monitoring meteorological and oceanographic conditions



Illustration 35. Photo of the ADCPs

Two acoustic current profilers (ADCPs) were installed in the proximity of the platform to measure wave and marine current conditions. The first one was installed in October and the second in November. Once the instruments are recovered, the data will be analysed.

At the same time, wave action was monitored using the data from the Puertos del Estado buoy (Las Palmas Este).

Wind (intensity and direction) was monitored with the ODAS oceanographic buoy installed at the test bed and from the Port of Las Palmas meteorological station.

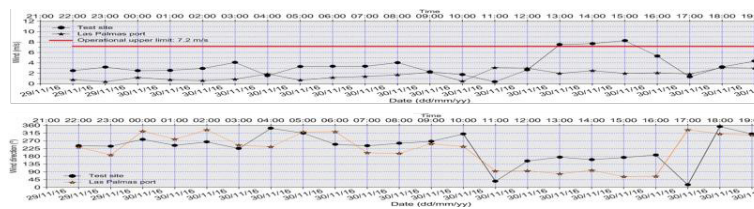


Illustration 37. Wind data graph

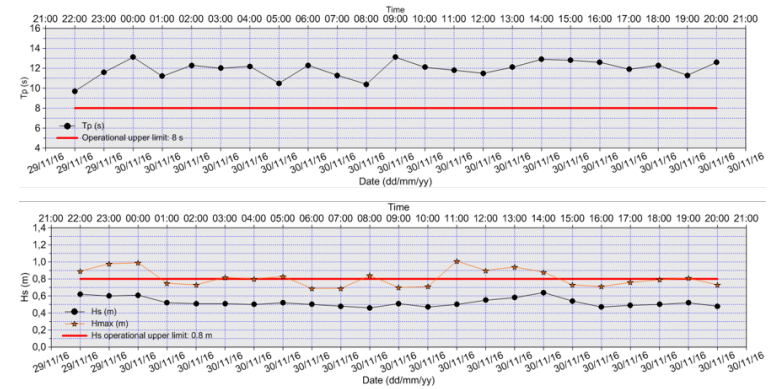


Illustration 36. Wave data graph

CHARACTERISATION ASSOCIATED WITH SPECIFIC PROJECTS

IECOM/REDSUB Project

The objective of the IECOM/REDSUB Project is to install and run a submarine electricity and communications network on the test bed. The two submarine cables are planned to run through an area that contains isolated specimens of the alga *Avrainvillea canariensis*, classed as “of interest for Canary Island ecosystems” according to the Canary Island catalogue of protected species (Act 4/2010, 4th of June: *Canary Island Catalogue of Protected Species*). This classification includes species that, while not endangered (“in danger of extinction” and “vulnerable”), deserve particular attention because of their ecological importance in area of the Canary Island Network of Protected Natural Spaces or the Natura 2000 Network. Thus, the protection of these species is only applicable within the spaces of the Canary Island Network of Protected Natural Spaces and the Natura 2000 Network, and is not therefore applicable in the case of the PLOCAN test bed.



Illustration 38. *Avrainvillea canariensis*

The area of interest was mapped using submarine video transects, in order to study the density of *Avrainvillea* specimens.

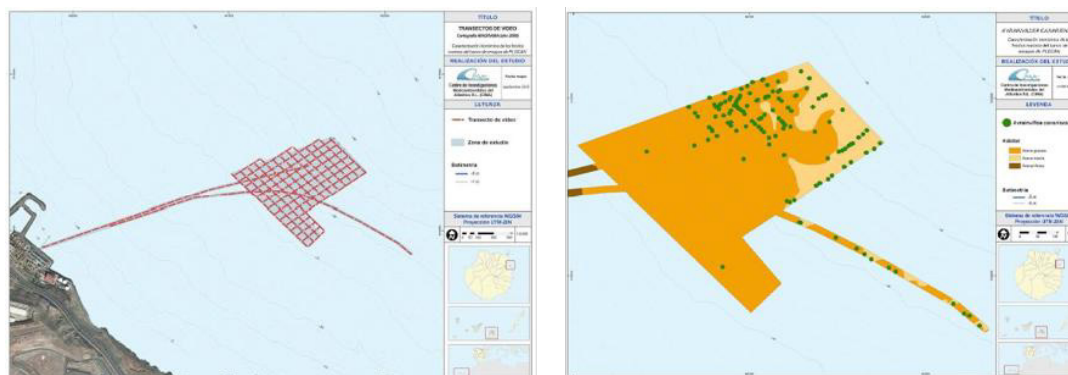


Illustration 39. Route of the cables and the area mapped

ELICAN Project

The objective of the ELICAN Project, co-ordinated by ESTYECO, is to install a prototype marine wind turbine on the test bed. This prototype will rest on the seabed at a depth of 28m, and with a tower rising up 80m above sea-level. ESTEYCO performed an environmental impact study on the project with the environmental information provided by PLOCAN. The environmental assessment concluded that the project does not have a significant impact. The environmental document proposes a detailed environmental surveillance plan that will be rolled out once the prototype has been installed. The technical plans and the environmental impact study were filed with the Ministry of Industry, Energy and Tourism (MINETUR) for their authorisation, and also with the Ministry of Agriculture, Food and the Environment (MAGRAMA) for environmental approval. At the end of 2016, the project was being processed using the simplified procedure (appendix II of the Environmental Assessment Act, Act 21/2013).

WIP10+ Project

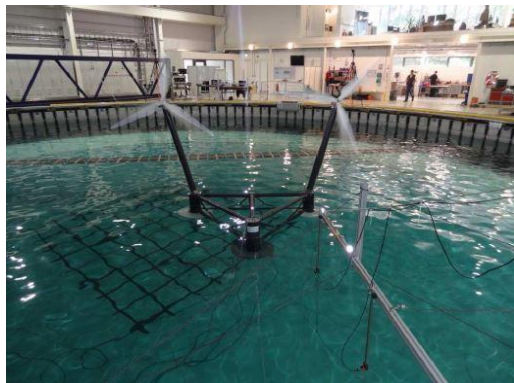


Illustration 42. Small-scale (1:40) prototype tested in the Edinburgh University tank

The WIP10+ (Wind integrated platform for 10+ MW power per foundation) Project is co-ordinated by Spanish company ENEROCEAN. Its objective is to build and test a floating platform that combines wind and wave energy. The 1:6-scale prototype will be installed on the PLOCAN test bed at the end of 2017. In 2016, an environmental assessment was made of the prototype, in order to assess its feasibility on the PLOCAN test bed. The conclusion was that it would not have a significant impact.

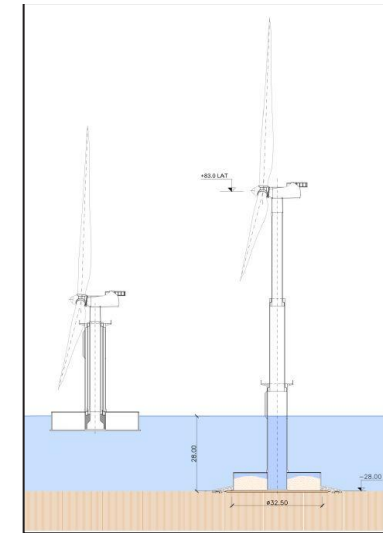


Illustration 41. ELICAN Prototype

e. OCEAN OBSERVATORY

On the one hand, it comprises the ESTOC (Canary Island European Oceanic Time Series Station) strategically situated at latitude 29°10'N and longitude 15°30'W and participates in seasonal campaigns. It is located in deep water, close to the up-welling, in a terminal region of the arrival of intermediate waters and in the Eastern part of the North Atlantic sub-tropical gyre. The ESTOC observatory currently consists of an oceanographic buoy and a mooring line. Both the electronic system and the design of the mooring were developed by PLOCAN staff. The observatory is anchored at a depth of 3610m with four observation levels: an atmospheric level (3m above the surface of the sea) and three oceanic levels (surface, 100m and 150m). The deployment of this mooring allows PLOCAN to measure atmospheric and oceanographic variables in real time (hourly resolution) at sea, which are transmitted in real time by satellite. At atmospheric level, the measurements taken are air pressure, air temperature, relative humidity, velocity and direction of the wind, precipitation and photosynthetically-active solar radiation. At the surface of the water column, hydrographic variables are measured, such as temperature, salinity, along with bio-chemical variables like dissolved oxygen, chlorophyll and pH. At sub-surface levels, hydrographic readings are also taken for temperature, salinity and currents, along with bio-chemical variables like dissolved oxygen, chlorophyll, turbidity and nutrients. The sub-surface observations will become available once the mooring is recovered.

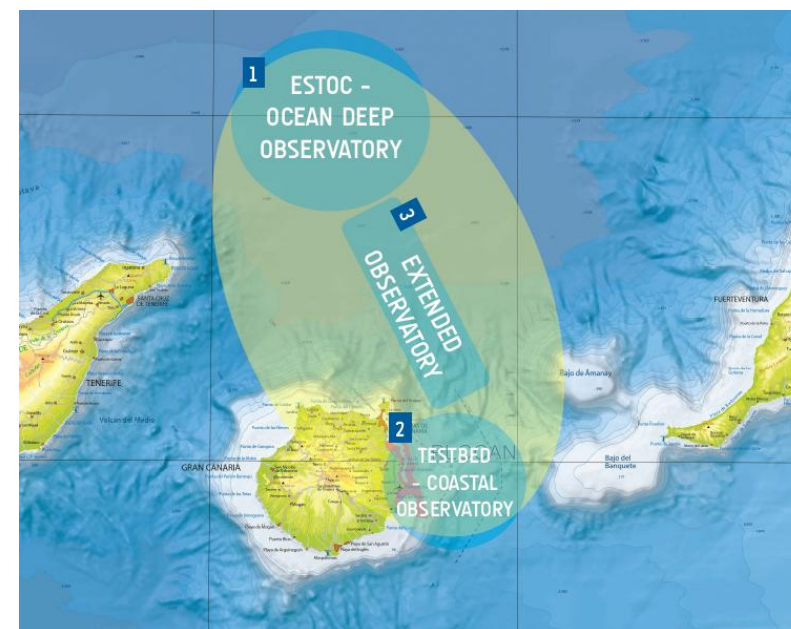


Illustration 43. PLOCAN deep water observatory

Two oceanographic campaigns were carried out at the ESTOC observatory in 2016, the first in February and the second in October. Both campaigns were conducted aboard the Spanish Oceanographic Institute's oceanographic ship *Ángeles Alvariño*. Both campaigns included maintenance of the surface buoy, the mooring and a discreet sampling in which data were taken of the water column using a CTD rosette to take samples of oxygen, carbon dioxide, nutrients (nitrate, silicate and phosphate), salinity, chlorophyll "a" and pigments.

During the first campaign, adverse weather conditions prevented maintenance work from being done on the buoy mooring, which had been in operation since October 2015. So, the only maintenance done was on the surface part. A NOAA (U.S. National Oceanic and Atmospheric Administration) drifter buoy was launched and 6 XBTs (bathy-thermography) units were also launched during the voyage from the ESTOC position to the Port of Las Palmas at regular, equidistant intervals.



Illustration 44. Loading the ESTOC buoy on board

At the beginning of June, the positions received were outside of the buoy's safety rotation diameter because the mooring line had broken and the buoy had started to drift. The buoy was recovered without any problem, which was not the case of the sensors situated at a depth of 150 metres.

During the October campaign, as part of the FixO₃ Project, and having participated in the ESTOC infrastructure in the TNA (trans-national access) calls for projects, the components proposed in the two projects approved in the call were moored. Both projects have an estimated execution period of one year at the ESTOC station.

In early December, the buoy broke loose once again and started to drift, but all the sensors moored at 80m, 100m and 150m were recovered.

All the real time and delayed data obtained from both the ESTOC mooring and the gliders on missions to ESTOC have been made available to users on the FixO₃ project web site, once they had been through quality control.



f. SUBMARINE VEHICLE AND INSTRUMENT BASE (VIMAS)

The submarine vehicle and instrument base includes gliders and ROVs (*Remotely Operated Vehicle*), along with two support vessels. PLOCAN UNO is a vessel adapted to the specific needs of PLOCAN like transporting containers and oceanographic operations. It is 11.84m long and has a 20m² work deck. PLOCAN DOS is 5.20m long and it is used as an auxiliary vessel in small operations in the area between La Isleta and Gando peninsulas.

PLOCAN also has other, highly-specialised equipment, such as:

Platform: ASV
Mod. Sailbuoy
Year: 2016
Serial Number: 1605
Payload: NB-CTD,
Optode-DO, C-3
(Chlorophyll, HC and
Turbidity), Airmar Met-
station.
Manufacturer: Offshore
Sensing (Norway)



Platform: ASV
Mod. Wave Glider SV2
Year: 2016
Serial Number: 3051
Payload: SBE-CTD,
Optode-DO, PAM-SAI,
Airmar Met-station.
Manufacturer: Liquid
Robotics (USA)



Platform: LARS (Launch
and Recovery System)
Mod. LITE compact
Year: 2015
Serial Number: 18846
Manufacturer: POMMEC
(Netherlands)



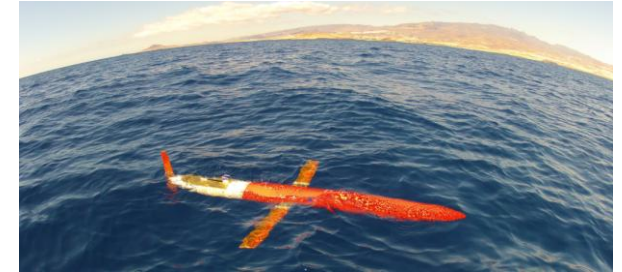
Platform: Underwater
glider
Mod. SLOCUM G2-Deep
(1000 m.) Hybrid
Year: 2014
Serial Number: 492
Payload: SBE-CTD,
Optode-DO, Wetlabs puck
Chl-A and Turb.
Manufacturer: Teledyne
Webb Research (USA)



Platform: Underwater glider.
 Mod. SLOCUM G2-Deep (1000 m.)
 Year: 2010
 Serial Number: 196
 Payload: SBE-CTD, Optode-DO, Wetlabs Puck Chl-A/Turb and Doppler RDI
 Manufacturer: Teledyne Webb Research (USA)



Platform: Glider profiler
 Mod. SPRAY Deep-1000
 Year: 2007
 Serial Number: 501
 Payload: SBE-CTD, SBE-DO, SeaPoint Chl-A and Turb.
 Manufacturer: Bluefin Robotics (USA)



Platform: ROV
 Mod. Seabotix Vlbv-950 (950 m.)
 Year: 2014
 Serial Number: EBR-1000-0614-066
 Payload: Bowtech camera HD b/n, Bowtech camera HD color, Triton Micron MK3 sonar, arm 2F.
 Manufacturer: Seabotix (USA)



Platform: ROV
 Mod. Praesentis Blipper-AT (150 m.)
 Year: 2006
 Serial Number: BL-005
 Payload: HD colour camera
 Manufacturer: Praesentis (Spain)
 NOTE: discontinued



Platform: Pressure chamber
 Mod. IB-180
 Year: 2015
 Manufacturer: IBERCO (Spain)



3. ORGANISATIONAL STRUCTURE (GOVERNING BODIES AND COMMITTEES)



Illustration 45. Organisational structure of the Consortium

The **Strategic Council** is the maximum body of governance and administration of the Consortium, comprised of the chairperson, deputy chair and council members. The posts of chair and deputy chair rotate and alternate for a two-year period between MINECO and the Government of the Autonomous Region of the Canary Islands (CAC). Members represent the MINECO and the CAC. The secretary, appointed by the Strategic Council, attends meetings, as does the director of the infrastructure.

The competences of the Strategic Council include setting the guidelines and general framework for running the project, setting the rules, guidelines and general criteria for the actions and operations of the Consortium, approving the management performance concerning compliance of its purposes and adopt the annual Consortium budget, the annual accounts and the liquidation of the matured budget, at the proposal of the executive committee. The chair of the Strategic Council is the highest representative of the Consortium.

The composition of the Strategic Council in 2016 was as follows:

CHAIRWOMAN

María Luisa Castaño Marín, Director General of Innovation and Competitiveness of MINECO

DEPUTY CHAIR

Manuel Miranda Medina, Director General of ACIISI

MEMBERS

José Ignacio Doncel Morales, Deputy Director General of Major Scientific-Technical Facilities

José Ramón Urquijo Goitia, Deputy Chairman of Organisation and Institutional Relations of CSIC

Eduardo Balguerías Guerra, Director of the Spanish Oceanography Institute

Adrián Mendoza Grimón, Deputy Minister of Industry, Energy and Trade of the Canary Island Regional Government

Luis Padilla Macabeo, Deputy Minister of the Treasury and Planning

José Miguel Barragán Cabrera, Deputy Minister of the President's Staff

The **Executive Board** is a governing body created to monitor and execute the activities of the Consortium, comprising four representatives of the CAC, at least one of whom must sit on the Strategic Council, and four representatives of the MINECO, at least one of whom must also sit on the Strategic Council. The posts of chair and deputy chair of the Committee shall alternate with the same frequency as the Strategic Council, bearing in mind that both bodies cannot be chaired by the same institution at the same time.

The Executive Board is the body responsible for putting the draft annual budget for the Consortium, along with the annual accounts and the liquidation of the matured budget, the draft annual action plan and projects and the scientific programme to be implemented in the infrastructure, to the Strategic Council for approval. The latest composition of the Executive Board in 2016 is shown below.

CHAIRMAN

Manuel Miranda Medina, Director General of the ACIISI

DEPUTY CHAIRMAN

José Ignacio Doncel Morales, Deputy Director General of Major Scientific-Technical Facilities

MEMBERS

Eladio Santaella Álvarez, Advisor from the Directorate General of the Spanish Oceanographic Institute

Ana Aricha Yanguas, Department Head, Department of Major Scientific-Technical Facilities

Eric Desmond Barton, Research Professor, OPIS, reporting to the CSIC Institute of Marine Research

Carlos Gustavo Díaz Perera, Director General of Planning and Budget

Ciro Gutiérrez Ascanio, Director General of Universities

Antonio López Gulías. Head of the area of co-ordination and relations with Research, Innovation and Information Society, ACIISI

The **Socio-economic Advisory Committee (CASE)**, as it is known in Spanish) is an advisory body to the Consortium whose mission is to advise on PLOCAN's activities, scientific and technological programmes and plans and propose future actions that can focus the Consortium's work on contributing to the sustainable socio-economic development of oceanic activities.

The CASE is formed by a group of people of acknowledged prestige in socio-economic fields relating to the purposes and activities of the Consortium. The functions of the CASE include drafting an advisory report once every four years on the future opportunities, prospects and capabilities of the centre. This report is presented to the Strategic Council to help them in the strategic orientation of the centre.

The composition of the CASE in 2016 was as follows:

Chairman:

José Regidor García. Rector of the ULPGC (University of Las Palmas de Gran Canaria).



Members:

Rafael Rodríguez Valero. Director general of the Merchant Navy
Andrés Hermida Trastoy. Director general of Fisheries Planning
Vicente Marrero Domínguez. Chairman of the Canary Island Maritime Cluster
Miguel Montesdeoca Hernández. Chairman of the Canary Island Engineering Cluster
Fernando Redondo Rodríguez. Chairman of the Canary Island Economic and Social Council
Antonio Sánchez Godínez. Rear Admiral engineer, director of naval constructions of the Ministry of Defence

Secretary:

Arturo González Romero. Director general of the INNOVAMAR Foundation

The **Scientific and Technical Advisory Committee (COCI)** is the other advisory body to the Consortium. Its objective is to advise on PLOCAN's activities, scientific and technological programmes and plans, propose future actions that can enhance the quality and scope of the work done and design and propose access to the platform for external scientists and to make the final selection of these.

The COCI is made up of people of acknowledged international prestige in fields relating to the purposes and activities of the Consortium. Its members were appointed by the Strategic Council, at the proposal of the institutions that form part of the Consortium.

The functions of the COCI include drafting a report once every four years on the future opportunities, prospects and capabilities of the centre, which is presented to the Strategic Council to help them in the strategic orientation of the centre.

The composition of the COCI in 2016 was as follows:

Chairman:

Prof Gerold Wefer. Professor of the University of Bremen.

Members:

Enrique Álvarez Fanjul, Head of the Area of Knowledge of the Physical Environment of Puertos del Estado (State Port Authority).
María Soledad Izquierdo López, Professor of the University of Las Palmas de Gran Canaria.
Dr Alicia Lavín Montero, Researcher from the Santander Oceanographic Centre (IEO).

Prof Chris Barnes, Professor of the University of Victoria (Canada).

