

PLOCAN: AN OFF-SHORE MULTIDISCIPLINARY PLATFORM AND TESTBED FOR DEEP SEA SYSTEMS AND OPERATIONS

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ABSTRACT

The Canary Islands Oceanic Platform (PLOCAN) is a public infrastructure for research, development and innovation in the fields of ocean science and technology, at increasing depths. Located East of Gran Canaria Island (Canary Islands, Spain), PLOCAN will provide rapid access to great depths at short distance from the shore, accelerating research and the generation of water column and deep-ocean knowledge. Specifically, PLOCAN will host a permanent deep-sea observatory, be a testbed for innovative technologies, form specialists and provide training in the field, and be a national base of manned and unmanned submersibles. PLOCAN's vision is focused on generation and exchange of science and innovations between the academic and the socio-economic spheres. PLOCAN will be a fully instrumented gate to the deep ocean, an efficient and cost-effective solution to test products and processes, and cluster private and public partnerships to face undersea challenges. PLOCAN also anticipates the diversity of technological and scientific opportunities that will result from the multiplication of ocean observatory initiatives. Beyond the realm of ocean observing systems PLOCAN's primary aim is to be an accelerator for marine and deep-sea research and development at large, to provide optimal working conditions in a controlled environment with the necessary environmental guarantees

1. INTRODUCTION

The fast-evolving sector of ocean R&D, in particular that driven by the need for a more sustainable use of ocean resources and new research priorities served by reliable ocean technologies, demands the availability of adapted infrastructures, operational equipment and instruments to measure critical phenomena and rapidly test new concepts' performance and interactions. In particular, infrastructures have to be prepared and equipped for environmental testing (e.g., mandated capacity for certification) and obviously provide the adequate skills for operating in the ocean, i.e. at the surface, through the water column and on the seabed. To date the ability to routinely and efficiently operate at great depth (i.e. where only remotely-operated or autonomous machines are viable solutions) has only been fulfilled by the oil industry, where fossil-energy market incomes and financial projections have made investments in skills and technology possible.

Accessing these infrastructures for science and R&D only has been privilege of a few and in specific areas (e.g. for mutual interests) and new concepts have to be developed to respond to new requirements, in particular those driven by strict environmental constraints and guarantees. This is one of the primary motivations of the Canary Islands Oceanic Platform (PLOCAN) initiative.

1.1. Capacities

To achieve its scientific-technological and socio-economic goals, PLOCAN has five main assets that will work jointly and take part in the scientific, technological and strategic objectives:

Observatory
Testbed

Base for underwater vehicles, machines and instruments
Innovation platform
Training and information dissemination centre

The observatory responds to the need for permanent real-time observation of the surrounding ocean; the testbed is fully equipped for testing and certification of new designs, demonstrators and prototypes, and relies on the observatory infrastructure for performance and environmental monitoring.

The general observing capacity will be geared to generate knowledge with regard to the sustainable exploitation of ocean resources (off-shore aquaculture farms, ocean energy conversion systems and other innovative designs). This will be achieved through the installation of a network of cables and junction boxes at appropriate distances from the platform, allowing for the deployment and test of technical demonstrators and prototypes. The observing system will progressively expand from seabed to water-column (complementing the already operational ESTOC station located North of the archipelago), while mobile platforms will be deployed from the platform to continuously sample the region at desired scales.

PLOCAN's cyberinfrastructure will be standard and respond to the Global Earth Observation System of Systems (GEOSS) guidelines for interoperability: this will be achieved at software level, implementing global data sharing principles, recognized standards and best-practices. At hardware level most of the instrumentation will follow the recommendations of the European Seas Observatory Network (ESONET), thus ensuring technological integration at European level (i.e. standard

scientific package, easy instrument development, exchange, testing, shared use of deployed resources and deployment procedures).

The Base for underwater vehicles, machines and instruments is the operational arm for the platform's oceanic activities. Among other equipments, it will include work and inspection class remotely operated and autonomous vehicles and related services.

The innovation platform will offer the environment and services to foster new concepts, products and services, and cooperation between public and private entities

The training and information dissemination center defines the formation agenda with specific events and courses focused on specific areas in ocean science, engineering and operations

Finally, a practical physical feature of the platform is the capacity to respond to accommodation needs on-site. The platform will offer accommodation for about 30 persons with single and double cabin-type bedrooms and all expected amenities for a comfortable stay (meeting rooms, restaurant, fitness centre, etc.).

1.2. Science

The latest ocean research priorities have been clearly set out in key strategic documents [1-4]. In Europe both the Marine Board of the European Science Foundation and the European Union indicate the need to deal in a decisive manner with what is known as The Deep Sea Frontier, for which it is necessary to have a significant development of appropriate knowledge and technology, which requires the creation and mobilization of specific instruments, in line with what is being promoted in Japan and the United States. In line with large scale international ocean observing system initiatives (NEPTUNE [5], ESONET [6], OOI [7], DONET [8], MACHO [9] and subcomponents like the VENUS [5] and MARS [10] observatories and testbeds), PLOCAN will host a permanent integrated deep ocean observatory system. This observatory will be the first of its kind in the Central Eastern Atlantic. It will also respond to the scientific needs of environmental impact monitoring of new technologies to be deployed and tested in the area.

