FixO³ - Milestone MS14: Second round of TNA projects information disseminated online

Project	312463 – Fixed Point Open Ocean Observatories Network
Work Package number	WP7
Work Package title	International and European networking of fixed-point observatories
Milestone number	MS14
Deliverable title	Second round of TNA projects information disseminated online
Description	This document is a product of WP9 (Transnational access to FixO3 infrastructures), the tasks of which are formally hosted by WP2 and WP7.
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Summary

This report provides information to be disseminated online about the projects evaluated favourably and to be funded under the Second TNA call. A description of each accepted project, having been granted permission from the authors is provided in Annex A. This document also includes some statistics on gender, composition and country of the teams involved in the proposals.

I Second TNA Call

The second FixO^3 call for Trans-National Access (TNA) opened on the 1st of May 2015 and closed on the 31st of July 2015. Details about the call definition and selection criteria are described here.

A total of 15 FixO^3 infrastructures were offered for access:

- Fourteen ocean surface, water column and seafloor observatory installations and systems
- One shallow water test site (OBSEA) with the ability to provide practical and time-efficient testing of instruments, systems, procedures and new technologies applicable to fixed open-ocean observatories

A TNA office e-mail address managed by PLOCAN (fixo3.tna@plocan.eu) was provided to facilitate various enquiries and also provided an electronic trail from which all the steps related to specific call procedure could be executed. The text box below includes the call timeline as stated in the different documents.

Opening of the call: **1st May 2015**
Signed submission forms shall be sent in PDF to: **fixo3.tna@plocan.eu**
Submission deadline for the first call: **31st of July 2015 17h00 GMT**
Evaluation and selection phase: from call opening **date to 31st of October**
Feedback to applicants: **15th of November 2015**
Project implementation time window: **early 2016 to August 2017**

From the fifteen infrastructures made available for free access, nine received proposals (60%). A total of nine proposals were submitted, six of the observatories received only one proposal, whereas two of the infrastructures received two proposals and one received three (Figure 1). Notably one of the proposals presented the same approach to five different observatories, and therefore there are in fact 13 requests to access nine observatories.

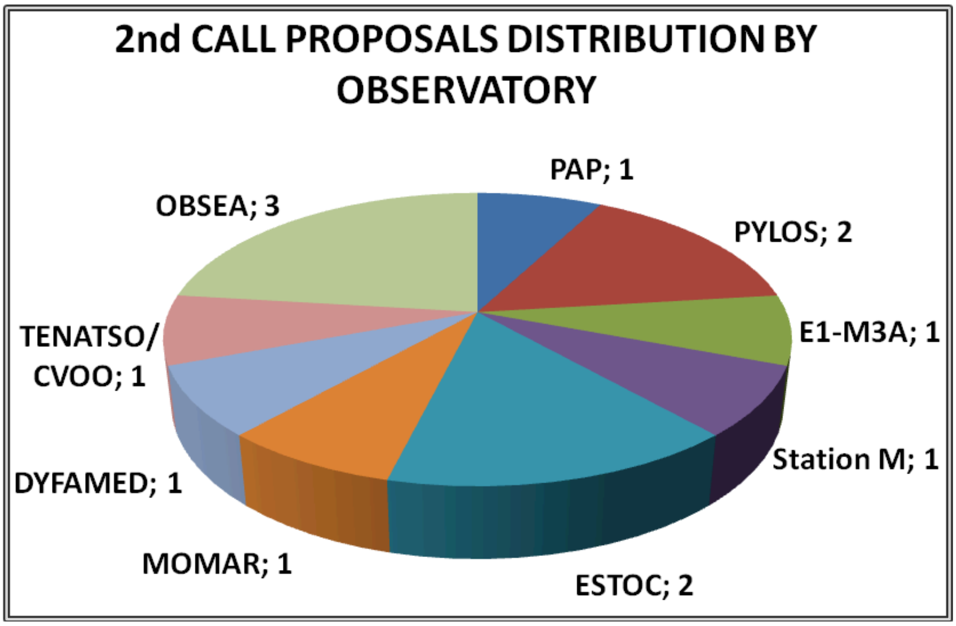

Figure 1. Distribution of the nine proposals by infrastructures (13 accesses).

The list of projects which passed the evaluation is included in the table below, in order of date submitted. This list includes the infrastructure and its main operator's name, the applicant as main investigator, the title of the proposal and the acronym (where provided). A more detailed description is included in Annex A.

Table 1. List of projects (2nd call) including proposal name, applicant and infrastructure involved.