4. PEOPLE IN PLOCAN

At 31 December 2016, the PLOCAN team was comprised of forty-six people. Thirty were full-time staff, eight were hired on R+D+i project contracts and eight people belong to the training and internship plan. The diagram below shows the internal organisational structure of the Consortium, with three distinct areas in which the Consortium staff are divided.

Furthermore, as shown in the illustration, the organisation has a support group reporting to the socio-economic area. This group is made up of staff from the former Canary Island Marine Sciences Institute that the Canary Island Government has temporarily brought under the umbrella of PLOCAN as support in these early stages of creating the infrastructure against a backdrop in which it has been impossible to hire people at the rate the project initially envisaged.

The illustrations below offer information about the PLOCAN staff (they do not include the support group).



Illustration 46. Organisational structure

The graph shows the age distribution of the PLOCAN staff at the end of 2016. Most of the staff fall in the thirty-five-thirty-nine age group.

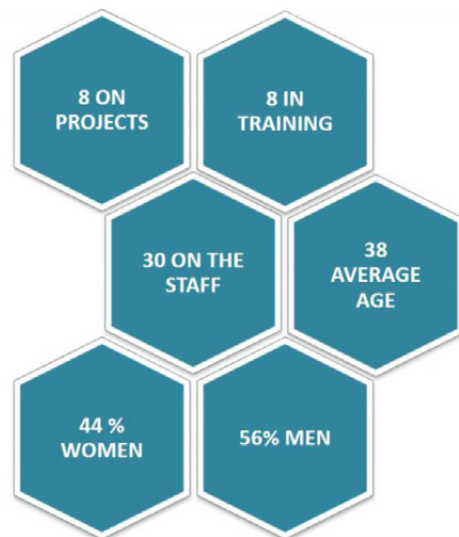


Illustration 47. People in PLOCAN (end of 2016)

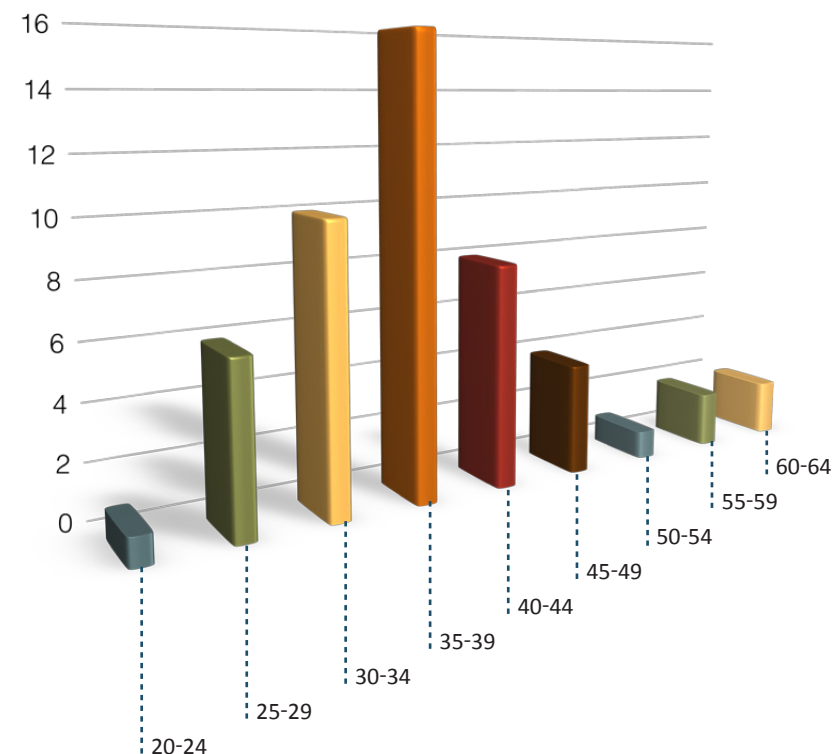


Illustration 48. Age distribution of the staff

The graphs below show the person/month ratio at the end of 2016 at the different organisational levels (staff members), and the person/month ratio of personnel hired on project contracts and Consortium staff. Internship and fellowship contracts are not included.

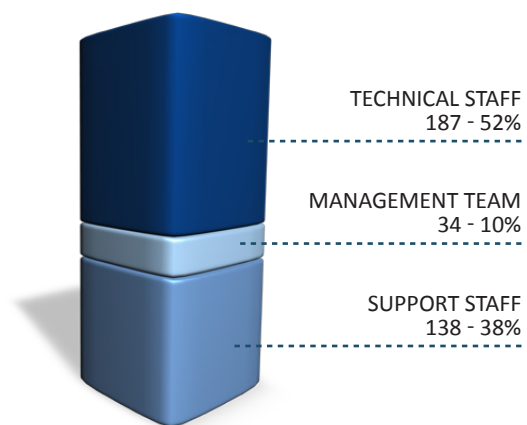


Illustration 49. Person/month units at the different staff levels of the organisation

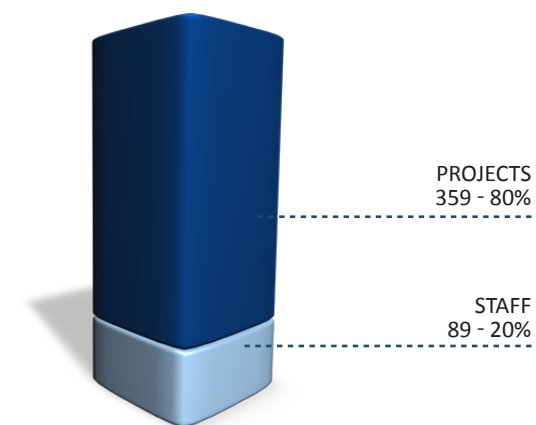


Illustration 50. Person/month units for staff and on project-based contracts

A total of 17 training course have been given, either externally or in PLOCAN, in 2016 for PLOCAN staff. The table below summarises the training actions received by PLOCAN staff

Training Course	Month start	Nº Participants	Nº Hours
Introduction to the Arduino Uno board	January	15	8
<i>Wave Glider vehicle</i>	January	8	16
<i>Sailbuoy vehicle</i>	February	8	32
Wind power and the market	March	2	8
<i>Web of Science</i> - Basic	March	10	2
<i>Web of Science</i> - Advanced	March	9	2
Health and Safety	April	10	60
3D Printer	April	10	3
H2020 Project Management	July	1	16
Professional Drone Pilot	September	1	70

Major Turn-Key Projects	July	1	65
Cloud Administration and Security	October	5	4
Customs Procedure	November	6	12
From stage fright to speaking in public	November	1	10
Microsoft Office PowerPoint	November	19	20
File System	December	4	4
Sediment Traps	December	9	10

At the same time, in 2016, there were 16 training/educational talks in the PLOCAN facilities for the staff, most of which were given by partner entities.



Illustration 51. Training talk in PLOCAN

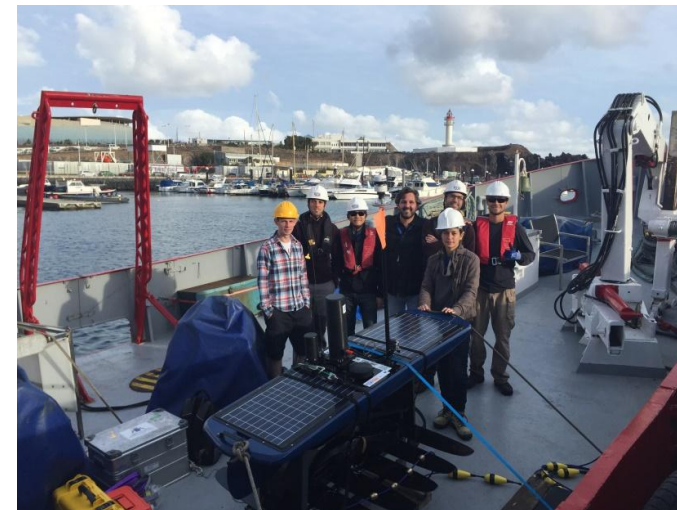


Illustration 52. Waveglider course

5. JOBS IN PLOCAN

There were only 3 job vacancies advertised in 2016. Candidates presented their applications through an app set up for the purpose that included all the information necessary to assess their candidacies.

The graphs analyse the proportion of men and women who sent in applications and the gender of the successful candidates.

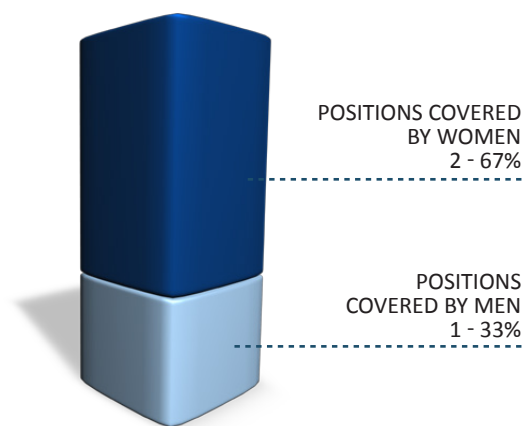


Illustration 54. Proportion of men and women who won the contracts on offer

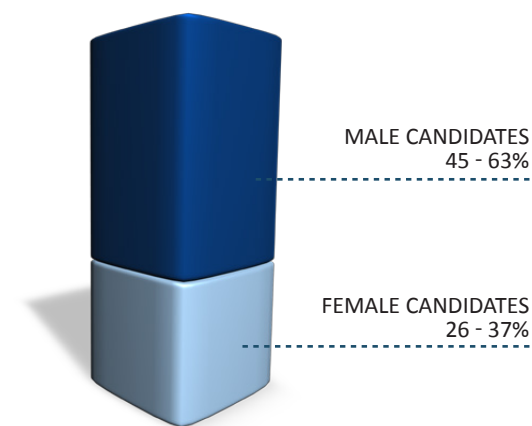


Illustration 53. Proportion of men and women who presented applications

6. PROJECTS CARRIED OUT

At the end of 2016, PLOCAN was managing a total of 23 projects. The constant drive to present projects for European and national calls for projects has put PLOCAN among the international public and private scientific-technical Community, generating an extensive network of partners of many different nationalities. The following graphs provide information on the active project partners in 2016 according to their origin, kind of institution and partners by specific project.

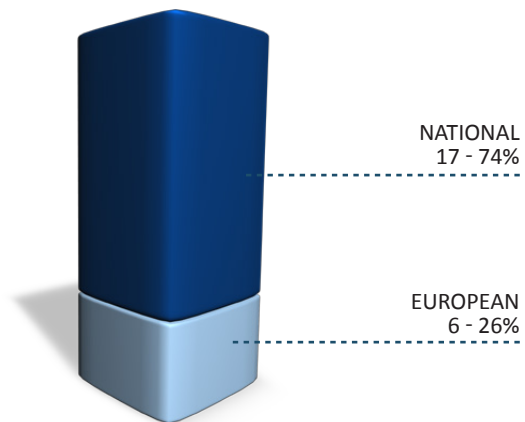


Illustration 55. Classification of projects by their source of funding

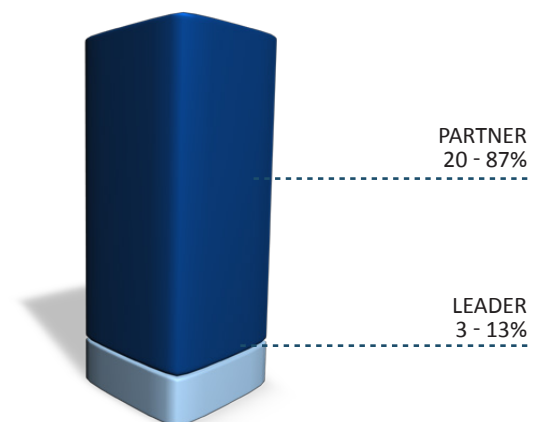


Illustration 56. PLOCAN's role in the projects in course in 2015

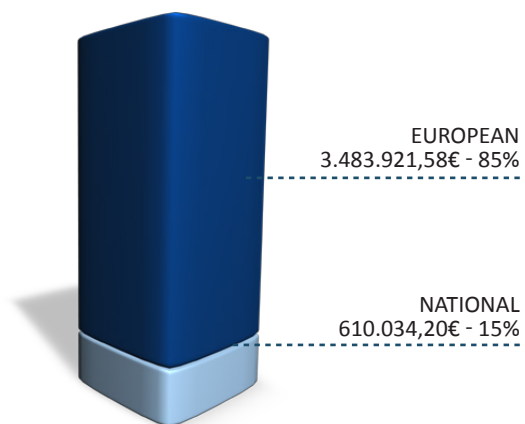


Illustration 57. PLOCAN funding from projects

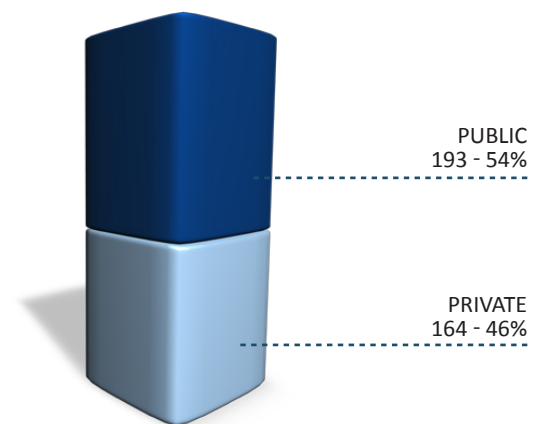


Illustration 58. Project partners by kind of organisation

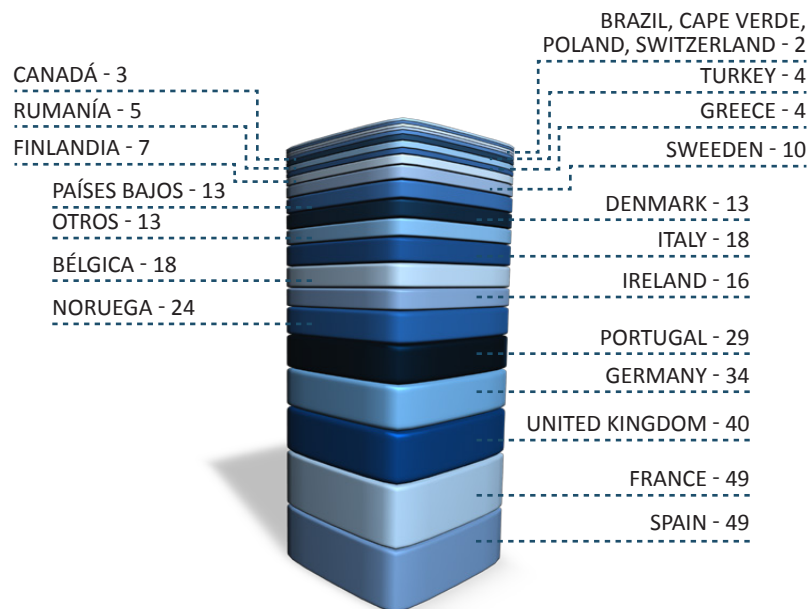


Illustration 6o. Project partners by countries

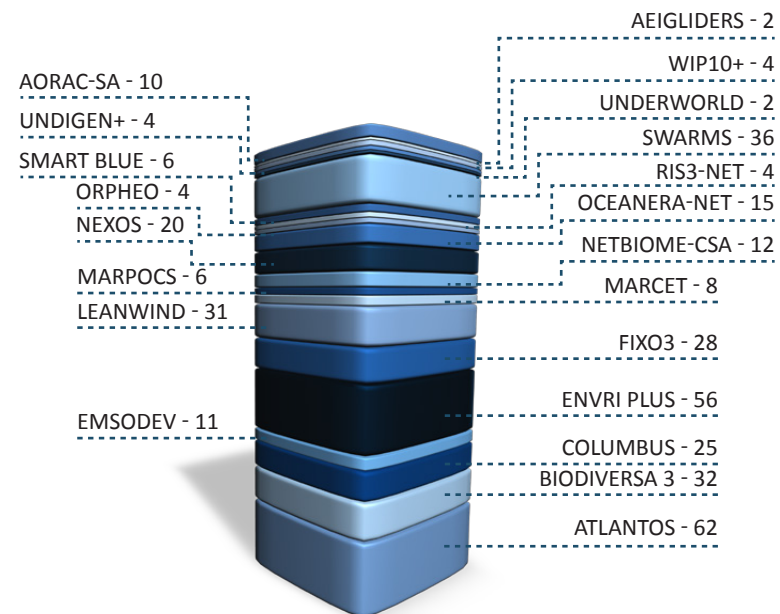


Illustration 59. Project partners by specific project



Illustration 61. World-wide distribution of project partners

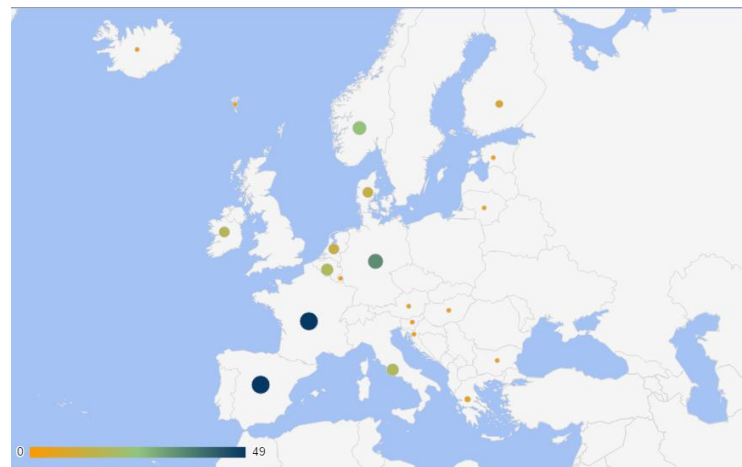


Illustration 62. European distribution of project partners

The list and description of projects managed by POCAN in 2016 (in alphabetical order), together with a brief summary of the most important activities carried out for each of them, is below:

AEIGLIDERS

Installing spectro-photometric pH sensors in un-manned autonomous vehicles (Gliders)

Origin of funding: Agrupaciones Empresariales Innovadoras (AEI) 2015

Participation: Partner

Starting and ending date: 01/03/2015-31/03/2016

Total project funding: 47.410,00 €

Funding for PLOCAN : 15.654,00 €

Percentage of external funding: 70 %

The project consists of adapting the SP200 family of spectro-photometric pH sensors to be installed and operate in both surface and submarine gliders. The spectro-photometric pH sensors were developed by Sensorlab SL as highly accurate devices, designed for measuring pH in open waters over periods of several months without the need to calibrate or maintain them. They are mainly used for monitoring climate change.

The solution is to install the pH sensors in un-manned autonomous vehicles, as this allows for much more frequent campaigns and at a far lower cost than conventional oceanographic campaigns.

The project has two major objectives:

- To adapt the technical characteristics of the sensors so that they can be used in un-manned vehicles
- To reduce the cost of the sensors, so that they are more competitive in the market and also to be able to enter into other applications.

The new range of sensors will open up new business opportunities, on the one hand because it will be possible to use them in new applications and on the other because new clients will discover them through the marketing done by the manufacturers of the gliders. There are currently no pH sensors installed in gliders anywhere in the world and there is certainly interest among the scientific community.

The AEIGLIDERS project came to an end on the 31st of March. The main results obtained from the project are as follows:

- ▶ Development of an improved version of a pH sensor
- ▶ Design and sizing of a mechanical-electronic system to integrate the pH sensor on Wave Glider
- ▶ Laboratory tests and checking the stability and reproducibility of the pH sensor measurements
- ▶ Seawater tank trials to assess the response of the pH sensor in more realistic conditions
- ▶ Mechanical and electronic integration of the pH sensor on Wave Glider

The project included dissemination actions such as those done as part of the Glider School held in the PLOCAN facilities, working sessions on Waveglider, taking part in Oceanology International, presenting an article for the MARTECH 2016 conference and taking part in the Espejo Canario radio programme in March.



IMPROVING OCEAN-GLIDER'S PAYLOAD WITH A NEW GENERATION OF SPECTROPHOTOMETRIC PH SENSOR

C. Almisas, C. Barrera, C. Waldmann, H. Precheur and S. Meckel.

Abstract: Ocean gliders have clearly become nowadays useful autonomous platforms addressed to measure a wide range of seawater parameters in a more sustainable and efficient way. This new ocean monitoring approach has implied the need to develop smaller, faster and more efficient sensors without reducing key features like accuracy, resolution, time-response, among others, in order to fit the glider operational capabilities. This work is aiming to present the latest development stages of a new spectrophotometric pH sensor, its integration process into a Wave Glider SV3 platform and the preliminary results derived from an offshore mission performed in subtropical waters between the Canary Islands and Cape Verde archipelagos.

Keywords: Glider, ASV, sensor, ocean, marine.