General scientific areas

Global change and ocean acidification
Ecosystems and biogeochemical cycles
Sustainability of ocean exploration and exploitation
Environmental impact and safety
Processes at the ocean-atmosphere interface
Study of midwater processes
Study of seabed-water column interactions

Specific scientific areas

Region-specific oceanic phenomena (subtropical gyre, upwelling, and turbulent processes, among others)

Life in the region's deep ocean (surface to depths >3000m)

Seismics and acoustics

Engineering sciences

Off-shore aquaculture science

Renewable energy harvesting and conversion sciences

1.3. Technology

As the world is gaining awareness that exploitation of natural resources must be re-thought, engineers and scientists are currently working towards developing new means and technical solutions that for most of them have not reached the necessary maturity to justify major initial investments. PLOCAN has been thought to provide these endeavours with the missing link that bridges conceptual design to technological demonstration, performance and environmental testing, and validation, in-situ. Access to the PLOCAN testbed is already open and the different procedures are described further down.

Technological areas

Renewable energy harvesting, conversion and distribution

Underwater systems and operations machinery

Instruments and sensors

Ocean observation-related technologies

Interoperability technologies

Material science and engineering

Off-shore aquaculture technologies

2. PROCEDURES OF ACCESS

Usually, scientific/technical infrastructures are characterized by having limited times of use which require difficult processes of competitive selection and which subject research groups to periods of delay, which in many cases make the planned research difficult or even impossible, thereby restricting and in most cases making use by private initiative impossible.

The capacities planned for PLOCAN, the high level of complementarity and planned interoperability makes it possible to promote its use widely both among the scientific community and the socio-economic group and in consequence it produces the need to establish different methods of access, which in general terms are as follows:

- By means of a public call to bid, carried out by the administrations working in consort, either specifically or as part of the general calls in support of the activities of R+D+i, jointly or separately.

- By a direct public call to bid issued by the PLOCAN Consortium with the specific procedures and criteria set down by the administrations acting in consort.

- By means of public calls from other administrations with which it is possible to come to specific agreements for use.
- By means of specific agreements between the organs of government of the Consortium, in accordance with its own regulations, among which are the researchers and associated and collaborating companies.

If exceptionally any incompatibility were to present itself, the organs of government of the Consortium will resolve the criteria and procedures for prioritization.

3. OBJECTIVES SUMMARISED

The plan is to build and operate an oceanic platform dedicated to science and technology that contains a set of facilities and experimental laboratories. It will be placed at 50-100 m depth, on the edge of the continental shelf, serving as a permanent access to the deep ocean using all kinds of vehicles, underwater machinery and instruments (autonomous, via cable or remotely operated) to observe, produce, take advantage of resources or install services at depth with environmental guarantees. PLOCAN will open new opportunities for a great range of institutions in challenging areas that up to now only the oil industry could face. Here is a summary of the objectives.

1. - To provide a scientific and technological platform with the most effective means and conditions to make and/or test observations and experiments at increasing depths.

2. - To provide businesses with the best and in many cases the only test-bed for innovative activities in the deep ocean with adequate environmental guarantees.

3. - To create the national base of vehicles and working tools for deep sea, operational and available on a permanent basis.

4. - To provide a unique meeting space of excellence for the public and private scientific-technical community to accelerate research and innovation, to explore and contribute to the sustainable management of the deep ocean.

5. - To provide training programs, from technicians to scientists, including specific formation and training to use the facilities and working devices, and access to the deep ocean.

6. - To test a public scientific-technical organization that can effectively manage highly skilled teams, complex and expensive instrumental devices and their relationship with innovative companies and socio-economic public and private institutions.

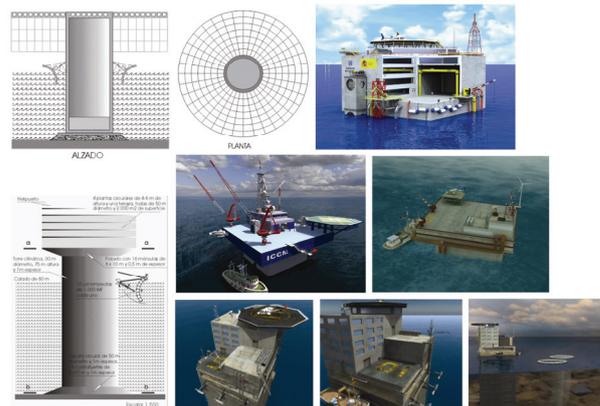


Figure 1. Possible aspects of the future platform PLOCAN

4. CONCLUSION

Activities will be essentially multidisciplinary, ranging from renewable energies, aquaculture, ocean observing fixed systems and submersibles, to biosciences and emerging technologies such as new materials and nanotechnologies. PLOCAN's vision is to be a true accelerator for marine and deep-sea research and development with optimal conditions and full environmental guarantees. Two years ahead of the planned official opening and start of operations, the academic world, entrepreneurs and corporations have already started to submit proposals to be included in the science and technology agenda. The platform will be operational end of 2011.

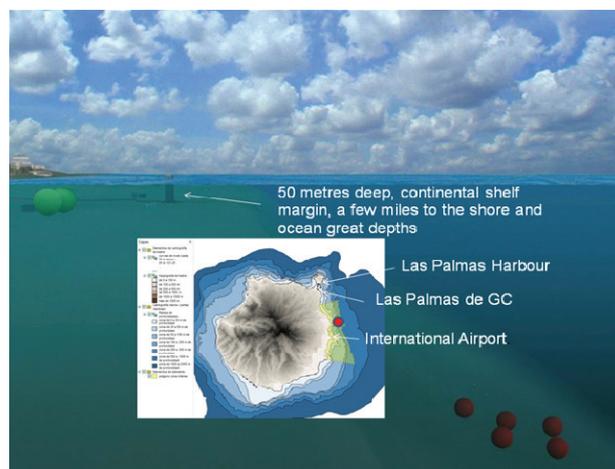


Figure 2. Location of the platform

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