Infrastructure	Infrastructure Operator	Applicant	Proposal title- Acronym
OBSEA	Universtitat Politècnica de Catalunya (UPC), SARTI Research Group Barcelona, Spain	Alberto Figoli, SMID Technology, La Spezia (Italy)	Shallow Water Hydrophone Array long term Deployment - SWHAD
PYLOS	Hellenic Centre for Marine Research (HCMR), 46.7 km Athens-Sounion Road, Anavyssos, Attica, GR-19013 Greece	Anders Tengberg (Aandera, Norway)	Early Detection of Increased Seismic Activities - EDISA
PYLOS	Hellenic Centre for Marine Research (HCMR), 46.7 km Athens-Sounion Road, Anavyssos, Attica, GR-19013 Greece	Peter SchjØlberg, Fugro Oceanor, Norway	Increase available power on oceanographic buoy and transmit AIS message with selected buoy parameters –INPOW-AISPAR
E1-M3A	Institute of Oceanography Hellenic Centre for Marine Research (HCMR), Thalassocosmos, Former US base at Gournes, P.O. Box 2214	Peter SchjØlberg, Fugro Oceanor, Norway	Improving mooring design using integrated load cell and transmitting AIS message with selected buoy parameters – IMLOC-AISPAR
MOMAR	French Marine Research Institute (IFREMER), BREST CENTER - 29280 Plouzané, France	Olivier Rod, SWEREA KIMAB, Sweden	Corrosion Resistance, Biofilm and Protection Data In Deep Seawater - DeepCorr
OBSEA	Universtitat Politècnica de Catalunya (UPC), SARTI Research Group Barcelona, Spain	Ivane Pairaud, Ifremer, France	Upwelling characterization with autonomous underwater vehicle - upAUV
ESTOC	Oceanic Platform of the Canary Islands (PLOCAN), Crta. de Taliarte s/n, 35214 Las Palmas, Canary Islands, Spain	Carlos Corela, Lisboa University, Portugal	SEISMIC AND ACOUSTIC noise analysis at ESTOC site - SEACOUT
Station M, PAP, ESTOC, TENATSO/CVOO and DYFAMED	1. Sta. M: University of Bergen, Geophysical Institute, P.O. Box 7803, NO-5020 Bergen, Norway 2. PAP: Natural Environmental Research Council (NERC) - National Oceanography Centre (NOC), Southampton, United Kingdom 3. ESTOC: Oceanic Platform of the Canary Islands (PLOCAN), Crta. de Taliarte s/n, 35214 Las Palmas, Canary Islands, Spain 4. TENATSO/CVOO: National Institute for Fisheries Research. Cova de Inglesa, C.P. 132 Mindelo -São Vicente, Cape Verde 5. DYFAMED: CNRS-INSU, Observatoire Océanologique de Villefranche sur Mer 181 Chemin du Lazaret, 06230 Villefranche-sur-Mer, France	Luciana Génio, Aveiro University, Portugal	**L**arval **O**ccurrences in **O**pen **O**cean: **C**onnectivity studies in the East **At**lantic and West **Med**iterranean - LO^{3}CAted
OBSEA	Universtitat Politècnica de Catalunya (UPC), SARTI Research Group Barcelona, Spain	Torstein Pedersen, Nortek, Norway	Currentmeter intercomparison in a shallow water environment- CISWE

II Next Steps towards implementation

Next steps for implementation are:

1. To sign an agreement between the Infrastructure Operator and the End User involved for each proposal before receiving funding;
2. Organize, manage and implement the TNA project.

After the proposal has been executed, a report will be produced and the data will be made publically available, in agreement with the FixO[3] policy, except if a moratorium has been requested and justified in the submission form.

From a FixO[3] perspective, we believe this second TNA call has been a success and we acknowledge the work executed by the Panel of Experts, as well as their availability to participate to the consensus meetings when needed.

All developments have been carried out in strict compliance with Annex III of the Grant Agreement.

III Statistics

In this section we include some statistics related to the human resources and organisations that participated to the Second FixO3 TNA Call. It should be noted that out of nine proposals, only two had a female principal investigator. Concerning teams, the situation is similar with only 8 women out of a total of 31 people (Figure 2, below right), although the percentage slightly increases with respect to the first call (26% in this call as compared to 20% in the first). This seems to reflect again the small number of women involved in ocean science.