I. INTRODUCTION

The overall goal of this challenging initiative is to improve ocean-observations capacity in the area of interest by using cutting-edge technologies in a cooperative and synergistic way between partners from different disciplines, by using new and existing resources provided by ongoing projects and initiatives at regional, national and international level, in order to cover the widest number of specific and common needs and requirements from each one of them, as well as additional stakeholders joining the initiative at a later stage.

The work is done in the framework of H2020 AtlantOS EU-Project. It is a BG 9 (Developing in-situ Atlantic Ocean Observations for a better management and sustainable exploitation of the maritime resources) research and innovation project that proposes the integration of ocean observing activities across all disciplines for the Atlantic, considering European as well as non-European partners, such as The Oceanic Platform of the Canary Islands (PLOCAN) and the Center for Marine Environmental Sciences (MARUM).

PLOCAN is a Research Infrastructure labelled by the ICTS (Unique Scientific and Technological Infrastructure) Spanish National Roadmap. It is a multi-purpose 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. The main purpose of MARUM is achieving a better understanding of key processes in the marine environment in order to provide information for sustainable use of the ocean. MARUM studies past and present environmental changes from coast to deep ocean at a global scale. Processes at and below the sea-floor are a special research focus.

II. MATERIALS AND METHODS

To achieve these objectives, PLOCAN and MARUM have explored the operational capabilities of the Wave Glider SV3 manufactured by the company Liquid Robotics to use the platform as a test-bed for new sensor developments, always in line with the end-user's goals for every single mission.

These autonomous surface vehicles are the best option to perform this task, as base their propulsion on external factors such as wave motion, its real-time communication availability, it is always visible on the sea surface so always ready to transmit and receive satellite communications and it is equipped with solar panels, this way the vehicle can power all its systems and payloads by this mean [1].

The surface part (Fig. 1) is a versatile platform equipped with GPS, Iridium satellite communication systems and payloads with state-of-the-art ocean sensors to monitor the environment around it. On this occasion, the sensor installed in there is the Turner C3 fluorometer to measure chlorophyll, turbidity and oil data. The sub part of the glider is tethered under the sea by a 6 m umbilical cable. It has articulated wings that vary its position with the sea motion propelling the vehicle so it does not need refuelling and is fully free of emission, encouraging the use of sustainable energy [2].



Fig. 1. Wave Glider SV3 around PLOCAN facilities.

A submarine payload has been developed to integrate a set of brand new basic sensors. It is enclosed in a custom subsea housing, physically attached to the Wave Glider sub part and is powered and communicates with the float through the Wave Glider umbilical cord. It has neutral buoyancy and has been designed to minimize drag (Fig. 2).



Illustration 63. Working session with Waveglider in the AEIGLIDER project

The project completed its execution phase on 31 March.

Illustration 64. Article presented at MARTECH 2016

AORAC-SA

Atlantic Ocean Research Alliance Support Action

Origin of funding: H2020-BG-2014-1 / BG-14-2014

Participation: Partner

Starting and ending date: 01/03/2015-29/02/2020

Total project funding: 3.447.000,00 €

Funding for PLOCAN: 247.000,00 €

Percentage of external funding: 79,36 %

The Atlantic Ocean Research Alliance Coordination and Support Action (AORAC-SA) is designed to provide scientific, technical and logistical support to the European Commission in developing and implementing trans-Atlantic Marine Research Cooperation between the European Union, the United States of America and Canada. The Coordination and Support Action (CSA) is carried out within the framework of the Atlantic Ocean Research Alliance as outlined in the Galway Statement on Atlantic Ocean Cooperation (May 2013). Recognising the evolving nature of the Atlantic Ocean Research Alliance, the hallmark of this proposal is that it is flexible, responsive, inclusive, efficient, innovative, value-adding and supportive.

To support the Commission in negotiations with the USA and Canada on trans-Atlantic Ocean Research Cooperation, the AORAC-SA support and governance structure comprises a Secretariat and Management Team, guided by a high-level Operational Board, representative of the major European Marine Research Programming and Funding Organisations as well as those of the USA and Canada. This structure is further able to draw on significant marine research expertise and experience through its partner organizations.

The CSA, reporting to the Commission representatives of the Atlantic Ocean Research Alliance, will be responsible for the organisation of expert and stakeholder meetings, workshops and conferences required by the Atlantic Ocean Research Alliance and related to identified research priorities (e.g. marine ecosystem-approach, observing systems, marine biotechnology, aquaculture, ocean literacy, seabed and benthic habitat mapping), support actions (e.g. shared access to infrastructure, dissemination and knowledge transfer, establishment of a knowledge sharing platform) and other initiatives as they arise, taking into account related Horizon 2020 supported trans-Atlantic projects (e.g. BG1, BG8 and BG13) and on-going national and EU collaborative projects (e.g. FP7).

PLOCAN co-ordinates WP5 on ocean observation. As part of this work package, a list of institutions, infrastructures and initiatives identified in the global Atlantic context was drawn up on oceanic observation that will make for a more efficient approach for managing and identifying potential co-operation among members states of the Atlantic alliance in the future.

The main project dissemination actions were carried out as part of the following events:

- ▶ Fifth meeting of the international Atlantic Seabed Mapping (ASMIWG) working group held in Ireland (Galway) in June
- ▶ Third annual stakeholders' conference of the Atlantic Strategy (Promoting Enterprise and innovation in the Atlantic area) held in September in Ireland (Dublin). The project was given the Atlantic Project Award by the European Commission and the Atlantic Strategy Group. This award is for excellent success achieved by projects in the target geographic zone of the Atlantic Strategy.



- ▶ Twenty-ninth meeting of international research ship operators (IRSO) held in Italy (Capri) in October.
- ▶ Scientific-technical seminar of the AtlantOS project (for an Atlantic Sustained and Integrated Autonomous In-situ Observing System) held jointly with the AORAC Project in the PLOCAN facilities in Gran Canaria in November



Illustration 65. Project dissemination leaflet



Illustration 66. Third annual stakeholders' conference of the Atlantic Strategy



Illustration 67. Participants in the V meeting of the Atlantic Seabed Mapping International Working Group (ASMIWG)

ATLANTOS

Optimizing and Enhancing the Integrated Atlantic Ocean Observing System

Origin of funding: H2020-BG-2014-2 / BG-08-2014: Developing in-situ Atlantic Ocean Observations for a better management and sustainable exploitation of the maritime resources

Participation: Partner

Starting and ending date: 01/04/2015-30/06/2019

Total project funding: 20.652.921,00 €

Funding for PLOCAN: 502.231,25 €

Percentage of external funding: 100 %

The overarching objective of AtlantOS is to achieve a transition from a loosely-coordinated set of existing ocean observing activities to a sustainable, efficient, and fit-for-purpose Integrated Atlantic Ocean Observing System (IAOOS), by defining requirements and systems design, improving the readiness of observing networks and data systems, and engaging stakeholders around the Atlantic; and leaving a legacy and strengthened contribution to the Global Ocean Observing System (GOOS) and the Global Earth Observation System of Systems (GEOSS). AtlantOS will fill existing in-situ observing system gaps and will ensure that data are readily accessible and usable. AtlantOS will demonstrate the utility of integrating in-situ and Earth observing satellite based observations towards informing a wide range of sectors using the Copernicus Marine Monitoring Services and the European Marine Observation and Data Network and connect them with similar activities around the Atlantic.

AtlantOS will support activities to share, integrate and standardize in-situ observations, reduce the cost by network optimization and deployment of new technologies, and increase the competitiveness of European industries, and particularly of the small and medium enterprises of the marine sector. AtlantOS will promote innovation, documentation and exploitation of innovative observing systems. All AtlantOS work packages will strengthen the trans-Atlantic collaboration, through close interaction with partner institutions from Canada, United States, and the South Atlantic region. AtlantOS will develop a results-oriented dialogue with key stakeholders communities to enable a meaningful exchange between the products and services that IAOOS can deliver and the demands and needs of the stakeholder communities. Finally, AtlantOS will establish a structured dialogue with funding bodies, including the European Commission, USA, Canada and other countries to ensure sustainability and adequate growth of IAOOS.

In April, a glider was launched in the Waters of the archipelago of Madeira by a group of PLOCAN specialists, in collaboration with scientists and technicians from the Madeira Oceanic Observatory (OOM) and the Portuguese Navy's Hydrographic Institute, aboard the Portuguese Navy vessel NRP-Zaire.



Illustration 68. Glider starting its mission in Madeira waters

The initiative, part of the European AtlantOS-H2020 project, was a regional contribution to international and European oceanic observation programmes and strategy in the Atlantic, organised via the Marine-Maritime Monitoring Network of Macaronesia (R3M).

The main objective of the mission was to collect bio-geo-chemical data from the water using temperature, salinity, dissolved oxygen, pigment (chlorophyll) and particles in suspension (turbidity) sensors between the surface and the first thousand metres of the water column, along a section of approximately 500 nautical miles running between the archipelagos of Madeira, the Salvagens and the Canary Islands.

Co-ordinating the project involved attending the Project General Assembly in Kiel, where one of the decisions taken was that PLOCAN would organise the next General Assembly in Gran Canaria. As part of WP3 of the project, a tender has been put out to buy two microCAT sediment

traps, a phytoplankton sensor and several floatation units to be moored at the ESCTOC observatory. In October, a mission was organised to Dakhla with SailBuoy and the first oceanographic buoy was moored in Morocco in co-operation with the Institut National de Recherche Halieutique (INRH). The November ESTOC glider mission was carried out as part of



Illustration 70. Sailbuoy Dakhla mission



Illustration 69. General Assembly of the Atlantos project in Kiel

Atlantos. As part of this work package, in 2016, work was done on an observation mission in co-operation with MARUM Center for Marine Environmental Sciences to install pH, CTD, oxygen sensors and a fluorometer on Wave Glider SV-3.

As part of WP6 a joint workshop was organised with the AORA-CSA Project held in the PLOCAN facilities (atlanticworkshop.plocan.eu).

The projects' dissemination/education actions were carried out in the framework of the Glider School 2016, the EGO Meeting 2016 and the AtlantOS-AHORA-CSA2016 workshop.

BIODIVERSA₃

BiodivERsA₃: consolidating the European Research Area on biodiversity and ecosystem services

Origin of funding: H2020-SC5-2014-one-stage / SC5-09-2014: Consolidating the European Research Area on biodiversity and ecosystem services

Participation: Partner

Starting and ending date: 01/02/2015-31/01/2020

Total project funding: 11.999.980,50 €

Funding for PLOCAN: 132.069,96 €

Percentage of external funding: 34,49 %

The loss of biodiversity and degradation of ecosystems jeopardize the sustainable provision of ecosystem services and are major scientific and societal challenges. Addressing this challenge and providing scientific support to stakeholders and policy makers requires a coherent interdisciplinary research framework, with coordinated strategies and programmes at the national, regional and international levels, which are the relevant scales for many biodiversity issues.

By networking 32 funding agencies from 18 countries, BiodivERsA₃ aims to strengthen the ERA on biodiversity. Building on the previous experiences of the projects BiodivERsA_{1&2} and NetBiome, BiodivERsA₃ will promote and support coordinated pan-European research on biodiversity and ecosystem services. It will strengthen research and research programmes coordination with the ultimate aim to provide policy makers and other stakeholders with adequate knowledge, tools and practical solutions to address biodiversity and ecosystem degradation.

The objectives are to:

- Enhance the capacity of the network to coordinate research programmes on biodiversity and ecosystem services more completely in Europe (including overseas territories) and to increase the international dimension of BiodivERsA activities.
- Develop a strategic, multi-annual vision of the network's priorities, based on ambitious mapping and foresight activities developed in collaboration with key initiatives in the field.
- Design and implement a co-funded call and other joint calls to better integrate research on biodiversity and ecosystem services across Europe.
- Develop a range of other joint activities, in particular alignment of national research programmes for biodiversity and ecosystem services, and activities for promoting mobility and equal opportunities for researchers and reinforcing data sharing.
- Promote effective science-policy and science-society (including sciencebusiness) dialogue during the whole research process



Illustration 71. Project partners at the General Assembly

The project general assembly was held in Budapest, in June 2016. During the year, work was done on the Cofund call for projects with the Belmont Forum on biodiversity scenarios and eco-system services, as well as work on the strategic research and innovation agenda (2016-2020) SRIA. The general assembly resolved to draw up an implementation plan for the next two years and agreed that BiodivERsA would become a JPI-type tool (Joint Programming Initiative). The project newsletter was published in July and distributed in digital format.



Illustration 72. Biodiversa project newsletter

CATAPULTA

La Plataforma Oceánica de Canarias como catalizadora de proyectos innovadores en el ámbito marino

Origin of funding: Programa Estatal de Fomento de la I+D+i Orientada a los Retos de la Sociedad / Acciones de Dinamización "Europa Redes y Gestores"

Participation: Only partner

Starting and ending date: 01/01/2015-31/12/2017

Total project funding: 143.000,00 €

Funding for PLOCAN: 143.000,00 €

Percentage of external funding: 100 %

The main endpoint of the CATAPULTA project is to deploy PLOCAN's potential to win and consolidate international financing to attract marine and maritime R+D+i to Spain and ensure its consolidation here. From a strategic standpoint, this will be aimed at:

- Enhancing the capacity-building and management of the number of proposed projects, for both ICTS users and for the PLOCAN infrastructures in the new European Union Framework Programme Horizon 2020 and other international programmes (COSME, Interreg, Eurostars, etc.)
- Fine tuning and bringing specifications in line with international standards and best practises, to improve the quality of the PLOCAN's Integral R+D+i Project Management System, from conception to rationale.

CATAPULTA will run for 3 years with an estimated starting date of 1st January and finishing on 31st of December 2017. In order to attain the main objective, the project is structured in accordance with the following specific objectives:

1. Develop the area of attracting resources and preparing proposals for international projects for ICTSPLOCAN users
2. Create and roll out a continuous training programme in the European Union's Horizon 2020 Framework Programme and accredit new personnel on an international level in project management
3. Reinforce and optimise the PLOCAN Integral Project Portfolio Management System.

The expected result of these actions is that PLOCAN sees at least a 70% increase in the number of proposals presented to the H202 programme against its participation in the FP7 programme, over the course of the 3 years of the project, both in projects to be hosted by the PLOCAN infrastructure and those aimed at fostering European participation among infrastructure users and that all this translates into at least a 95% increase in proposal approvals.

A new member joined the project team in 2016. At the end of 2016, the team had analysed around 40 funding programmes. They received a total of 9 training actions. The protocol for enhancing the impact on European proposals and their practical guide was drawn up. The team has participated in 12 dissemination events in order to drill deeper in new European funding programmes and to *network* with potential platform users (as this is one of the objectives of the project). It has also taken part in organising two PLOCAN events. The first was the international "Ocean observation and sensors" workshop held in May, which discussed new proposals for calls for projects for the Horizon 2020 Programme. The second is the session of B2B meetings held as part of the SWARMs Project, in which 11 Canary Island SMEs met with over 20 international companies and institutions from the field of robotics and submarine telecommunications. The CATAPULTA team also organised visits by researchers to the work being done on the platform so that they could get to know the facilities and consider possible uses for the platform in future projects.



Illustration 74. Session of B2B meetings



Illustration 73. Infoday H2020 with and for society

COLUMBUS

Monitoring, Managing and Transferring Marine and Maritime Knowledge for Sustainable Blue Growth

Origin of funding: H2020-BG-2014-1 / BG-11-2014: Monitoring, dissemination and uptake of marine and maritime research

Participation: Partner

Starting and ending date: 01/03/2015-28/02/2018

Total project funding: 3.997.488,00 €

Funding for PLOCAN: 49.000,00 €

Percentage of external funding: 100 %

We are standing at the dawn of a century that will be largely affected by how we as a society are able to manage our oceans and their resources. Marine and Maritime Research has a critical role to play in developing our understanding of the seas and advance technology so that we can develop their economic potential in a sustainable manner.

The COLUMBUS project intends to capitalise on the EC's significant research by ensuring accessibility and uptake of research Knowledge Outputs by end-users (policy, industry, science and wider society). COLUMBUS will ensure measurable value creation from research investments contributing to sustainable Blue Growth within the timeframe of the project. Adopting proven methodologies and building on significant past work, COLUMBUS will first identify end-user needs and priorities. It will then set about identifying and collecting "Knowledge Outputs" from past and current EC projects. Rigorous analysis will take place to identify specific applications and end-users. Transfer will be achieved and measured through tailor-made knowledge transfer. All knowledge collected will be made accessible the pre-existing Marine Knowledge Gate.

In March, 57 participants from 36 organisations and 11 countries, including PLOCAN, met in Brussels for the first Blue Society Knowledge Transfer Conference organised by the European Commission COLUMBUS H2020 project. The event is the first of three international annual conferences that will be hosted by COLUMBUS with the common objective of bringing project partners, generators of knowledge and final users together with specialists in knowledge transfer. Bringing these stakeholders together and the associated success stories will allow the knowledge transfer process implemented as part of COLUMBUS to get feedback and ensure that the best practises acknowledged in COLUMBUS with respect to knowledge transfer, are passed on to the interested parties.

Along with Irish company SmartBay, PLOCAN's mission in the COLUMBUS Project is to represent European test beds. The work done on the project in 2016 was limited to attending project meetings and helping to draft "Best practises guide for the industry" (part of WP5). The meeting of the partners was held in Vigo in July. In October, as part of WP7, PLOCAN, along with EuroGOOS (European Global Ocean Observing System) and EMODnet (European Marine Observation and Data Network) took part in organising the event "From the resources available to the public to innovation in the blue economy", held in Brest and designed for small and medium-sized enterprises that develop innovative applications using marine data.

As part of the education/dissemination activities, PLOCAN wrote and published an article in the Magazine Energética XXI, Number 160, in September.



Illustration 76. Article in Energética XXI



Illustration 75. Meeting of partners in Vigo

EMSODEV

EMSO implementation and operation: DEvelopment of instrument module

Origin of funding: H2020-INFRADEV-1-2015-1 / INFRADEV-3-2015: Individual implementation and operation of ESFRI projects

Participation: Partner

Starting and ending date: 01/09/2015-31/08/2018

Total project funding: 4.470.474,00 €

Funding for PLOCAN: 40.000,00 €

Percentage of external funding: 100 %

The EMSODEV (European Multidisciplinary Seafloor and water-column Observatory DEvelopment) general objective is to catalyse the full implementation and operation of the EMSO distributed Research Infrastructure (RI), through the development, testing and deployment of an EMSO Generic Instrument Module (EGIM). This module will ensure accurate, consistent, comparable, regional scale, long-term measurements of ocean parameters, which are key to addressing urgent societal and scientific challenges such as climate change, ocean ecosystem disturbance, and marine hazards. This will result in the increased interoperability of EMSO nodes thanks to the harmonized collection of ocean essential variable time series.

In addition, EGIM will also greatly help optimize the investments and operational efficiency of the EMSO research infrastructure thus improving RI effectiveness and its attractiveness for member states and users, including for industry.

PLOCAN's role in the project is to implement the EGIM module in Canary Island waters, specifically, at the ESTOC station. A proposal was presented in May and at the end of the year is was in the evaluation stage.

In collaboration with participants in the FixO3 project, an article was published on the cost and benefit of the infrastructures in the open ocean (EMSO/water column), in the peer-review journal Marine Policy. PLOCAN is co-author of the article.



Cost and value of multidisciplinary fixed-point ocean observatories

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Illustration 77. Article published in Marine Policy

ENVRI PLUS

Environmental Research Infrastructures Providing Shared Solutions for Science and Society

Origin of funding: H2020-INFRADEV-1-2014-1 / INFRADEV-4-2014-2015: Implementation and operation of cross-cutting services and solutions for clusters of ESFRI and other relevant research infrastructure initiatives

Participation: Partner

Starting and ending date: 01/05/2015-30/04/2019

Total project funding: 14.683.533,75 €

Funding for PLOCAN: 81.000,00 €

Percentage of external funding: 100 %

ENVRIPLUS is a cluster of research infrastructures (RIs) for Environmental and Earth System sciences, built around ESFRI roadmap and associating leading e-infrastructures and Integrating Activities together with technical specialist partners. ENVRIPLUS is driven by 3 overarching goals:

- 1) favoring cross-fertilization between infrastructures
- 2) implementing innovative concepts and devices across RIs
- 3) facilitating research and innovation in the field of environment to an increasing number of users outside the RIs.

ENVRIPLUS organizes its activities along a main strategic plan where sharing multi-disciplinary expertise will be most effective. It aims to improve Earth observation monitoring systems and strategies, including actions towards harmonization and innovation, to generate common solutions to many shared information technology and data related challenges, to harmonize policies for access and provide strategies for knowledge transfer amongst RIs. ENVRIPLUS develops guidelines to enhance trans-disciplinary use of data and data-products supported by applied use-cases involving RIs from different domains. ENVRIPLUS coordinates actions to improve communication and cooperation, addressing Environmental RIs at all levels, from management to endusers, implementing RI-staff exchange programs, generating material for RI personnel, and proposing common strategic developments and actions for enhancing services to users and evaluating the socio-economic impacts. ENVRIPLUS is expected to facilitate the structuration and improve quality of services offered both within single RIs and at pan-RI level. It promotes efficient and multi-disciplinary research offering new opportunities to users, new tools to RI managers and new communication strategies for environmental RI communities. The produced solutions, services and other project results are made available to all environmental RI initiatives, thus contributing to the development of a consistent European RI ecosystem.

PLOCAN is taking part in elaborating and implementing a network of inter-operable, low-cost sensors in collaboration with other entities, including CNR, Ifremer etc. As part of the project, PLOCAN, took part in the second ENVRI *week* held in the Netherlands in May.



FIXo3

Fixed point open ocean observatory network

Origin of funding: FP7-INFRASTRUCTURES-2012-1

Participation: Partner

Starting and ending date: 01/09/2013-31/08/2017

Total project funding: 6.999.999,37 €

Funding for PLOCAN: 613.282,61 €

Percentage of external funding: 67,48 %

The fixed point observatory network (FixO 3) seeks to integrate European fixed point open ocean observatories and enhance access for the community in general to these key facilities. This will provide multi-disciplinary observations in all parts of the oceans from the air-sea interface to the deep ocean bed. Co-ordinated by the National Oceanography Centre, United Kingdom, FixO 3 will be based on the significant advances achieved by the EuroSITES, ESONET and CARBOOCEAN FP 7 programmes. With a budget of €8.4m over 4 years (from September 2013), the initiative has 29 partners from the areas of academe, research institutions and SMEs. Moreover, 14 international experts from a wide range of disciplines make up the Advisory Committee.

The programme will be achieved by means of:

1. Co-ordination activities to integrate and harmonise the current technological, procedural and electronic infrastructure processes. Strong ties will be fostered with a broad community from academe, industry, politics and the general public via dissemination, an exchange of know-how and training activities.
2. Support actions to offer a) access to observatory facilities for those who do not currently have such access and b) free access to data and product services.
3. Joint research activities to innovate and improve the current capacity for multi-disciplinary in-situ observation of the ocean. Open ocean observation is currently a priority for European marine and maritime activities, as reflected in the recent declaration made by the EurOCEAN 2010 Conference, and internationally from the declaration of the OceanObs09 Conference. The programme proposals will provide important data on environmental products and services to tackle the Framework Directive on Marine Strategy and to provide support for the E.U. Integral Maritime Policy. The FixO 3 network will provide free access to top-quality in-situ fixed point data. It will provide an integral framework of open ocean facilities in the Atlantic Ocean from the Arctic to the Antarctic and throughout the Mediterranean, allowing for an integral, regional and multi-disciplinary approach to understand natural and man-made changes in the ocean.



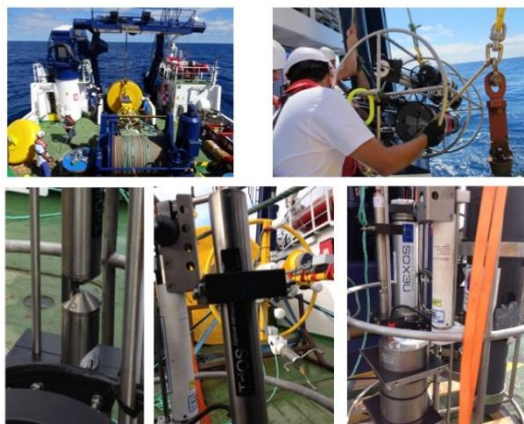


Illustration 79. Mounting the optical nitrate sensor

In 2016, the execution control was performed on all the projects funded by the TNA (transnational access) calls, and 70% of the funds approved for these projects has been sent. Two of the projects approved for carrying out on the ESTOC station managed by PLOCAN have also been executed. These projects were done on the back of a mooring during the autumn campaign aboard the Ángeles Alvariño oceanographic vessel. One of the projects was presented by the University of Oldenburg (Germany) and the other by the University of Aveiro (Portugal). In the former, an optical nitrate sensor was moored at a depth of 150 metres. In the latter, four traps were set with different substrates for larvae at 600m, 800m and 1200 metres.



Illustration 78. Anchoring the larvae traps

This year, PLOCAN has continued to provide access to the data from the ESTOC buoy and mooring, except in periods when data have not been available due to incidents with the mooring. In the context of WP2, co-ordinated by PLOCAN, a sensor reading interface has been developed. PLOCAN also contributed to the “Handbook on best practices” deliverable. To that end, PLOCAN took part in the initial experts’ workshop organised by HCMR in Athens. The report “Searching FixO₃ observatories time series through GEOSS” was also written, which includes an analysis of the FIXO3 infrastructure as a user.

In the area of education and dissemination, a third project newsletter was published.

The project general assembly was held in the PLOCAN facilities in September.



Illustration 81. Project newsletter



Illustration 80. Photo of the project partners during the assembly

LEANWIND

Logistic efficiencies and naval architecture for wind installations with novel developments

Origin of funding: The Ocean of Tomorrow 2013 / FP7- OCEAN-2013 / OCEAN.2013-4 Innovative transport and deployment systems for the offshore wind energy sector

Participation: Partner

Starting and ending date: 01/12/2013-30/11/2017

Total project funding: 9.986.231 €

Funding for PLOCAN: 203.930 €

Percentage of external funding: 75,88 %

The main objective of LEANWIND is to reduce costs over the whole life cycle and supply chain of offshore wind farms and to develop state-of-the-art tools and technologies. The marine wind energy industry in inshore shallow water sites still has to become economically competitive with conventional energy sources while new sites are planned further off-shore or in deeper waters, giving rise to new challenges. The off-shore wind power industry has still to apply lean principles in the logistics operations of wind farms and in all stages of its life cycle, as the LEANWIND Project proposes. Lean principles were originally developed by Toyota to optimise the processes of the manufacturing industry. These optimisation and efficiency principles have subsequently been adopted by many other industries to eliminate wasteful stages and to make processes more responsive. These principles will be applied to each of the critical stages of the project: logistics processes, land-based transport links, temporary storage and port facilities, vessels, cranes and lifting machinery, safety and operations and maintenance. The LEANWIND approach will ensure the elimination of unnecessarily complex or wasteful stages of the development process, which makes the transition between stages faster, enhances quality and hence optimises time and costs to enable the industry to reduce the gap between current expenditure and the economic aspirations of the industry.



Illustration 82. Photo of partners during the visit to the PLOCAN construction works

At the beginning of the year, PLOCAN hosted the third general assembly of project partners at its facilities, attracting around fifty technicians, scientists and project managers. During the assembly, a visit was organised to the construction work on the platform in Puerto de La Luz (Las Palmas).



Illustration 83. Project general assembly in Cork

The next project general assembly was held at the National Maritime College of Ireland (Cork) in November.

Apart from co-ordinating WP7, PLOCAN is also responsible for tasks in WP4 and WP7, including the deliverable "Condition Monitoring Software and RAMS tool kit for wind turbines", due in August. This report was written by the ULPGC, PLOCAN *third party* in the project.

MARCET

Red Macaronésica de Transferencia de Conocimientos y Tecnologías Interregional y Multidisciplinar para proteger, vigilar y monitorizar los cetáceos y el medio marino, y analizar y explotar de forma sostenible la actividad turística asociada

Origin of funding: Programa de Cooperación Territorial INTERREG V A España-Portugal (MAC 2014-2020) / Cooperación TRANSFRONTERIZA

Participation: Partner

Starting and ending date: 08/11/2016-07/11/2019

Total project funding: 1.030.914,13 €

Funding for PLOCAN: 264.990,32€

Percentage of external funding: 85 %

The MARCET project transfers and disseminates cutting-edge science and technology in order to promote growth and sustainable development of tourism directly and indirectly related to Whale Watching, through the creation of new eco-innovative products and services. In particular, centres specialised in the monitoring and tracking of cetacean health and in operational oceanography will be brought together from across the region in order to integrate, harmonise and optimise knowledge, infrastructures and best practices in the region.

The official starting date for the MARCET project is the beginning of November, but none of the project tasks have been executed in 2016. The project will actually start in the first quarter of 2017.



MARPOCS

Multinational Response and Preparedness to Oil and Chemical Spills

Origin of funding: Call for Proposals 2015 - Prevention and Preparedness Projects in Civil Protection and Marine

Participation: Partner

Starting and ending date: 01/01/2016-31/12/2017

Total project funding: 648.595,00€

Funding for PLOCAN: 42.530,07 €

Percentage of external funding: 75 %

The need for regional cooperation in the NE Atlantic to face marine pollution has been previously demonstrated by historic accidents in Spanish, Moroccan, French and Portuguese coasts. The Lisbon Agreement promotes regional cooperation in case of pollution incidents. Transnational strategies to face marine pollution with hazardous and noxious substances (HNS) and especially with oil spills have been under development in the region. However, the Atlantic sub-region involving Morocco, Madeira and Canary Islands has not been similarly prepared in an integrated fashion. Furthermore, recent oil and gas prospecting and drilling activities in the region. Although spill accidents with HNS are not as frequent as oil spills, their impacts, the variety of products and increasing volume transported justify the development of regional and cross border capacities. MARPOCS is an environmentally sensitive and socio-economically dependent upon marine resources and marine-based tourism.

Built on previous EU efforts, and in compliance with parallel international protocols (e.g. OPRC-HNS), strategies and current EU RTD initiatives, MARPOCS promotes a common operational framework supported with state-of-the-art model-based decision support tools and exercises for oil and HNS spills, adapted to the region and supported by cross border cooperation, implementation and training of local, regional and national authorities. This strategy will strengthen the capacity for mutual assistance and multinational preparedness and response to accidental pollution episodes in this crossborder sub-region, as planned in the Lisbon Agreement.

Work is currently being done on providing the consortium with the sensitivity indexes necessary, also to feed the models. The first project newsletter was published in June.



Illustration 85. Project newsletter

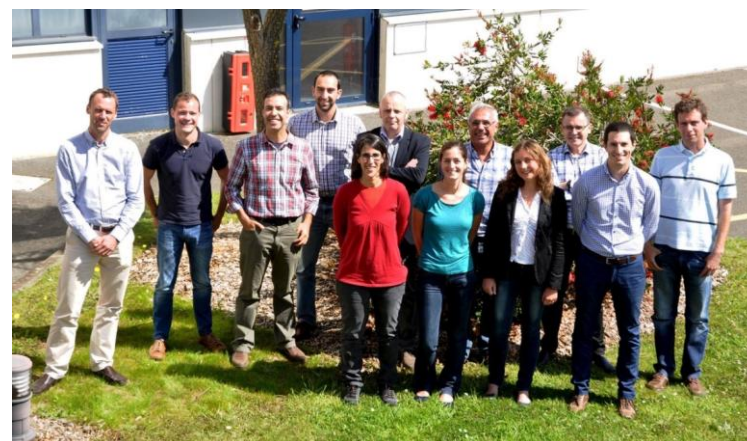


Illustration 84. Participants in the second project co-ordination meeting

NETBIOME-CSA

Strengthen European research cooperation for smart and sustainable management of tropical and subtropical biodiversity in ORs and OCTs

Origin of funding: ENVIRONMENT 2013: ONE-STAGE / FP7ENV-2013-one-stage / ENV.2013.6.5-2 Mobilising environmental knowledge for policy and society

Participación: Partner

Starting and ending date: 02/05/2013-30/04/2016

Total Project funding: 999.615 €

Funding for PLOCAN: 88.573 €

Percentage of external funding: 89,17 %

NetBiome-CSA ampliará y fortalecerá alianzas de investigación y la cooperación para una gestión inteligente y sostenible de la biodiversidad tropical y subtropical en las regiones ultraperiféricas (RUP) y los países y territorios de ultramar (PTU). Esto se logrará a través de un proceso participativo movilizándolo a los actores, sus conocimientos y recursos para iniciativas tales como análisis de política y de prioridad, diálogos entre múltiples partes interesadas, intercambio de buenas prácticas, formación y emisión de recomendaciones.

El proyecto se basa en la asociación de investigadores de la biodiversidad existente creada a través del proyecto ERA-Net NetBiome y asume el desafío de movilizar más interesados en todos los niveles de la hélice cuádruple (instituciones de conocimiento, empresas, gobierno y sociedad civil) para abordar aquellos desafíos prioritarios identificados para conciliar la conservación y manejo sostenible de la biodiversidad tropical con el desarrollo sostenible de las regiones y territorios de Europa, basado en los beneficios que se desprenden de la gran biodiversidad. Las actividades del proyecto, específicamente adaptadas a las necesidades y prioridades identificadas por las RUP y los PTU, contribuirá a: una mejora en la gobernanza de la investigación y la innovación; una alineación de los esfuerzos de investigación con las necesidades políticas fortaleciendo las políticas basadas en la evidencia; una implementación e impacto mejorados de la estrategia de la biodiversidad de la UE y el Plan estratégico del CDB; unas herramientas de gestión de la biodiversidad innovadoras (*Biodiversity Management Toolbox*), un aumento del desarrollo socio-económico y cultural regional; una mayor visibilidad internacional de las RUP y los PTU y la captación de sus buenas prácticas, experiencia y conocimiento; una eficaz cooperación internacional y transregional entre RUP y PTU europeos y con terceros países. NetBiome-CSA aborda completamente el tema (ENV.2013.6.5-2) y el subtema (g) del programa de trabajo puesto que sus actividades promoverán alianzas de investigación para el manejo sostenible de la biodiversidad en RUP y PTU europeos, dando lugar a una continuación y ampliación de la alianza NetBiome.

NetBiome-CSA has allowed PLOCAN, and the Canary Islands in general, to co-ordinate with the outermost regions (ORs) and overseas countries and territories (OCTs) Europe-wide, to draw the European Commission's attention to the importance of conserving biodiversity in these territories, where 70% of European diversity is found.

The final project conference was held in April under the title of "Boosting biodiversity research cooperation" in a session of the European Parliament. A strategic document drawn up as part of the project was presented during this session. This presentation gave rise to the initiative of presenting two pilot projects to the



European Commission (EC). These projects are “Mapping and assessing the state of ecosystems and their services in ORs and OCTs: establishing links and pooling resources” and “Improving participatory tools for effective biodiversity management and sustainable development of the European Outermost Regions (ORs) and Overseas Countries and Territories (OCTs)”. The event comprised introductory speeches from members of the European Parliament and executives from the EC,



Illustration 86. Session in the European Parliament



Illustration 87. Front cover of the project strategy document

and then continued with the presentation of two panel discussion that addressed the actions and achievements of research co-operation in the European ORs and OCTs, and about the future of the consortium through a NetBiome road map respectively. There was a debate after each panel, which concluded with the intervention of the session chairperson, M.E.P. Ricardo Serrão Santos, who presented the final conclusions. A video prepared by the consortium on the European ORs and OCTs was also presented before the second panel. The project was completed at the beginning of May.

NEXOS

Next generation, cost-effective, compact, multifunctional web enabled ocean sensor systems empowering marine, maritime and fisheries management

Origin of funding: The Ocean of Tomorrow 2013 / FP7- OCEAN-2013 / OCEAN.2013-2 Innovative multifunctional sensors for in-situ monitoring of marine environment and related maritime activities

Participation: Leader

Starting and ending date: 01/10/2013-30/09/2017

Total Project funding: 5.906.479 €

Funding for PLOCAN: 500.324 €

Percentage of external funding: 82,31 %

According to those responsible for marine research in Europe in the Ostend Declaration of 2010, support for the development of a truly integrated and sustainably funded European oceanographic observation system is a major challenge. This can be achieved with the long term measurement of key parameters but it is hindered by the cost and the lack of reliability of oceanographic sensors in general. The NeXOS Project aims to improve the time and space cover, the resolution and the quality of marine observations by developing cheap, innovative and inter-operable in-situ sensors that can be deployed from multiple platforms and web services for key domains and applications. This will be achieved by developing new, low-cost, compact, integrated sensors, with multiple functions, including the measurement of key parameters that are useful for a series of objectives, from more accurate marine monitoring and modelling to better evaluation of fisheries. Seven new, compact, efficient sensors will be developed, based on optic and acoustic technologies, aimed at most of the descriptors identified by the Framework Directive on Marine Strategy aimed at attaining a good ecological state. Two of the new sensors will contribute specifically to the Common Fisheries Policy with the pertinent variables for an eco-systemic approach to fisheries.

All the new sensors will meet the need for multi-platform integration, inter-operability of data and sensors with quality guarantees and the reliability requisites. All of these will be specified for each new sensor system. All the new sensors will be calibrated, integrated in several types of platform, scientifically validated and demonstrated. Finally, one of the main objectives of NeXOS is to improve the competitiveness of European SMEs in the marine sensor market. With this purpose, the specifications and requisites of the sensors will be evaluated in an early stage of the project for market penetration.



The project management committee held its sixth meeting in mid-April in the German city of Rastede, with the participation of representatives of the multi-disciplinary consortium made up of 21 partner institutions and European companies directly involved in the field of technological development and innovation in the marine and maritime sectors. The assembly allowed for a detailed analysis of the status of the project and to discover the guidelines for the third execution period until it finalises, including sensor demonstration plans on the different monitoring platforms.



Illustration 90. Project general assembly

NeXOS Project up to November, over 80 international communications had been generated in the main specialist events.

In February, at Oceanology International, a working group was organised and set up to deal with the inter-operability of sensors and data generated, in co-operation with another three projects funded under the same topic. Three webinars were also organised: Smart Sensor Interface, Optical tools for marine ecosystem and Biofouling systems.

The NeXOS Project general assembly was held in La Seyne-sur-Mer (France) in October. During the assembly, a demonstration of the O1 MiniFluo sensor was carried out on the Alseamar Seaglider platform.

From the beginning of the



Illustration 88. Project management committee



Illustration 89. O1 MiniFluo sensor demonstration

OCEANERA-NET

Coordination of national research activities of member states and associated states in the field of ocean energy

Origin of funding: ERA-NET Call 2013 / FP7- ERANET-2013-RTD / ENERGY.2013.10.1.3 Supporting the coordination of national research activities of Member States and Associated States in the field of OCEAN energy (ERA-NET)

Participation: Partner

Starting and ending date: 01/12/2013-30/11/2017

Total Project funding: 2.205.037,57 €

Funding for PLOCAN: 125.034,61 €

Percentage of external funding: 89,65 %

The vast European coastline houses enormous potential for ocean energy to be exploited as a source of renewable electricity, contributing to the objectives for 2020 and beyond. The ocean is a complex working environment, relatively little is known about it and it is widely used by other sectors, such as fishing, transport and leisure. However, the price of generating ocean energy is high, estimated by DG MARE, for 380 GW. Several member states and regions are currently funding ocean energy research, demonstration, technology and innovation (R+D+T+i). There is a common objective to generate know-how of the marine environment and to accelerate the development of this emerging sector. But these research efforts are not co-ordinated. For this reason, member states are proposing the ocean energy ERA-NET as described in this document. The ERA-NET will provide a framework for joint, trans-national activities and will co-operate with the EERA Ocean Energy Joint Programme and other important European projects and the industry stakeholders.

This wide-reaching ERA-NET brings together 16 partners from nine states with the intention of obtaining the benefits of a co-ordinated funding of research. The member states have different levels of commitment to the ocean energy sector, and it is important that the ERA-NET actions reflect this fact. The objective is to improve the quality, scope and fragmentation of research with better networks, tackling common barriers and improving co-ordination. The proposal establishes the implementation of the project from the creation of networks and sharing of know-how, to the launch of at least one joint, trans-national call for projects. This way, the partners will develop a shared vision of the sector, an action plan to deliver and a toolbox for administration. The result will be less fragmentation in funding research, the development and greater dissemination of best practices and support for marketing the ocean energy sector.

The OCEANERA-NET Project, in collaboration with the International Conference on Energy (ICOE 2016), held in Edinburgh in late February, organised an informative event and institutional and business encounter to present the results of the first call for projects and the details of the second one, as an opportunity to provide information and stimulate interaction among players interested in forming international consortia and presenting proposals for the second call for projects. The project had its own stand at ICOE 2016.



The project's second joint call for projects was put out in February. 11 countries/regions took part, presenting 19 pre-proposals in six different themes. 7 of these were finally financed.



Illustration 91. Oceanera-Net event at ICOE 2016

During 2016, work was done on a proposal to organise a workshop "Learning from the past to have a future" in the PLOCAN facilities during the first half of 2017. This proposal was accepted.

In September, PLOCAN took part in the workshop "Stage metrics for Ocean Energy Technology Development", held in Edinburgh (Scotland). In November, the project had a stand as part of its participation in the "Ocean Energy Europe 2016 Conference & Exhibition" held in Brussels.

ORPHEO

Coordination of national research activities of member states and associated states in the field of ocean energy

Origin of funding: Plan Estatal de Investigación Científica y Técnica y de Innovación 2013-2016 / Programa Estatal de I+D+i Orientada a los Retos de la Sociedad / Convocatoria: Retos-Colaboración 2016

Participation: Partner

Starting and ending date: 01/07/2016-31/12/2018

Total Project funding: 359.789,87 €

Funding for PLOCAN: 62.513,20€

Percentage of external funding: 100 %

The aim of the ORPHEO project is to study techniques that enable the optimization, through advanced and intelligent control, of the profitability that can be obtained from an integrated hybrid floating platform that includes generation from wind power and wave energy and is connected to the grid as part of a renewable energy farm in the sea.

The W2Power Platform (in its different variants of wind, hybrid wind-wave and combined with other uses such as aquaculture), that will be object of study for this optimization, is a joint development of several companies, based on the patent of the Norwegian company Pelagic Power, shared by ENEROCEAN. The project starts from them theoretical and experimental results obtained in the development of wave converters and their integration in floating platforms in the Offshore2Grid project and tank tests of the converters and the complete platform performed in Cork and Edinburgh thanks to the tank access provided by FP7 MARINET to reach TRL5 for the technology of the hybrid W2Power platform.

ORPHEO will be developed in parallel with the international project WIP10+ (coordinated by EnerOcean, and with TTI Ltd (UK), Ingeteam Service and Ghenova as partners and CTAER, UCA and PLOCAN as outsources), in which the wind variant (without inclusion of waveconverters) will be tested and that has recently been selected by the ERANET COFUND DEMOWIND Consortium to demonstrate a scale prototype at PLOCAN's test site in the Canary Islands. WIP10+ will allow the technological demonstration of the W2Power platform in a exclusively wind configuration (Wind2Power), that will include the installation in the sea of a floating platform at a 1:6 scale in Gran Canaria (reaching TRL6), that will serve as a starting point for the inclusion of additional uses and for testing advanced control algorithms that will be developed in ORPHEO.

The ORPHEO project includes industrial partners that are active in the development of the W2Power platform control: INGETEAM SERVICE SA, who manages aspects related to the control and operational life of the wind generators and will coordinate the ORPHEO project and ENEROCEAN SL who, in addition to coordinating the WIP10+ project, has developed the Wave2Power converters that will be integrated into the platform and the global control system of the platform. These two companies will be complemented by the following research centers: PLOCAN, University of Cadiz and University of Málaga. The ORPHEO Project is funded by the Spanish Ministry of Economy, Industry and Competitiveness in the scope of the Research, Development and Innovation program focused on the Society Challenges in the framework of the Scientific, Technical and Innovation Plan 2013-2016, section 1: "Research Challenges", R+D+I Projects, Call 2013..

El proyecto ORPHEO, incluye los socios industriales activos en el desarrollo del control de la plataforma W2Power, INGETEAM SERVICE SA, que gestiona los aspectos relacionados con el control y vida operativa de los generadores eólicos y coordinará el proyecto ORPHEO y ENEROCEAN SL que además de coordinar el proyecto WIP10+, ha desarrollado los convertidores de energía de las olas Wave2Power que se integrarían en la plataforma y el sistema de control global de la plataforma. Estas dos empresas serán complementadas por los siguientes centros de investigación: PLOCAN, Universidad de Cádiz y Universidad de Málaga.

The ORPHEO Project was presented at the technical conference on marine energies held at the University of Cadiz in November



RIS₃NET

Cooperación Interregional para el Crecimiento Inteligente de las Regiones MAC

Origin of funding: Programa de Cooperación Territorial INTERREG V A España-Portugal (MAC 2014-2020) / Cooperación TRANSNACIONAL

Participation: Partner

Starting and ending date: 01/11/2016-31/12/2018

Total Project funding: 537.997,53 €

Funding for PLOCAN: 162.775 €

Percentage of external funding: 85 %

RIS₃_Net will develop a strategy for institutional co-operation and a system of common governance, aimed at those institutions responsible for the planning, execution and follow-up of the intelligent specialisation strategies in the MAC regions, taking into consideration its possible extension to other countries. RIS₃_Net will enable:

- An increase in common knowledge of the RIS₃ strategies of the participating regions.
- The sharing of needs, difficulties and challenges affecting the MAC regions, related to the revision, execution and follow-up of intelligent specialisation strategies.
- The creation of a governance that will permit a common work framework to be established.
- The exchange of knowledge and best practices with regards to R&D and innovation policies and information systems for the follow-up and evaluation of the strategy.
- The development of pilot actions in the form of "Proofs of Concept".

The RIS₃_net Project was re-formulated at the end of 2016 to bring it in line with the new economic conditions of the regions of Madeira and Azores, which faced significant cuts to their budgets in the allocation. Work on the project tasks did not start in 2016.

SMARTBLUE

Red de clusters marino-marítimos regionales para la competitividad PYME de la economía azul

Origin of funding: INTERREG V A España-Portugal (MAC 2014-2020) / Cooperación TRANSFRONTERIZA:

Participation: Partner

Starting and ending date: 01/11/2016-31/10/2019

Total Project funding: 847.523,23 €

Funding for PLOCAN: 170.024,51 €

Percentage of external funding: 85 %

Within the sphere of blue economy there are endless development opportunities in established maritime subsectors such as fisheries, maritime transport and ports, and in emerging sectors such as maritime tourism (recreation and cruises), aquaculture, and marine biotechnology, as reflected in the European Strategy for Blue Growth.

In this regard, the SMART BLUE ATLANTIC project will develop activities to promote networks and services to support innovation and internationalisation focused on the concept of regional maritime clusters and aimed at SMEs in blue economy within the MAC co-operation area. This will result in an increase in the critical mass and capacity that will produce economies of scale in networks dominated by small businesses working together to innovate and access other markets, obtaining better results than would be obtained from acting individually.

Just like the previous project, Smart Blue suffered cuts to the budgets of the Portuguese partners, meaning that it had to be re-formulated, which in turn, delayed its roll-out until the following year.



SWARMS

Smart and Networking UnderWater Robots in Cooperation Meshes

Origin of funding: ECSEL-2014-1 / ECSEL-01-2014: ECSEL Key Applications and Essential Technologies (RIA) y Programa Estatal de I+D+i Orientada a los Retos de la Sociedad / Acciones de Programación Conjunta Internacional 2014. Although included in the same card, Swarms national and Swarms international are considered independent projects attending to fund

origin.Participation: Partner

Starting and ending date: 01/07/2015-30/06/2018

Total Project funding: 6.406.818,64 € +5.675.266,54 €

Funding for PLOCAN: 231.156,25 € + 232.080,00 €

Percentage of external funding: 65,13 %

Nowadays, the major part of offshore operations is done by divers in dangerous missions. Since their number is limited, the dependency on their work represents a real threat to the offshore industry. The extended use of unmanned underwater vehicles (AUVs/ROVs) could solve this problem but since they are usually tailor-made for a specific task and difficult to operate their deployment is very expensive.

The overall goal of the SWARMS project is to expand the use of AUVs/ROVs and facilitate the creation, planning and execution of maritime and offshore operations. This will reduce the operational cost and increase the safety of tasks assigned to divers.

The SWARMS project aims to make AUVs/ROVs accessible to more users by:

- Enabling AUVs/ROVs to work in a cooperative mesh thus opening up new applications and ensuring re-usability as no specialized vehicles are needed but heterogeneous standard vehicles can combine their capabilities,
- Increasing the autonomy of AUVs and improving the usability of ROVs The approach is to design and develop an integrated platform (a set of Software/Hardware components), incorporated into the current generation of underwater vehicles in order to improve autonomy, cooperation, robustness, cost-effectiveness, and reliability of the offshore operations.

SWARMS' achievements will be demonstrated in two field tests in different scenarios:

- Inspection, maintenance and repair of offshore infrastructure
- Pollution monitoring
- Offshore construction operations

SWARMS is an industry-led project: big technology companies will collaborate with SMEs specialized in the subsea, robotics and communication sectors and universities and research institutions to ensure that the newest innovations in subsea robotics will arrive fast to market. As voice of the customer, two end-users are also part of the consortium.

The project advanced with the installation of the set of scheduled sailing and positioning equipment and accessories in the ROV (multi-beam sonar, altimeter, acoustic positioning system, integral electronic system). At the same time, a buoyancy problem in the vehicle, caused by installing the accessories, was solved.

The central offices of the Polytechnic University of Madrid (UPM) hosted the second plenary meeting of the SWARMS Project consortium in February, with PLOCAN participating as a partner. After six months of co-ordinated work at a distance, the partners met to share the developments achieved. For PLOCAN, the meeting was highly interesting as it defined the terms and conditions for the different experiments and manoeuvres that would be carried out at its facilities

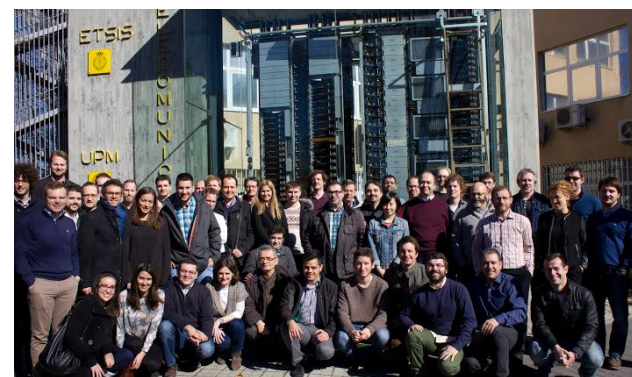


Illustration 92. Plenary meeting of partners at the Polytechnic University of Madrid

after the summer.

The project's early trial demonstrations took place between September and October. These trials validated the initial developments of the project by giving good results. These sessions attracted about 70 people to the PLOCAN facilities for the two weeks. Representatives of the European Commission then came to PLOCAN to conduct the first assessment of the project, which turned out to be highly positive, with PLOCAN getting a special mention for the organisation. Finally, as all the

partners were present, they held the third general assembly of the consortium and a B2B session in an approximation between local companies in the sector and the project partners.

The main dissemination/education actions organised within the project included the aforementioned B2B



Illustration 94. Tercera asamblea plenaria del proyecto en el mes de octubre

sessions, organised in co-ordination with the CATAPULTA Project in September (this information can be found in the section on the CATAPULTA project).



Illustration 93. Early Trials of the project at Taliarte docks

UNDERWORLD

UNDERWater radiocommunications for Optimized monitoring using multiRelay Devices

Origin of funding: Proyectos I+D+i Retos 2013

Participation: Partner

Starting and ending date: 01/01/2014-30/06/2017

Total project funding: 314.524 €

Funding for PLOCAN: 113.619 €

Percentage of external funding: 100 %

The two research groups from the University of Las Palmas de Gran Canaria and from the Polytechnic University of Madrid have been working on HF communications over for the last sixteen years. Most of their achievements have been obtained thanks to funding obtained from previously awarded domestic projects (TEC2004-06915-Co3, TEC2007-67520-Co2 and TEC2010-21217-Co2) and several private projects funded by AEMA and the Ministry of Defence. When PLOCAN joined, a sound consortium was created able to face the scientific, technical and technological challenges of this proposal: the re-assessment of electro-magnetic communications (EM) in networks of submarine sensors. To date, most wireless underwater communications have been implemented with acoustic systems, generally considering that underwater communications by radio cannot meet the requirements set.

In fact, the limited range of water due to attenuation is the main obstacle to the environment we face. The reasons that arouse interest in the project are as follows: The growing interest of the civil and military industry, environmental and port management entities, among others, in achieving reliable underwater links with higher data rates than acoustic communications. Have a specific key application as an objective: environmental monitoring: in general, it is considered that this is not a better alternative to acoustic communications at great depth between remote sites, with limitations on power or on high data rates. But our scenario focuses on shallow areas both in sea water on the coast and in fresh water in rivers, dams and reservoirs. In this situation, EM systems are the best option as acoustic systems lose performance. Finally, the paradigm change that has come about thanks to aspects such as DSPs, new, more efficient antenna or new considerations concerning alternative propagation mechanisms.

This project will help: 1) to design new antennae, 2) propagation models, 3) to design low power communications systems and mainly, 4) in a new paradigm in which submarine communications are based on a set of static nodes and also on unmanned vehicles (UUV) that resolve the existing attenuation with multi-jump communication protocols. This new network will be able to both improve existing detection and estimation procedures with data fusion and distributed consensus/ dissemination algorithms, apart from including functions such as self-location, tracking vehicles or providing help to shipping.

All this can be achieved thanks to the combination of theoretical contributions, measuring campaigns, modelling and the development of software and hardware. In fact, the best asset of this project is the balance between these aspects with a view to creating an operational wireless network of submarine sensors that will also be attractive for transferring technology to the interested entities. The major challenge is only feasible thanks to merging the experience and the skills acquired by each of the institutions involved..



The project attended two conferences, the first is the communications and submarine networks conference “UComms 2016” held at the end of August in Lerici (Italy), where two articles were presented with the participation of PLOCAN staff. The second one was the XXXI National Symposium of the International Scientific Radio Union “URSI 2016”, held in Madrid at the beginning of September, where a summary of all the measurement campaigns and the main project results were presented.

Three measurement campaigns were conducted at Taliarte docks, one in May, the second in August and the other in November.



Illustration 95. Photos of the measuring campaign conducted at the Taliarte dock



Illustration 96. Assembling the measuring system in the controlled environment of the PLOCAN saltwater pool

Two articles have been published in “Sensor” as part of the project.

UNDIGEN+

UNDIGEN Marine Autonomous System

Origin of funding: Retos-Colaboración 2014

Participation: Partner

Starting and ending date: 27/01/2014-30/06/2017

Total Project funding: 266.454,81 €

Funding for PLOCAN: 43.168 €

Percentage of external funding: 100 %

The consortium for the Undigen Project (MINECOIPT- 2011-1770-920000), led by the tech company Wedge Global, S.L. has developed a wave energy converter that is in the final stages of sea trials with an innovative electricity generation system, which, in turn, is potentially ideal for different kinds of Wave Energy Converters – WECs –(including Vertical and pendulum point absorbers and Oscillating Water Column).

Notwithstanding the potential of this innovative electricity generation system from a purely energy point of view, it also opens up the possibility of applying this technology autonomously; in other words, as a platform for installing equipment to measure the marine environment with a view to addressing a potential industrial-commercial development as imminently as possible.

It is worth mentioning that the Wedge approach to wave power, focusing from the beginning and giving priority to PTO as they consider it the key component of the global conversion system (WEC), once this key component can modify the properties of the collector, configured, in turn, as a direct conversion system that eliminates intermediate stages and, therefore, provides greater reliability and associated shelf life, together with a significant reduction in operating costs and maintenance of WECs.

Consequently, the central objective of the project focuses on rolling out this action with a view to being able to use the renewable energy generated to autonomously feed the equipment installed in the collector. This can be equipment of different kinds, coastal surveillance equipment, marine research equipment, etc., along with the characterisation of the marine environment for different purposes from a global perspective.

The device spent 2016 berthed at the Nelson Mandela dock in the port of Las Palmas. It was serviced and several operational trials were conducted with the wave action to be found inside the port basin.

Wip 10+

Wind Integrated Platform for 10+ MW Power per Foundation

Origin of funding: ERA-NET COFUND H2020 / DemoWind ERA-NET Cofund Action / Joint Call 2015. **Topic:** Offshore Wind, Topic 2 - Floating offshore turbines

Participation: Partner

Starting and ending date: 27/01/2016-31/12/2018

Total Project funding: 758.000€

Funding for PLOCAN: 30.000 €

The consortium for the Undigen Project (MINECOIPT- 2011-1770-920000), led by the tech company Wedge Global, S.L. has developed a wave energy converter that is in the final stages of sea trials with an innovative electricity generation system, which, in turn, is potentially ideal for different kinds of Wave Energy Converters – WECs –(including Vertical and pendulum point absorbers and Oscillating Water Column).

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PLOCAN completed the deliverable of activity in November for the area of installing the prototype. Towards the end of the year, the first components started arriving for assembling the prototype, so that it can be installed on the test bed next year.



7. AGREEMENTS SIGNED, PARTICIPATION IN NETWORKS AND DEVELOPMENT OF STANDARDS

The consortium signed the following agreements in 2016:

- ✓ Agreement between the Canary Island Oceanic Platform and Fraunhofer to co-operate in a range of fields relating to marine science and technology, signed on the 20th of January 2016
- ✓ Collaboration framework agreement between Institut National de Recherche Halieutique (INRH) and PLOCAN to regulate collaboration in order to carry out activities of mutual interest for both parties, in particular those related to the marine and maritime sector, the ocean and deep-sea environment with regard to science (R&D and Innovation) technology, training, entrepreneurship, business development and dissemination of knowledge for both sides, signed on the 10th of March 2016
- ✓ Co-operation agreement between the PLOCAN Consortium and ENEROCEAN S.L. as part of the European "Wind integrated platform for 10+ MW power per foundation" project to regulate PLOCAN's participation as a sub-contracted entity in the project (installation of the marine wind turbine prototype to be built on the PLOCAN test bed and the consequent experimental trials), signed on the 25th of January 2016
- ✓ Co-operation agreement between MINECO and PLOCAN for Spain to participate in the EMSO-ERIC European research infrastructure consortia, devoted to the European multi-disciplinary research of the seabed, signed on the 5th of May 2016
- ✓ Co-operation agreement between Tecalia and PLOCAN to regulate the terms of the co-operation between the parties for engaging in activities of mutual interest, and especially activities relating to the marine and maritime sector, oceanic, deep-water environment with respect to science (R+D+i), technology, training, entrepreneurship, business development and the dissemination of knowledge, signed on the 27th of July 2016
- ✓ Protocol of actions between PLOCAN and the SPEGC to regulate the terms of co-operation between the parties for undertaking activities of mutual interest, and especially, those relating to the marine and maritime sector, oceanic, deep-water environment, with respect to science (R+D+i), technology, training, entrepreneurship, business development and the dissemination of knowledge, signed on the 28th of July 2016
- ✓ Co-operation agreement between PLOCAN and the Canary Island University Foundation of Las Palmas for organising a training programme for innovation managers 2016-2017, signed on the 22nd of September 2016
- ✓ Agreement between PLOCAN and the Polytechnic University of Madrid to provide practical training for students in their own offices or places or work, and collaboration with the teaching staff of the degree courses offered in UPM in areas of mutual interest, signed on the 10th of November 2016
- ✓ Co-operation agreement between SOCIB and PLOCAN to set up RIM (Network of Marine Infrastructures) and define its operational regulations pursuant to the guidelines established by the CPCTI agreement of the 7th of October 2014 and its appendixes, signed on the 19th of December 2016.

Institutional networks

PLOCAN has been a member of the **International Network of innovative maritime territories** since 2012. The network includes Spain, France, Germany, Italy, Argentina, Mexico, the United States, China and Vietnam.

PLOCAN participates in the **“Energy and Sustainability School”** of the University of Las Palmas de Gran Canaria. The idea of this school was to act as a meeting point and discussion forum between the University and Society in issues of interest for the future of the Canary Islands. It is part of the university’s programme of dissemination, promotion and transfer of knowledge at the service of culture, quality of life and economic development.

PLOCAN has been part of the FECYT **EURAXESS** network since 2014. This deals with research mobility and is an “ECP-Euraxess Contact Point”. In April 2016, PLOCAN undertook to apply the “European Charter for researchers and the Code of conduct for the recruitment of researchers”.

PLOCAN forms part of the following initiatives:

- ▶ **Atlantic Stakeholder Forum** for driving blue growth in the European Atlantic Arc
- ▶ **Galway Statement Implementation** for defining a strategy for blue growth in the framework of the European Atlantic
- ▶ **Ocean Energy ERA-Net Consortium** to drive the marine, renewable energy sector in Europe

PLOCAN participates in the **R+D+i Working Group** set up in March, chaired by Pedro Ortega, Regional Minister of Economy, Industry, Trade and Knowledge, with a view to analysing and proposing improvements to the Smart Specialisation Strategy (RIS3), and possible actions and identify key new technologies for Canaries. The general objective of this working group is to foster R+D activities and the process of transferring their results to the productive fabric.

The working group also comprises the Canary Island Government, the University of Las Palmas de Gran Canaria (ULPGC), the University of La Laguna (ULL), The Canary Island Institute of Technology (ITC), the Canary Island Oceanic Platform (PLOCAN), the Canary Island Astrophysics Institute (IAC), the Large Canary Island Telescope (GRANTECAN) the Canary Island Institute of Agrarian Research (ICIA) and the Canary Island Health Research Foundation (FUNCANIS).

PLOCAN is a member of the management committee and the technical committee **PRO-GRAN CANARIA** (currently known as BESTinGC) set up in 2016 and driven by the Cabildo (Government) of Gran Canaria through its Gran Canaria Economic Promotion Company (SPEGC). On the technical committee, PLOCAN also participates in the committee’s marine-maritime group.



Technical networks

The PLOCAN oceanic observatory (ESTOC) forms part of the **European observatory network EMSO** (European Multidisciplinary Seafloor and Water Column Observatory) and FixO3 (European Fixed Open-Ocean Observatories Network), as one of the Spanish nodes. The European Commission resolved to set up the European Multidisciplinary Seafloor and Water Column Observatory-European Research Infrastructure Consortium (EMSO ERIC). The agreement was published in the official journal of the European Union on the 1st of October 2016. The members of this infrastructure are Ireland, Greece, the Kingdom of Spain, the French Republic, the Italian Republic, the Portuguese Republic, Romania and the United Kingdom of Great Britain and Northern Ireland. The entity representing Spain in EMSO is the Canary Island Oceanic Platform. EMSO comprises ocean observation systems that monitor environmental processes in real time, including natural risks, climate change and marine ecosystems. The EMSO observation nodes are located in strategic sites in Europe, from the Arctic to the Atlantic and from the Mediterranean to the Black Sea. EMSO ERIC will co-ordinate, facilitate and optimise the use of instruments and resources for pan-European marine operations with a view to gaining the maximum benefit for the specialist ocean-observation community.

PLOCAN forms part of the **EMODnet Network** (European Marine Observation and Data Network) comprising over 160 entities that share oceanographic data, products and meta-data with a view to making them available to public and private users. PLOCAN's membership was formalised in December 2016.

PLOCAN belongs to the robotics, automation, maritime safety and marine energies groups of the **Spanish Maritime Sector Technology Platform (PTME)**. This organisation offers all stakeholders related to the sea and other aquatic environments, a place for meeting and dialogue.

Since 2008, PLOCAN has been a member of the **European network "Everyone's Gliding Observatories" (EGO)**, an international scientific-technical forum of glider technology users.

Since 2010, PLOCAN has been a member of **I-COOL (International Coalition of Ocean Observing Laboratories)**, co-ordinated by Rutgers University.

Since 2008, PLOCAN has sat on the **International Committee on Marine Technologies MARTECH**.

PLOCAN is a member of the **Marine Technology Society (MTS)**.

PLOCAN is a member of the **European Atlantic group of Gliderport facilities**, along with CNRS (France), SAMS (Scotland), NACO (Norway), GEOMAR (Germany) and NOCS (Great Britain).

PLOCAN is a member of the **International Waveglider-Users Group**, co-ordinated by the German institution MARUM, along with MBARI, SCRIPS, CMRE, LAMMA, IFREMER, WHOI, GEOMAR, NOCS, etc.

PLOCAN is an active member of the **international education programme Educational Passages**, co-ordinated by NOAA. Two sailing dinghies fitted with GPS were launched from the island of El Hierro in 2016, so that students can follow their route across the Atlantic.

PLOCAN is working in co-ordination with a **network of glider users in the North Atlantic**, co-ordinated by the Memorial University in Canada, along with institutions in Ireland, Germany, Portugal and the United Kingdom.

PLOCAN is a member of the **European technology and Innovation Platform for Ocean Energy (TP Ocean)** that brings together over 200 experts from the off-shore energy sector to define a clear strategy for technological development. TP Ocean is officially recognised by the European Commission as a European Technological Platform (ETP).

PLOCAN is a member of the **European association of marine energies (Ocean Energy Europe)**, set up to galvanise the marine energy sector in Europe, and sits on one of the Ocean Energy Forum committees, a working group that specifically addresses the main challenges that marine energies face in their progress towards the industrialisation of this sector.

PLOCAN is a member of the **Spanish Standards and Certification Association (AENOR)** through its sub-committee AEN/206/SC114. The objective of this sub-committee, known as "Marine energies: wave and current converter", is to set standards for everything to do with harnessing power from waves and marine currents for generating electricity. The functions of this sub-committee concern setting standards for the technology and procedures associated with transforming the energy of waves and marine currents into electrical energy. PLOCAN currently contributes by providing experts for the working groups dealing with assessing environmental impact and energy resources.

PLOCAN is a member of the **Association of Renewable Energy Producers APPA Marine**, a body with twenty-six partners. It was founded in 2006 in order to bring the industry together and work on developing this technology in Spain. Its members include most of the companies and entities engaged in activities in this sector in Spain, putting it a unique position to provide a realistic overview of the industry. The immediate objective of the Marine Section of APPA is to promote a suitable legal framework and the associated technological development, to give marine energy considerably more importance in renewable energy output by 2020.

PLOCAN co-operates with **Ocean Energy Systems**, an initiative of the international energy agency on ocean energy. The PLOCAN test bed is listed by them as an infrastructure for testing devices in the open sea.

In 2013, PLOCAN signed up to the initiative to set up a Management Committee for the **Macaronesia Marine Maritime Cluster**, which seeks co-operation and the creation of synergies in the maritime sector with a view to formulating projects and to make optimum use of EU legislative and financial instruments for the period 2014-2020.

PLOCAN participates in the **EuroGOOS HF-Radar Group**, co-ordinated by EMODNEt Physics.



PLOCAN sits on the **Scientific Access Committee of the EU-TNA Glider Programme**.

PLOCAN forms part of the **Program Committee of Oceans of Tomorrow Projects** to assess advances, contributions and impacts of projects financed by the European call for projects Oceans of Tomorrow.

PLOCAN belongs to the **Wave Energy Working Group** driven by EVE with the objective of stimulating technological progress and the application of wave-driven generating device technology.

An agreement was signed on the 19th of December to set up a **Network of Marine Infrastructures (RIM)** between the Canary Island Oceanic Platform (PLOCAN) and the Balearic Isles Coastal Observation System (SOCIB). These two ICTSs share a common strategy to develop initiatives of co-ordination and common interest. They will also drive co-ordination with other Spanish bodies and agencies working in their sphere of activity, in areas such as storing and managing the data captured by the different observation platforms. The specific objectives of the RIM are as follows:

- ▶ Optimise performance in areas of common interest in line with the ICTS strategy plans and actions by co-ordinating resources and services, share, enhance efficiency and get better performance from the resources co-ordinated by the RIM in order to optimise resources and gain value added from the facilities.
- ▶ Jointly manage co-ordinated resources
- ▶ Foster and roll out actions of common interest to the member institutions by means of joint plans covering:
 - ✓ Training
 - ✓ Dissemination and education
 - ✓ Participation in R+D+i projects and applications for grants
 - ✓ Mobility for researchers and technologists
 - ✓ Joint or co-ordinated purchases
 - ✓ Exchange of infrastructure and service capacity and use
 - ✓ Other actions of common interest
- ▶ Advise MINECO, at its request, in its area of action
- ▶ Participate in, co-ordinate or contribute to initiatives on a national or international level
- ▶ Comply with the organisational, structural and technical requirements of a Network of Outstanding Scientific-Technical Infrastructures (Network of ICTS) set out by the Scientific, Technological and Innovation Policy Board or by its Executive Commission
- ▶ Other actions that drive the use of the RIM at the service of R+D+I in Spain

Developing standards

PLOCAN sits on AENOR Sub-committee SC114. The objective of the sub-committee is to set common standards for the wave and marine current-based electricity generating sector (SC114: MARINE ENERGIES. WAVE AND CURRENT ENERGY CONVERTERS).

Two plenary sessions of SC114 were held in 2016, in the AENOR offices in Madrid, with the participation of PLOCAN.

SC114 organises its work through specific working groups aimed at generating technical standards and/or specifications in specific areas. The working groups that involve PLOCAN currently are the mooring systems group, which has already created a technical standard (Marine energy – Wave, tidal and other water current converters – Part 10: Assessment of mooring systems for marine energy converters) and the submarine noise group that is still working on technical specifications. They hope to complete this work by the end of 2017.

8. TRAINING, FOSTERING SCIENTIFIC-TECHNOLOGICAL VOCATIONS AND DISSEMINATION

Training programmes

PLOCAN has organised training programmes at different levels in 2016:

Training Programme 2+2: This is a programme aimed at providing highly-specialised complementary training that will help students who complete it to find a job. The aim is to supplement the training received at university, with a practical side in a laboratory environment. The objective of the training grants is to make it easier to find a job and to supplement the academic training of university graduates by developing in them know-how, attitudes and skills that enable them to put their training into practise and to enhance their ability to find a job in highly-specialised international technological circles. The programme is organised in two different phases:

- a. A 1st 2-year fellowship to provide students with the know-how they need to hold a job in this field.
- b. A 2nd 2-year phase based on an intern employment contract

The call for applications was put out in April 2016 and 3 candidates were selected from a total of 107 applications. The lines of action defined for the call were as follows:

- ▶ Oceanographic observation and data processing
- ▶ Marine energies and electricity connections
- ▶ Marine/submarine vehicles, instruments and machinery
- ▶ Development of web applications and systems analysis



Training Programme 0.5+2: This is a programme aimed at providing highly-specialised supplementary training and jobs for VT graduates. The objective is to supplement academic education and provide work experience for specialised qualified staff from vocational training cycles. The programme is organised in two different phases:

- c. First of all, a 6-month fellowship to reinforce students' theoretical and practical knowledge in this field
- d. A 2nd phase consisting of an intern employment contract

The call for applicants was put out in June 2016 and 3 candidates were selected from a total of 27. The lines of action defined for the call for applicants were as follows:

- ▶ Support for the PLOCAN Socio-Economic Area
- ▶ Telecommunications and information technology systems
- ▶ Mechanical Manufacture Design
- ▶ Analysis and Quality Control Laboratory

Dual Inserta Training Programme: In January, PLOCAN and the University Foundation of Las Palmas signed an agreement to foster employment among university and vocational training graduates to act as a supplement to the 2+2 and 0.5+2 training programmes. The aim of the programme is to enhance access to the job market by organising periods of technical-practical training that will allow beneficiaries to complete and acquire the technical and transversal skills currently required. The training period for participants in this programme is 6 or 10 months. 4 students were hired through this training programme in 2016, who have worked in the following areas:

- ▶ Marine Vehicles, Instruments and Machinery - Building ROVs (*Remotely Operated Vehicles*).
- ▶ PLOCAN legal department
- ▶ Innovation Unit
- ▶ Training Unit

Innovation Management training and capacity building Programme: This programme is part of the Canary Island Government's Canary Island Agency for Research, Innovation and Information Society (ACIISI) Project, co-funded by the European Social Fund (ESF). This programme, which intends to create an innovative system in the region, connects and transfers knowledge among all the stakeholders in the system is free for PLOCAN and has enabled a student to join PLOCAN, where she has been working since mid-December as an innovation manager. She provides solutions to the demand from the innovation projects currently on-going in PLOCAN. This is therefore, practical training that lasts 3 months to work on innovation matters. At the same time, it also provides theoretical training by means of semi-face-to-face and on-line modules.



Illustration 97. Visit to the platform by students from the KOSMOS project

Short stays: These are *stages* for students from other national or foreign institutions to gain specific training. These are organised on demand, by sending in an application at least one month in advance. One Erasmus+ student has been accepted as part of the European NeXOS Project, which PLOCAN co-ordinates, 8 students on the Biological Oceanography Master in the GEOMAR institution as part of the KOSMOS project, and 28 students on a specific Marine Renewable Energies programme from the University of Exeter in the United Kingdom.



Illustration 98. Visita de los estudiantes de la Universidad de Exeter



Illustration 99. Photo of Erasmus+ students from the NEXOS project

Students have continued to come to PLOCAN this year for university and vocational training curriculum internships in the facilities. These internships are compulsory for students finishing their studies and they are regulated by a specific teaching syllabus. These students come to PLOCAN for an average of 3 months, working full-time. 5 university students came in 2016 from the fields of engineering (I.T. and chemical), Marine Sciences, Translation and Interpreting and Business Administration and Management. A further 5 vocational training students

from Higher Certificate in Administration, Electronics, I.T. and Chemistry have also done on-the-job training at PLOCAN.

PLOCAN has also continued to work in collaboration with the University of Las Palmas de Gran Canaria on Bachelor and Master Dissertations. In this case, 3 dissertations were started: on Marine Sciences, Electronic and Information Technology and one Master Dissertation in Industrial Technologies.

Finally, PLOCAN signed up to the *Canarias Masterclass* initiative in 2016, promoted by the *Canary Talent* association, aimed at advising future university students. *Canarias Masterclass* is an innovative programme in which selected students have the chance to share a working day with an expert in the professional sector they are interested in. The objective is to help students to choose their professional career and to gain first-hand experience of what their future could really be like. Two students visited the PLOCAN facilities in June.

In short, a total of 72 students have taken part in PLOCAN training programmes this year, engaging in activities related to the Consortium's activities.

Training initiatives

PLOCAN is running three active training initiatives, which act as a supplement to non-university education.

Glider School



Illustration 100. Glider School 2016

The seventh PLOCAN Glider School was held in 2016, in the second week in November. The school brought together representatives from all the glider manufacturers, *Teledyne Marine*, *Liquid Robotics*, *Alseamar*, *Offshore Sensing*, *Kongsberg Maritime*, in the sector, along with international benchmark institutions, *Memorial University*, *MARUM*, *Rutgers University*, *CNRS*, etc, and users of these latest-generation autonomous, off-shore observation platforms. The school programme comprised both theoretical and practical sessions in the PLOCAN facilities, at the Taliarte docks and in open waters off the coast of Telde. Students had the chance to use the five glider technologies available. Once again, the school consolidated its position as an international benchmark in high-level glider training. The school was attended by 14 students from Ecuador, France, Ireland, Israel, Portugal and Spain. The training sessions were given by teachers from France, Germany, Canada, Norway, USA and Spain.

EDUROVs

The workshop to attract and motivate high school students towards science and technology by building and remotely operating submarine vehicles (ROVs), is a PLOCAN initiative, in collaboration with the VICOROB group (*Computer Vision and Robotics Group*) from the University of Gerona. The project is co-funded by the Social Work Charity of La Caixa Bank. In this project, high school students, along with their teachers, build ROVs and pit their handling skills against other schools at a meeting. 23 secondary schools from the Canary Islands and one from Madeira (Portugal) took part in this year's event. In January, PLOCAN organised a training course called "Introduction to the Arduino uno motherboard", aimed at the secondary school teachers taking part in the workshop. The demonstration event was held in June in the "Julio Navarro" municipal swimming pool. The students did tests with their ROVs and demonstrated the specifics of their designs. The event brought together representatives of the Canary Island Government, the Ministry of Economy and Competitiveness and the Las Palmas de Gran Canaria City Council, the ULPGC and Caixabank to award the schools a shield at the end of the activities, as a souvenir of having taken part in the project.



Illustration 101. Group of students taking part in EDUROV

A dedicated manual was published in August that included the latest news on the project, entitled “EDUROVs Educational Project, Arduino and Scratch implementation manual for controlling ROVs”.



Illustration 102. Photo of the EDUROVs event

Educational Dinghies



Illustration 103. Launching educational dinghies Canarias-II and Canarias-III on El Hierro

This project stems from the international project *Educational Passages* started in USA. It consists of primary and secondary school students building a small sailing dinghy that is then launched into the ocean. The students can follow its voyage by GPS. These dinghies sail for months without any kind of support and they can cover enormous distances. For primary students, it is a relaxed way of discovering geography and history from the standpoint of sailing. Secondary students can learn earth sciences and oceanography, including wind, currents, wave action and climatology. Two of these dinghies were launched in 2016, from the island of El Hierro, one in May and the other in November. Both launches were widely covered in the media.

9. PARTICIPATION IN EVENTS AND VISITS RECEIVED

The Chairman of the Cabildo de Gran Canaria (Island Government) and the Mayor of Telde accompanied by the Minister of Economy, Industry, Trade and Knowledge of the Canary Island Government, the director of the Canary Island Agency for Research, Innovation and Information Society and the chair of the Strategic Council of PLOCAN visited the Consortium's facilities in Taliarte at the end of January.

During the visit, the director of PLOCAN explained the Consortium's activities as an Outstanding Scientific and Technical Infrastructure for research, development and innovation in the field of marine science and technology funded by the joint initiative of the Canary Island Regional Government and the Spanish Central Government through the Ministry of Economy and Competitiveness and supported by the European Regional Development Fund. In his presentation, he told them about the Consortium's projects and informed them in detail about the construction work being carried out on the platform.



Illustration 104. Institutional visit to PLOCAN



Illustration 105. PLOCAN delegation at ICOE 2016

PLOCAN took part as a partner in the ICOE 2016 conference (International Conference on Ocean Energy), and it also had a joint stand organised by IEX (Spain Exports and Investments). ICOE is the main international off-shore energies event, held in Edinburgh this year, at the end of February, attracting over 700 representatives of the industry from all over the world.

PLOCAN also took part in an informative, institutional and business event to present the results of the first call for projects and the details of the second call for projects of the OCEANERA-NET Project and contributed to two communications: "A singular facility at the PLOCAN test site", and "Environmental monitoring at the PLOCAN marine test site", dealing with its marine energy test bed and the oceanic platform, which is currently under construction.

After the conference, PLOCAN took part in International WaTERS, an ICOE-associated event attended by delegates from 9 countries. This event tries to present different experiences

world-wide in off-shore renewable energy test beds.

PLOCAN attended the Ocean Sciences Meeting (OSM) 2016 held at the end of February in New Orleans, and presented several communications on several of the projects that are currently on-going on time series oceanic observation (FixO₃ project), operating gliders (AtlantOS and EGO), developing new generation marine sensor equipment (NeXOS), and co-ordinating internationally-managed oceanic observation and exploration programmes in the Atlantic (AORAC-SA).

The two-yearly Oceans Sciences Meeting OSM, co-sponsored by the American Geophysics Union (AGU), the Association for Science, Limnology and Oceanography (ASLO) and The Oceanographic Society (TOS) is the international benchmark for scientists, engineers and users of the ocean to promote, disseminate and exchange knowledge, ideas, applications and scientific-technical advances concerning the multi-disciplinary and broad set of current ocean sciences and marine technologies.

The conference was attended by around one hundred companies and institutions from the sector from all over the world, along with almost two thousand registered delegates. The event offered a multi-disciplinary programme of parallel oral sessions, a poster exhibition forum and a showroom dedicated specifically to companies, with stands for them to present their products and latest technological advances.



Illustration 106. Ocean Sciences Meeting 2016



Illustration 107. Underwater Intervention 2016

PLOCAN took part in the Underwater Intervention (UI), a world-wide benchmark forum for the deep water technical diving and submarine robotics industry, held in New Orleans, United States, at the end of February, with an oral presentation (The ocean-glider school) dealing with the glider school held every year in Gran Canaria.

UI is jointly sponsored by the Association of Diving Contractors International (ADCI) and the International Remotely Operated Vehicle (ROV) Committee of the Marine Technology Society (MTS). The event included a spacious area for demonstrating the latest technological advances from the leading companies in the sector, and a technical programme of oral presentations on specific themes, such as manned submersibles, AUV, technological training and education, sensors and instruments, submarine engineering, technical diving, ROV, etc.

At the beginning of March, students from the University of Las Palmas de Gran Canaria (ULPGC) studying the Master in ICT- Information and Communications Technology – Solutions for Welfare and the Environment (BiMeTIC), along with three of their teachers, visited the PLOCAN facilities. The visit was part of the Master syllabus and its main objective was to show the students, not only the on-shore facilities of the infrastructure, but also the capabilities, lines of scientific-technical work and activities – operational and educational – that PLOCAN is currently involved in, and the potential professional opportunities in the field of ICTs and their applications in the marine and maritime sectors.



Illustration 109. Uzbek delegation

objectives, its facilities and its most important projects. The meeting was also used to explore synergies with the innovation system that is currently being developed in Uzbekistan.

In March, the PLOCAN team that is participating in the national project DEMOLA that promotes collaborative innovation and which connects the university with the working world to successfully tackle challenges presented its proposals after four months of hard work on “New uses of the oceanic platform”.

A Uzbek delegation made up of different universities, science parks and government agencies related to R+D+i visited PLOCAN at the beginning of March to find out more about what PLOCAN does to attract researchers, projects and investment to the marine-maritime sector.

During the visit, Uzbek delegates had the chance to get a first-hand view of PLOCAN’s vision and



Illustration 108. Visit from BiMeTIC Master students



Illustration 110. Presentation by the Demola team

Students summarised the different work packages covered: “Health and Environment”, “Safety and Emergencies”, “Education and Training” and “Events and Art” in front of staff from PLOCAN and the Canary Island Institute of Technology. The first edition of 'DEMOLA Canarias' is the result of over six months' work, including signing agreements with the two public universities of the Canary Islands. Over 30 companies have been contacted, around 40 talks have been given to attract students from schools to get almost 300 students to sign up, register 117 challenges and get a final result of 7 challenges involving 30 students. With the DEMOLA Project, the Canary Island Government is driving the open innovation model that offers opportunities for young talent with this collaborative model.

PLOCAN took part in Oceanology International 2016 in London in mid-March. This forum is held every two years and is a world-wide reference for a clearly emerging sector in the marine-maritime and Blue Growth context, like the sciences and technologies of monitoring the coastal and oceanic environment. Oceanology International was held with an agenda of scientific lectures on sectors and issues such as marine technologies to monitor the ocean, exploring renewable energy resources, marine robotics, data management, hydrography, geo-physics and geotechnics, among other, along with an ample programme of additional activities on top of the large number of exhibition stands.



Illustration 111. Oceanology International 2016

Over one thousand companies and exhibiting institutions showed their latest products and technological developments concerning autonomous marine observations platforms, sensors and their accessories to over eight thousand delegates, along with consulting services in the area of operating and using marine technologies of this kind. PLOCAN's participation enabled them to disseminate some of the main technological projects and initiatives that the Consortium are currently tackling in this context (AtlantOS, FixO3, AORA-CSA, NeXOS, EMSO, etc.), promote PLOCAN's international glider school, interact directly with international partners and vendors in order to resolve technical issues, quite complex ones sometimes, and reinforce co-operation bonds in others, for future actions and to discover the latest technological developments and advances in the sector first hand.



Illustration 112. Testing the DeDaVe Vehicle

In March, PLOCAN took part in the second Catch-The-Next-Wave (CTNW) seminar on future technological trends in robotics and automation. Catch-The-Next-Wave was organised by the

British Marine Technology Group, XPrize, the National Environmental Research Council and the National Oceanographic Centre of the United Kingdom, with the support of the Institute of Marine Research, Science and Technology (MAREST), the Society of Underwater Technology (SUT) and the Marine Technology Society (MTS).

An ample agenda of oral presentations by researchers, technologists and directors of companies and institutions showed over two hundred attendees the very latest developments programmed for the coming years in the field of autonomous marine vehicles and platforms destined to become the new generation of real benchmark technological solutions in each of their specific sectors of application.

PLOCAN's participation in the event was driven by both its alignment with several of PLOCAN's general and specific objectives as it is part of Oceanology International, an event with an enormous international impact, and because of the scope and repercussion of the subjects tackled, which in turn, allows them to enhance future opportunities of international co-operation in technological projects and initiatives of this kind, both in the private and in the public sector.



Illustration 113. CTNW technological seminar



Illustration 114. Participants in the encounter held at Tecnia

REV, from the Loire, in France, and PLOCAN, also took part.

The director of the Area of Science, Technology and Innovation of PLOCAN, presented the PLOCAN test bed at the meeting "Wave and current energy: Towards validation in a marine environment" organised by the Basque Country Energy Cluster and the Basque Maritime Forum, in the Tecnia offices in the Vizcaya Technology Park. In his intervention, he presented the main characteristics of the PLOCAN Test Bed.

The meeting focused on the pilot testing, demonstration and validation phases, at full scale or reduced scale, of prototypes of devices to harness the energy of waves and currents, scheduled in two main sessions. The first, covering the major challenges to developing wave and current power, included the participation of representatives of the European OPERA Project and the engineering company Energie de la Lune. In the second session, some of the main marine energy testing and validation sites presented their services and current projects in the Atlantic Strategy. The Basque Country and Aquitaine sent representatives from Bimep, Mutriku and Seeneoh. SEM-

In May, PLOCAN attended the Ocean SITES meeting, a network of marine observatories and stations that measure ocean variables both on the sea surface and in the water column from the surface down to the seabed. Automatic systems are used at these points where possible, with advanced sensors and telecommunications systems to obtain high-resolution data, often in real time, to build long time series. Observations cover meteorology, physical oceanography and important parameters in the carbon cycle, ocean acidification, ecosystems and geo-physics.

This year, Ocean SITES held its 11th Executive Board meeting and the 8th meeting of the data management teams, hosted by the National Oceanography Centre in Southampton, United Kingdom. PLOCAN's participation consisted of presenting the main scientific achievements from the observations made in the European Oceanic Time Series Station in the Canary Islands "ESTOC". These observations currently form part of the work being carried out in the European Fix O₃ project (Fixed- point Open Ocean Observatories), which in turn, is the European deep ocean observation network. The objective of this event is to enhance co-ordination and knowledge among partners and the search for harmonisation and standardisation of observations with a view to facilitating access to the data by any user wishing to do so.



Illustration 115. PLOCAN at FIMAR 2016

(Remotely-Operated Vehicles). Moreover, a pool was set up to demonstrate the results, where people attending the fair could try some of the submarine vehicles developed.

At the beginning of May, PLOCAN took part in the sixth International Sea Fair (FIMAR), organised jointly by the Cabildo (Island Government) of Gran Canaria, through the Canary Island Trade Fair Institution (Infecar), The Las Palmas de Gran Canaria City Council and the Las Palmas Port Authority.

The Marine-Maritime Scientific Education Conference CONMAR was held at the same time as FIMAR. PLOCAN made presentations at these events, focusing on blue growth and how this is related to the Atlantic Strategy and marine energies. The conferences set a double objective, on the one hand, to educate and raise awareness of the challenges and opportunities of the marine-maritime economy for the city of Las Palmas de Gran Canaria, the island of Gran Canaria and for a region like the Canary Islands, and on the other, to foster the participation of society and the people, listen to their opinions, their vision and actions and try to integrate their motivating forces into developing specific initiatives and projects.

PLOCAN's participation in FIMAR was an integral exhibition in two marquees, showing the work that it is currently doing in the EDUROVs Project to attract and motivate secondary school students towards engineering by building and remotely operating submarine ROVs

PLOCAN also attended the 'hackathon' (parallel encounter to FIMAR, for programmers and other people related to software and hardware development, such as engineers and designers) Blue Weekend. The event was held in the Edificio Miller, organised by the Gran Canaria Economic Promotion Society and the Marine Park collaborative work centre. The PLOCAN team participated with a low-cost system to detect faults in submarine waste-water pipes. This solution was based on a monitoring system that provides periodic information on the state of the installation, and acts in case of an alert.

In May, representatives from the European Commission, the Ministry of Finance and Public Administrations, Ministry of Employment and Social Security and the Canary Island Government visited the on-shore facilities and the platform currently in construction at the Nelson Mandela Dock of the port of La Luz and Las Palmas to monitor the ERDF Operational Programme in the Canary Islands.

The objectives of the ERDF Operational Programme for the Canary Islands for the programme period 2007-2013 form part of the general content of the common policies and, basically, they are the objectives of growth, employment and social cohesion that guide all the political interventions of the European Union (Common Guidelines on Growth and Cohesion), and the final purposes of the main development plans drawn up by the General State Administration (National Reform Plan, National Strategy Framework of Reference).

The Canary Island development strategy for the period 2007-2013 set as a global objective or target, to promote the sustainable development of the Autonomous Region, attempting to consolidate a competitive economy of full employment that, while friendly to the environment and the natural values of the island territory, also allows for an enhancement of the social and territorial cohesion of the archipelago, the quality of life of its citizens and real convergence with the European Union.

To achieve this goal, the ERDF Operational Programme for the Canary Islands defined instrumental final objectives in accordance with the diagnostic analysis performed on the socio-economic situation of the Autonomous Region of the Canary Islands and in the context of the strategic development priorities that the European Commission has set for the next programming period 2007-2013. One priority for these objectives is to enhance the competitiveness of the productive fabric of the Canary Island economy by promoting the decisive factors of economic growth and by optimising the supply of basic natural resources for the socio-economic system in the framework of environmental sustainability, with particular emphasis on developing the Knowledge Economy.

PLOCAN was designed as a scientific and technological infrastructure mobilised by knowledge and technology to induce a new productive fabric in the marine and maritime field, in harmony with the blue growth strategy established in the European Union. PLOCAN is part of Strand 1 "Development of the knowledge economy", priority issue 02 and with a co-funding rate of 85%.



Illustration 116. Monitoring the ERDF operational programme

In mid-May, PLOCAN and Ocean Networks Canada organised a seminar in the PLOCAN facilities on developing ocean observation technologies in order to create a platform to respond to contingencies and international collaboration in the marine field. The seminar addressed present and future challenges relating to the technical observation resources (sensors and platforms) required for the surveillance of the oceans. The event attracted international experts from the academic and business worlds to tackle the needs of these sectors with respect to new technologies for ocean observation and monitoring the environment.



Illustration 117. Participants in the joint Ocean Networks-PLOCAN event

and during the life of the ENVRIplus Project, new research projects are expected to appear in the H2020 and ESFRI programmes. The meeting of the ENVRI community presented the vision of the ENVRIplus Project, along with related products and solutions. The meeting also facilitated dialogue and interaction around future needs, challenges and developments in the ENVRI community.

ENVRIplus is a project that brings together environmental, terrestrial research infrastructures, projects and networks, along with specialist technical partners. The objective is to create a coherent, inter-disciplinary and inter-operable cluster of environmental research infrastructures throughout Europe.

30 European, U.S. and Canadian experts from both the public and private sector took part in the meeting. These experts included representatives of recognised international prestige, like Ocean Networks Canada, and companies from the oil and gas industry, like Kavala Oil.

The seminar was opened by the Minister of Economy, Industry, Trade and Knowledge of the Canary Island Government, the Ambassador of Canada in Spain and Andorra, the rector of the University of Las Palmas de Gran Canaria and the director of PLOCAN.

PLOCAN participated in the ENVRI week, held in May and focusing on developing research infrastructures related to the environment, held from the 9th to the 13th of May. PLOCAN's activity is for the new sensor networks, representing FixO₃.

The current context of environmental research infrastructures and networks is in constant flux,



Illustration 118. Visit by delegates of ENVRIplus to the platform building works

At the end of May, a delegation from Indonesia comprised of different companies and government bodies related to the construction, naval, maritime and tourism sectors visited PLOCAN to see what the Outstanding Scientific Technological Facility does to attract researchers, projects and investment in the marine-maritime sector.

The visit, which took place after the Seminar on the Maritime and Tourist Infrastructure of Indonesia given in the Gran Canaria Chamber of Commerce, allowed the Indonesian representatives to discover the vision and the objectives of PLOCAN first hand, along with its scientific-technological capabilities and its most important projects. The meeting was also useful for exploring synergies with the activities currently being carried out in Indonesia.



Illustration 119. Visit to PLOCAN by an Indonesian delegation

The students that won the scientific promotion event organised by the Caja Rioja Foundation, Divulgaciencia, travelled to Gran Canaria in June to visit the PLOCAN facilities, among other things. The students were given the chance to see the building work on the Oceanic Platform, situated on the Nelson Mandela Dock of the port of La Luz and Las Palmas.

The youngsters that took part and won prizes in “Divulgaciencia 2015”, are studying Compulsory Secondary Education and Middle and Higher Vocational Training.



Illustration 120. Visit from the winners of Divulgaciencia 2015



Illustration 122. Participants at the GEO seminar

ordinated network of Earth observations that provides permanent information." GEO member governments include 101 nations and the European Commission and 95 participant organisations comprised of international agencies with a mandate for observing the Earth.

Representatives of the legislative assemblies of the Canary Islands, Azores, Cape Verde and Madeira visited the Taliarte Marine Pole for the VIII Atlantic Parliamentary Conference held in June. This is a meeting of the parliaments of Macaronesia that analysed issues of mutual interest, the fight against common difficulties, shared opportunities and the purpose underpinning development projects for these regions, with the aspiration of taking their conclusions to the European institutions. They addressed aspects concerning the economy, tourism, transport, communications, energy and new technologies.

The delegates to the conference visited the PLOCAN facilities.

Representatives of science, the business world and the public administration met at the end of May in Berlin at the GEO 2016 European projects seminar, focused on Earth observation. PLOCAN participated in the session entitled "Towards an Integral Ocean Observation System – Optimising monitoring and data-sharing capability", presenting a talk entitled "Observation with sensors and associated developments". Founded in 2005, GEO is a voluntary association of governments and organisations that envisages "a future in which decisions and actions in benefit of mankind are informed by an integral, co-



Illustration 121. Visit by delegated to the Atlantic Parliamentarians Conference



Illustration 123. Visit by the Japanese delegation

and Technology Campus of the Canary Islands visited the on-shore facilities of PLOCAN, where they got an idea about the scientific-technological operational and training lines of work and activities that PLOCAN is currently engaged in. The students were a first group of students organised in the strands of “Biomedicine and Health” and “Energy, Biodiversity and the Environment” in the modality of R+D projects offered by the Campus. Another group of students will visit PLOCAN soon.

The aims of the University of La Laguna (ULL) and the University of Las Palmas de Gran Canaria (ULPGC) includes “bringing the research work carried out in their departments and scientific structures to Canary Island Society, in an easy-to-understand and practical manner, without losing scientific rigour”. That is why their respective Scientific Culture and Innovation Units, Cienci@ULL and DivulgaULPGC, design and implement an annual programme of activities to promote scientific culture. One of these activities is the Canary Island Science and Technology Campus (CCT CANARIAS), a practical, game-based training programme aimed basically at stimulating the “scientific curiosity of the student body of 3rd and 4th grade of Secondary Education and Lower Sixth students in Canary Island schools”.

The acting Ambassador of Japan in Spain, his attaché and the new Japanese consul in the Canary Islands visited the building works on PLOCAN’s marine platform and the on-shore facilities at the end of June to see the work that the Outstanding Scientific Technological Facility does to attract researchers, projects and investment in the marine-maritime sector. This visit by the Japanese diplomats coincided with the sixtieth anniversary of the presence of the Japanese fishing fleet in the Canary Islands.

The Japanese representatives were shown the PLOCAN strategy and objectives, its scientific-technological capabilities and its most important projects. The meeting was also useful for enhancing relations between the Canary Islands, via PLOCAN, and the prefecture of Iwate in Japan. These relations were established in 2014 to generate synergies in R+D+I between their respective test beds.

In July, thirty students taking part in the Science



Illustration 124. Visit by students from the Science and Technology Campus



Illustration 125. Visit from representatives of Tecnalía

As part of the agreement signed with Tecnalía, they sent a delegation to PLOCAN at the end of July to see the facilities and the activities engaged in here. TECNALIA is the largest private applied research and development centre in Spain and one of the most important in Europe, with 1,400 experts of more than 30 nationalities working on transforming knowledge into GDP to improve the quality of life of people by creating business opportunities for companies.

PLOCAN and TECNALIA have identified common objectives that allow them to consider larger challenges; to become national and international benchmarks in their respective fields of work and to achieve their *raison d'être* and their goals by making better use of the resources available, with efficient and efficacious management, enabling them to attain the objectives set and the results proposed.

The agreement comprises broadening collaboration to other areas of common interest such as R+D+i programmes and projects, including international co-operation, programmes to stimulate technological transfer to industry and institutions, specific life-long training for corporations, entrepreneurship and business innovation actions, initiatives and projects; dissemination of marine science and technology-related knowledge; joint management and use of infrastructures or any other kind of collaboration in matters of scientific or technological infrastructures and instrumentation; share and exchange services between the parties and joint provision of services to third parties; and anything else related to the purposes of the agreement.

The National Oceanographic Institute of the United Kingdom (NOC) hosted the seventh two-yearly EGO conference (Everyone's Gliding Observatories) in September at its head offices in Southampton, congregating over one hundred and fifty delegates representing the international community of scientists and technicians using glider technology, along with the leading companies in the sector that have supported the organisation of the event with sponsorship in co-operation with the European AtlantOS-H2020 project.

A wide-ranging agenda of presentations, poster exhibitions, tutorials, guided tours and commercial presentations gave EGO delegates the chance to see both the latest devices and technological advances in vehicles, sensor technology and their applications, along with the most important results arising from the multi-disciplinary and ever-growing use of autonomous marine observation platforms in national and international initiatives, projects and



Illustration 126. PLOCAN presentation at EGO

programmes, which now maintain a permanent presence in both coastal and off-shore waters of the seven continents.

PLOCAN took part in the seventh EGO conference with the presentation of three papers concerning their activities and capabilities in the field of gliders, with the following titles "Improving in-situ ocean observations in the Macaronesia region with gliders", "PLOCAN Glider School: The hands-on ocean glider technology and training forum", and "A role for gliders in sustained observations on the eastern boundary of the subtropical Atlantic", an article written in co-operation with NOC and the Moroccan National Institute for Fisheries Research (INRH).

In December, the Director of the State Research Agency of the Ministry of Economy, Industry and Competitiveness, Marina Villegas, opened the meeting entitled "The European Union-Community of Latin American and Caribbean States Common Research Area on Renewable Energies and Research" at the PLOCAN facilities.



Illustration 128. Visit to the PLOCAN facilities



Illustration 127. RERIs workshop opening ceremony

The meeting was attended by partners of the ALCUENET (Latin American, Caribbean and European Network for Research and Innovation) and ERANET LAC (European Union, Latin American and Caribbean Network for joint innovation and research activities) projects, who share the common strategic objective of reinforcing a sustainable R+D Community between the European Union and the Community of Latin American and Caribbean States, bringing together the players involved in research and innovation with a view to exploring a range of management and support possibilities for a joint, bi-regional call for projects in renewable energies implemented in major research infrastructures. The pertinent partners of the projects, from both the public and private sectors and from civil society, join forces to back collaboration, in the context of bi-regional research and the area of co-operation of innovation. With their eyes on this strategic objective, the partner countries from both regions are seeking common visions on specific issues, co-ordinating activities and identifying priorities and funding for R+D projects in which they have shared interests.

The meeting focused on assessing the prospects of availability of infrastructures for research and innovation and the implementation of a joint pilot call for projects in the field of Renewable Energies, in the European Union-Community of Latin American and Caribbean States for co-operating in R+D relating to energy research and innovation agendas. In this context, PLOCAN was presented as an infrastructure at the service of the scientific and business community.

Discussions included key players, from funding organisations of over 20 countries of the European Union and the Community of Latin American and Caribbean States, experts in science and technology in the field of renewable energies and the management of major infrastructures.

10. PUBLICATIONS, COMMUNICATIONS TO CONFERENCES AND OTHER DISSEMINATION ACTIVITIES

Publications have been generated at several levels in 2016, as presented in the sections below. With respect to scientific publications, all the PLOCAN publications have been compiled in the *EndNote* repository of the *Science* web site.

Books

- ▶ [L_1] Patricia López García and **María José Rueda-López**, *Manual de Procedimientos Técnicos y Buenas Prácticas. 01:PTL-ALC, PTL-SAL, PTL-O₂, PTL-ChL, PTL-CTD*, ISBN: 978-84-608-6553-7, May 2016.
- ▶ [L_2] Carlos Rodríguez Cabrera, **Carlos Barrera Rodríguez**, Daura Vega Moreno and Diego Llinás Rueda, *Manual de construcción de Botes Educativos*, ISBN: 978-84-608-6552-0, May 2016.
- ▶ [L_3] Saúl Robaina Hernández, Carlos Rodríguez Cabrera, **Eduardo Quevedo Gutiérrez**, Daura Vega Moreno, Iván Juanes Prieto and Xavier Cufí Sole, *Proyecto educativo EDUROVS – Manual de implementación de Arduino y Scratch para el control de ROVs*, ISBN: 978-84-608-6554-4, August 2016.

Chapters of Books

- ▶ [CL_1] **Eduardo Quevedo**, Gustavo Marrero and Félix Tobajas, *Approach to Super-Resolution through the Concept of Multi-Camera Imaging*, Image and Video Coding, ISBN: 978-953-51-2775-8, November 2016.

Scientific Journals

- ▶ [RC_1] Montes, E., F. E. Muller-Karger, **A. Cianca**, M. W. Lomas, L. Lorenzoni and S. Habtes, *Decadal variability in the oxygen inventory of North Atlantic subtropical underwater captured by sustained, long-term oceanographic time series observations*, *Global Biogeochemical Cycles*, vol.30, issue 3, pp. 460-478, JCR = 3.965, March 2016.



- ▶ [RC_2] Mairi M.R. Best, Paolo Favali, Laura Beranzoli, Jérôme Blandin, Namik M. Çağatay, Mathilde Cannat, Juan José Dañobeitia, **Eric Delory**, Jorge M.A. de Miranda, Joaquín Del Río Fernandez, Henko de Stigter, Mick Gillooly, Fiona Grant, Per O.J. Hall, Susan Hartman, **Joaquín Hernández-Brito**, Nadine Lanteri, Juergen Mienert, Gheorge Oaie, Jaume Piera, Vlad Radulescu, Jean-Francois Rolin, Henry A. Ruhl, Christoph Waldmann, and all contributors to the EMSO Consortium, "*The EMSO-ERIC Pan-European Consortium: Data Benefits and Lessons Learned as the Legal Entity Forms*", Marine Technology Society Journal, vol. 50, nº4, pp 8-15, JCR = 0.678, ISSN: 0025-3324, June 2016.
- ▶ [RC_3] **Daniel A. Real-Arce**, **Eduardo Quevedo**, **Carlos Barrera**, **Joaquín Hernández**, **Octavio Llinás**, Fernando Barbero and Álvaro Morais, "*A New Integrated Border Security Approach: The FP7 PERSEUS Project*", Marine Technology Society Journal, vol. 50 nº4, pp 1-12 JCR = 0.678, ISSN: 0025-3324, August 2016.
- ▶ [RC_4] Luisa Cristini, Richard S. Lampitt, Vanessa Cardin, **Eric Delory**, Peter Haugan, Nick O'Neill, George Petihakis and Henry A. Ruhl, "*Cost and value of multidisciplinary fixed-point ocean observatories*", Marine Policy, vol. 71, JCR = 2.453, ISSN: 0025-3324, pp 138-146, September 2016.
- ▶ [RC_5] Javier Zazo, Sergio Valcarcel Macua, Santiago Zazo, Marina Pérez, Iván Pérez-Álvarez *, Eugenio Jiménez, **Laura Cardona**, **J. Joaquín Hernández** and **Eduardo Quevedo**, "*Underwater Electromagnetic Sensor Networks. Part II: Localization applications*", Sensors, vol. 16 nº2176, pp 1-18 JCR = 2.033, ISSN: 1424-8220, December 2016.

Information Journals

- ▶ [RD_1] "*The Oceanic Platform of the Canary Islands*", Ocean News and Technology, September 2016.

Reports

- ▶ [I_1] L. Coppola, M. Ntoumas, R. Bozzano, M. Bensi, S. Hartman, M. Charcos Llorens, J. Craig, JF. Rolin, G. Giovanetti, D. Cano, J. Karstensen, **A. Cianza**, D. Toma, C. Stasch, S. Pensieri, V. Cardin, A. Tengberg, G. Petihakis, L. Cristini, "*FixO3 – Handbook of best practices*", June 2016.
- ▶ [I_2] BSc Renewable Energy Third Year Students, "*Green Canaria, The Pathway to 100% Renewable Energy in Gran Canaria by 2050*", June 2016.

Conferences

- ▶ [C_1] **Eduardo Quevedo**, Daura Vega, Carlos Rodríguez and Eugenio Gil, "*Aprendizaje por proyectos aplicado a robótica submarina orientado a profesores y alumnos de secundaria*", Conference on Educational Technologies and Innovation – Tools and new methodological perspectives", February 2016.
- ▶ [C_2] **V. Monagas**, **F. Rodríguez**, **J. González**, **J. Hernández-Brito**, **M. J. Rueda**, **O. Llinás**, "*A Singular Facility at the PLOCAN Test Site*", International Conference on Ocean Energy (ICOE), February 2016.
- ▶ [C_3] **J. González**, **V. Monagas**, **X. Remírez**, **L. Cardona**, P. López, A. Luque, **E. Delory**, **C. Llerandi**, **M. J. Rueda**, **J. Hernández-Brito**, **O. Llinás**, "*Environmental Monitoring at the PLOCAN Marine Test Site*", International Conference on Ocean Energy (ICOE), February 2016.



- ▶ [C_3] **C. Barrera, MJ. Rueda, A. Cianca, J. Brito and O. Llinás**, "*Ocean gliders for marine biodiversity monitoring in the Macaronesia region (R3M)*", Workshop on Essential Ocean Variables for monitoring and assessment of marine biodiversity and ecosystems health, June 2016.
- ▶ [C_4] S. Velasco, **E. Quevedo**, J. Font, A. Oscoz, R. L. López, M. Puga, **J.H. Brito, O. Llinás**, G.M. Callicó and Roberto Sarmiento, "*Snorkelling between the stars: submarine methods for astronomical observations*", Meeting of the Spanish Royal Astronomy Society, July 2016.
- ▶ [C_5] E. Jiménez, G. Quintana, P. Mena, P. Dorta, I. Pérez, S. Zazo, M. Pérez and **E. Quevedo** "*Investigation on Radio Wave Propagation in Shallow Seawater: Simulations and Measurements*", Underwater Communications and Networking Conference, August 2016.
- ▶ [C_6] P. Mena, P. Dorta, G. Quintana, I. Pérez, E. Jiménez, S. Zazo, M. Pérez, **L. Cardona and JJ. Hernández-Brito**, "*Experimental testbed for seawater channel characterization*", Underwater Communications and Networking Conference, August 2016.
- ▶ [C_7] Gara Quintana-Díaz, Pablo Mena-Rodríguez, Iván Pérez-Álvarez, Santiago Zazo, Pablo Dorta-Naranjo, Eugenio Jiménez-Yguacel, **Laura Cardona-Díaz**, Marina Pérez, **Eduardo Quevedo-Gutiérrez, José Joaquín Hernandez Brito**, "*Underwater radiocommunications: measurements, simulations and results*", XXXI National Symposium of the International Radio Science Union, September 2016.
- ▶ [C_8] **C. Almisas, C. Barrera**, H. Precheur, C. Déniz, C. Waldmann, S. Meckel, "*Improving Ocean-Glider's Payload with a new generation of spectrophotometric pH sensor*", Seventh International Workshop on Marine Technology, October 2016.



11. COMMUNICATION

The main communication actions conducted by PLOCAN in 2016 are as follows:

January

Regional radio interviewed the director of PLOCAN concerning the development of marine renewable energies and an informative press conference was held for the William Kirkwood (MBARI)'s lecture. The visit by the Minister of Economy of the Canary Island Government, Pedro Ortega, and the Chairman of the Cabildo, Antonio Morales, to PLOCAN were also covered in the media.

February

The press picked up on the initiative of the Las Palmas de Gran Canaria City Council, through the departments of Economic Promotion and Mobility, Municipal Buses and the Canary Island Oceanic Platform, to study the feasibility of using renewable marine energy in the electricity grid of the future BRT (Bus Rapid Transit) in order to reduce the use of fossil fuels in the system.

The media covered the assembly of the LEANWIND European project partners to make wind and marine power generation more competitive and Antonio Fernández, of the programme "Españoles en la Mar" broadcast on National Radio followed the news.

March

Once again, PLOCAN worked with GEOMAR and the University of Las Palmas de Gran Canaria on the Kosmos experiment in the port of Taliarte and both text and photographs of the trials of a new unmanned submarine vehicle called DeDaVe, designed by the German Fraunhofer Institute of Imaging Optoelectronics, Technologies, Systems and Management (IOSB) on the PLOCAN test bed were distributed. Furthermore, preparations started on organising the presentation of the prototype of the Estecyo Foundation.

April

Dissemination of a press release with pictures of an oceanographic research mission in the waters of Macaronesia using a PLOCAN glider that was launched in the waters of Funchal, Madeira.

May

The media spread news about the progress of construction of the Oceanic Platform, which included coverage of the seminar on developing ocean observation technologies, held on the 16th and 17th of May, in the PLOCAN on-shore facilities in Taliarte, opened by the Minister of Economy, Industry, Trade and Knowledge of the Canary Island Government.



PLOCAN also worked with the ESTEYCO Foundation on the visit to the construction works of the prototype off-shore wind turbine Mario Luis Romero Torrent, attended by the Minister of Economy, Industry, Trade and Knowledge of the Canary Island Government and the Chairman of the Cabildo of Gran Canaria, in Arinaga. The prototype will be tested on the PLOCAN test bed.

The fourth Submarine Robotics Workshop, Project EDUROV, promoted by the Social Work Charity of "la Caixa" and PLOCAN, aimed principally at stimulating vocation in technical and scientific disciplines among young people by building prototypes in schools, attracted the works of 590 students from 30 high schools, 26 from the Canary Islands and four from the mainland: INS Sant Feliu de Guíxols, Girona; IES San Fernando, Seville; IES A Basella, Pontevedra; and IES Juan Antonio Pérez Mercader, from Huelva. The event was held in the Julio Navarro swimming pool in Las Palmas de Gran Canaria with the presence of the Regional Minister of Economy, Industry, Trade and Knowledge.

PLOCAN also worked with the Department of Communication of the Caja Rioja Foundation after a visit from students as part of the Divulgaciencia project that Fecyt finances.

June

A tender for the PLOCAN Ship-to-Shore Electricity and Communication Infrastructures was put out over the media.

July

PLOCAN presented the co-operation agreement with the TECNALIA applied research centre in the PLOCAN offices, along with the agreement with SPEGC for driving the blue economy. The written media had special coverage of the completion of the building works on the platform in the port of La Luz and Las Palmas.

September

PLOCAN collaborated in writing an article on the Columbus Project for the specialist journal Energética XXI, and the media were invited to cover the meeting of the European Network of Fixed Ocean Observatories (FIX O3). They were later sent a press note and pictures of the project general assembly. A press conference was also called for the start of a series of trials and demonstrations as part of the European Smart Robots Working in Co-operative Networks (SWARMs) Project, in which PLOCAN is involved as a partner. Information and pictures were also sent out on the meeting organised in PLOCAN to generate B2B contacts and meetings with the regional industry as part of its commitment to help to enrich and stimulate business opportunities in the marine and maritime sector of the Canary Islands as part of the activities organised around the European SWARMs Project, funded by the European Commission and the Ministry of Economy and Competitiveness.



October

The media covered the “Atlantic Project Award”, granted by the European Commission and the Atlantic Strategy Group for the European support and co-ordination Project for the Atlantic Ocean Research Alliance (AORAC-SA). PLOCAN is a member of this project and continues to publish news about the Esteyco Foundation prototype Elisa and about taking the oceanic platform to the test bed.

November

PLOCAN sent out releases and pictures of the opening and closing ceremonies of the VII PLOCAN Glider School, and they organised a visit to the platform construction works at the Nelson Mandela Docks for representatives of the consortium, the Ministry of Economy, Industry and Competitiveness, the Canary Island Government, the Central Government Representative in the Canary Islands the Regional Minister of Economy, Industry, Trade and Knowledge and the director of the Canary Island Agency of Research, Innovation and Information Society.

They also started preparing for publicising PLOCAN’s participation in the Canarias III educational dinghy programme, as part of the International Educational Passages Project that PLOCAN co-ordinates in the Canary Island, and a piece for the programme “Teleplaneta” broadcast on Spanish National Television covering the mooring of the oceanic platform on the test bed, which had an enormous impact in both the local and national media.

December

PLOCAN put out a press note and pictures of the meeting “The Common European Union-Community of Latin American and Caribbean States Area of Renewable Energies and Research Infrastructures” held on the 12th and 14th of December with the presence of the director of the State Research Agency of the Ministry of Economy, Industry and Competitiveness, Marina Villegas, the director of the Canary Island Agency for Research, Innovation and Information Society of the Canary Island Government, Manuel Miranda, the head of the Transversal Scientific-Technical Programmes, Reinforcement and Excellence Sub-Division of the State Research Agency, Joaquín Serrano, and the director of PLOCAN, Octavio Llinás. An interview was also arranged for the manager of PLOCAN for the programme “Rostros de Telde”.



12. CORPORATE SOCIAL RESPONSIBILITY

PLOCAN uses the report on socially-responsible practises published each year by the Secretary of State for Public Administrations of MINHAP, as a guide, along with the Spanish Company Corporate Social Responsibility Strategy 2014-2020 adopted by the Council of Ministers at their meeting of the 24th of October 2014. The measures are arranged around three issues: environment, labour rights and policies and good governance. Some of them stem from the actions envisaged in the action plan and others are general. A large proportion of the measures have been in regular use in recent years, whereas others have only recently been rolled out.



Illustration 129. CSR issues

The measures implemented in 2016 include:

- ▶ Periodic control of water consumption, electricity consumption, paper and other raw materials and the management of incidents detected
- ▶ Improving the selective collection of waste and control of hazardous and non-hazardous waste management
- ▶ Spill risk control and the implementation of an environmental emergency procedure
- ▶ Energy efficiency improvement study on the buildings and replacing bulbs with LEDs
- ▶ Fuel consumption control
- ▶ Health and safety training for the staff over and above the requirements of health and safety regulations
- ▶ Assessment of staff performance
- ▶ Transparency section of the organisation's web site has been activated, giving access to regulations, institutional and organisational information and financial information, budget and contractual information

- ▶ Integrated management system certification

The measures implemented in previous years, which have continued to be developed in 2016, are as follows:

In the case of Strand 1 measures, some are related to the management and internal operation of the Consortium and others with the marine-maritime, scientific-technological activity itself. These measures include:

- Developing an environmental surveillance plan for the construction of the platform, going beyond the obligations set out in the environmental impact statement.
- Continual environmental monitoring of the test bed
- Climate control and office equipment-related energy-saving measures

Strand 2 includes the measures aimed at enhancing the wellbeing and working atmosphere of employees. Those rolled out in 2016 include:

- Training actions. Annual implementation and assessment of the training plan
- Measures aimed at motivating the staff in the vision and awareness of the objectives of the project.
- Reinforce health and safety beyond compulsory compliance
- More flexible working hours
- Provision of resources and working systems to promote ideal conditions
- Work in co-ordination with the staff delegates to improve the working atmosphere
- Improve communications. Provide information of interest to employees on the intranet

Strand 3 envisages measures relating to good governance. These include:

- Certification pursuant to quality standard UNE ISO9001 in accordance with the firm commitment of the senior management to quality
- Implementation of an integral management system in accordance with UNE-EN ISO 9001:2008 (certified in 2015), ISO 14001:2004 (environment) and OHSAS 18001:2007 (health and safety) in PLOCAN offices and services in its on-shore facilities
- Enforce the SCR plan
- Interaction with people and stakeholders. Develop and improve the communication plan. Attention to stakeholders
- Foster scientific-technological vocations
- Shared management of infrastructures with other institutions and synergetic use of resources
- Co-operation with public and private entities. Propitiate national and international co-operation agreements with public and private entities
- Roll out document-management and working systems that promote collaborative work between members of the organisation and with third parties
- Propitiate the exchange of know-how and temporary mobility of people with other institutions
- Propitiate bringing in new projects that bring the Consortium additional funding
- Increase the kind and number of services
- Assess project management
- Up-date and maintain documented work procedures



13. MANAGEMENT SYSTEM

An integral management system (IMS) has been rolled out in the organisation during 2016, in line with the senior management's wish to enhance the quality management system certified in 2015. The scope of the credentials obtained last year covered the training schools, whereas the current system also includes project management. Not only has the scope been broadened, standards ISO 9001, ISO 14001 and OHSAS 18001 have also been introduced, hence bringing the organisation in line with environmental and health and safety management regulations.

PLOCAN's definition of quality combines a concern for doing things as well as possible and for constant improvement, in order to comply with the requirements of our clients, and with legal requirements and regulations. Quality is a direct commitment of the senior management, as they have stated in the quality policy appended to the organisation's quality manual and to this report. PLOCAN pursues maximum quality and customer service objectives in its activities, which focus on helping to bring the best technological research, development and innovation to the market as fast as possible to drive economic growth and employment by providing efficient access to the ocean at increasing depths and in an environmentally-sustainable manner.

The scope of the integral management system rolled out in 2016 is "Marine science and technology services and the administrative management associated with the Training Schools and Management of ocean observation, marine energy, submarine sensors and vehicles, blue economy and growth and biodiversity and sustainability projects". The work done has involved the majority of the organisation staff and has been co-ordinated by the PLOCAN senior management through the quality department that reports directly to the director.

The procedures that describe the processes that the organisation carries out were drafted in the first half of 2016. All pursuant to the following standards:

- ▶ ISO 9001 Quality management systems
- ▶ ISO 14001 Environmental management systems
- ▶ OHSAS 18001 Health and safety in the workplace systems

The system is comprised of three kinds of procedures: strategic, key and support. Strategic procedures are those that describe system planning and its review and validation method. Key procedures describe the training school held in PLOCAN and the management of ocean observation, marine energy, submarine sensors and vehicles, blue economy and growth, biodiversity and sustainability projects that the organisation manages. These are the two central elements included in the certification scope. Finally, the support processes describe all the transversal activities engaged in by the organisation, such as managing procurement, customer satisfaction, human resources, emergencies, legal requirements, etc. PLOCAN has a designated team to manage the IMS that reports directly to the director.

First of all, the system undergoes an annual internal audit and review conducted by the director and the system management team. These reviews highlight any management anomalies and actions are established to remedy them. Secondly, the system undergoes an external audit performed by a certification entity.



Sometimes, this latter audit consists of monitoring the situation and sometimes it is a certification audit. The certification audit takes place when new elements are added to the scope or if new standards are added. The audit conducted in 2016 was to monitor the quality management system and certify the environmental and health and safety management systems.

The internal system audit was performed on the 7th of September and the management review on the 9th. The external certification took place on the 26th, 27th, 28th and 29th of September, after which, the audit team resolved to certify the integral management system.



Illustration 130. Certification of the PLOCAN management system

The wish of the PLOCAN senior management is to progressively broaden the services included in the system until the entire organisation is certified in the near future.

With respect to the environmental management system, an environmental emergency drill was run on the 23rd of December to check the staff's capacity to respond to an event of this kind, following the corresponding procedures.

14. HEALTH AND SAFETY IN THE WORKPLACE

In matters of health and safety, PLOCAN not only meets the requirements set out in the Health and Safety in the Workplace Act, it also meets international standard OHSAS 18001 (Health and safety management in the workplace)

Up until May 2016, PLOCAN had contracted ASPY PREVENCIÓN S.L. as an outside health and safety provider. The actions carried out by ASPY and PLOCAN in the area of health and safety up to May 2016 were as follows:

- ▶ Health and safety assessment of the work places and jobs
- ▶ PPE provided for all employees
- ▶ Specific training and information for all employees in accordance with their jobs
- ▶ Annual medical check-ups for all employees

- ▶ Self-protection plan

The contract with ASPY was suspended in June and a new one signed with PREVIMAC, SEGURIDAD Y SALUD LABORAL, SOCIEDAD DE PREVENCIÓN S.L.U. as the new outside health and safety service.

- ▶ The PREVIMAC system includes all the compulsory aspects under the legislation in effect:
 - ▶ Health and safety policy
 - ▶ Health and safety plan
 - ▶ Health and safety procedures
 - ▶ Planning training actions
 - ▶ Revision and adaptation of the work place and job health and safety assessment, in line with its criteria (work in progress)

An emergency fire drill was run on the 15th of April that detected certain deficiencies, which were subsequently remedied with a view to a possible real emergency.



Illustration 131. PLOCAN staff gathering at the meeting point

15. PLOCAN IN FIGURES

Below is an analysis of the most important numbers with respect to budget execution in 2016.

REVENUES AND CONTRIBUTIONS 2016

Concerning revenues and contributions received in 2016, the total figure for 2016 amounts to €16,013,391.28.

Revenues include those stemming from ordinary allocations from the consortium members (Ministry of Economy, Industry and Competitiveness and the Canary Island Government – €2,085,853.00), the revenues earned from PLOCAN participation in R+D+I projects, from national and international centres and companies and from financial revenues.

Table 3. Revenues and contributions 2016

ITEM	AMOUNT
REVENUES	16,497,662.38
Revenues from previous years and projects	14,384,577.48
Ordinary allocations	2,085,853.00
Financial revenues	9,890.58
Revenues from activities	17,341.32
OTHER CREDITORS	-484,271.10
TOTAL	16,013,391.28

Table 4. Expenses and investment 2016

ITEM	AMOUNT
Personnel	1,344,245.49
Current expenses, goods and services	730,989.64
Acquisition of fixed assets	4,272,120.80
Training	70,076.00
Project expenses	633,448.44
Taxes	100,288.28
Reserves pending application	8,862,222.63
TOTAL	16,013,391.28

EXPENSESE AND INVESTMENT 2016

With respect to expenses and investments in 2016, fixed asset acquisitions amounted to €4,272,120.80. This sum includes the payments made during the year relating to the construction of the platform.

Attention should also be drawn to the personnel expenses (€1,344,245.49) and expenses arising from executing R+D+I projects (€633,448.44).

TAXES
100,288.28 - 1%

PROJECT EXPENSES
633,448.44 - 9%

TRAINING
70,076.00 - 1%

ACQUISITION OF
FIXED ASSETS
4,272,120.80 - 60%

CURRENT EXPENSES,
GOODS AND SERVICES
730,989.64 - 10%

PERSONNEL
1,344,245.49 - 19%