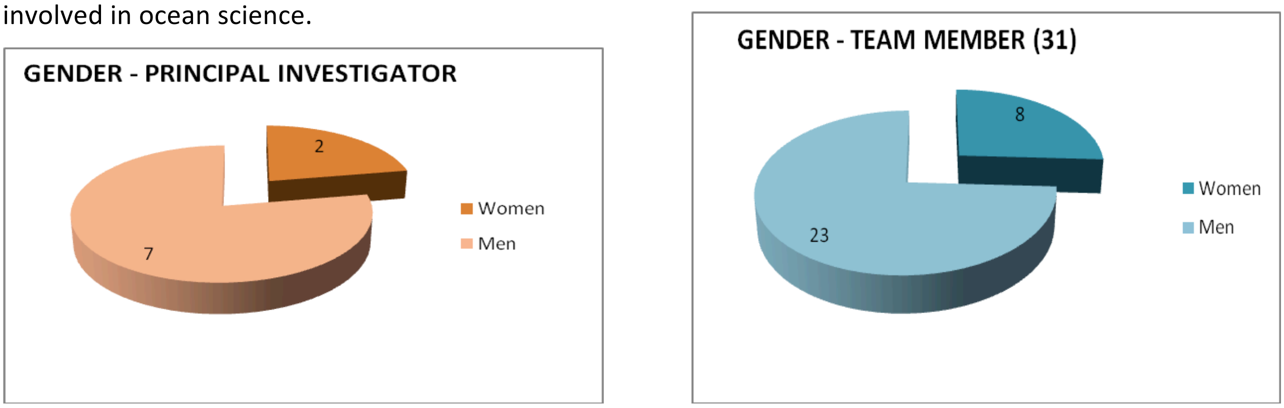

Figure 2. Gender distribution per principal investigator and team member.

Figure 3. Type of teams and number of countries per proposal.

With respect to the type of teams, the number of companies has increased very much with respect to the first call, in fact it has passed from representing 16% to 71% of the teams involved in this second call (Figure 3, above left). This fact shows the effort done to involve the industrial sector in the TNA of FixO3, following the results of the first call. Most proposals include only teams from one country, in 2 cases the teams came from 2 countries and one of the proposals included teams from 3 countries (Figure 3, above right).

Teams from eight different countries have participated in this Second FixO3 TNA call (Figure 4), with 5 teams from France; other two countries (Norway and Spain) have teams participating in 4 proposals, Sweden in 3, Portugal in 2 and other three countries (Brazil, Italy and USA) just in one proposal.

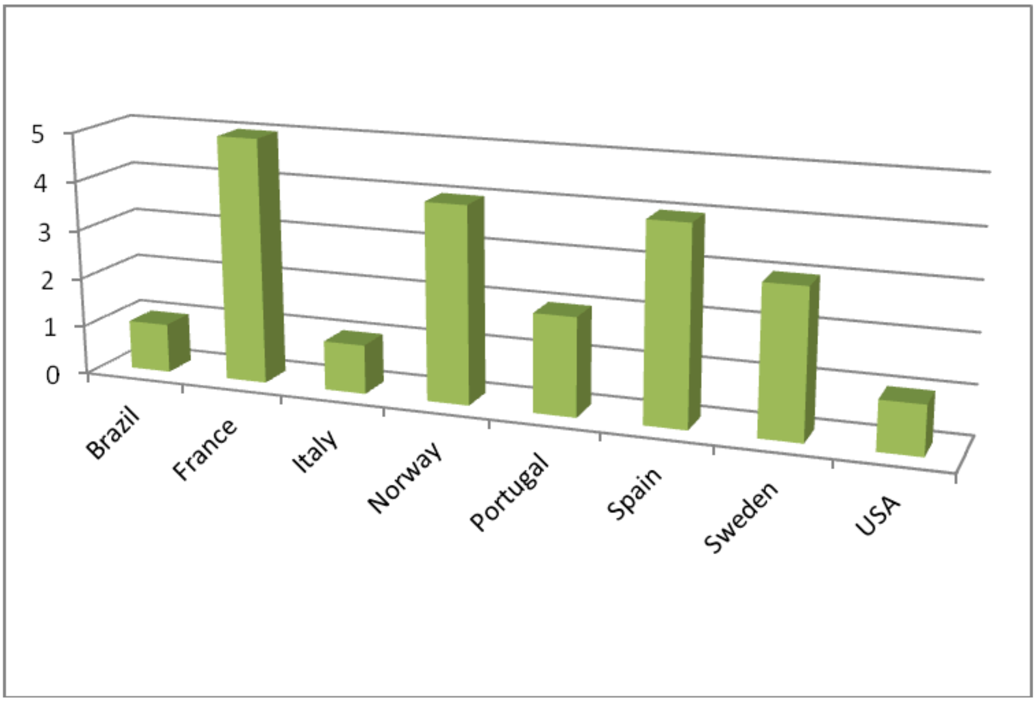

Figure 4. Number of teams by country, second call.

The number of people per proposal belonging to the same or different entities are depicted in Figure 5. Most of the teams in the proposals are composed of 2 or 3 people. There are teams composed of 5, 6, 7 and 9 people, one for each case.

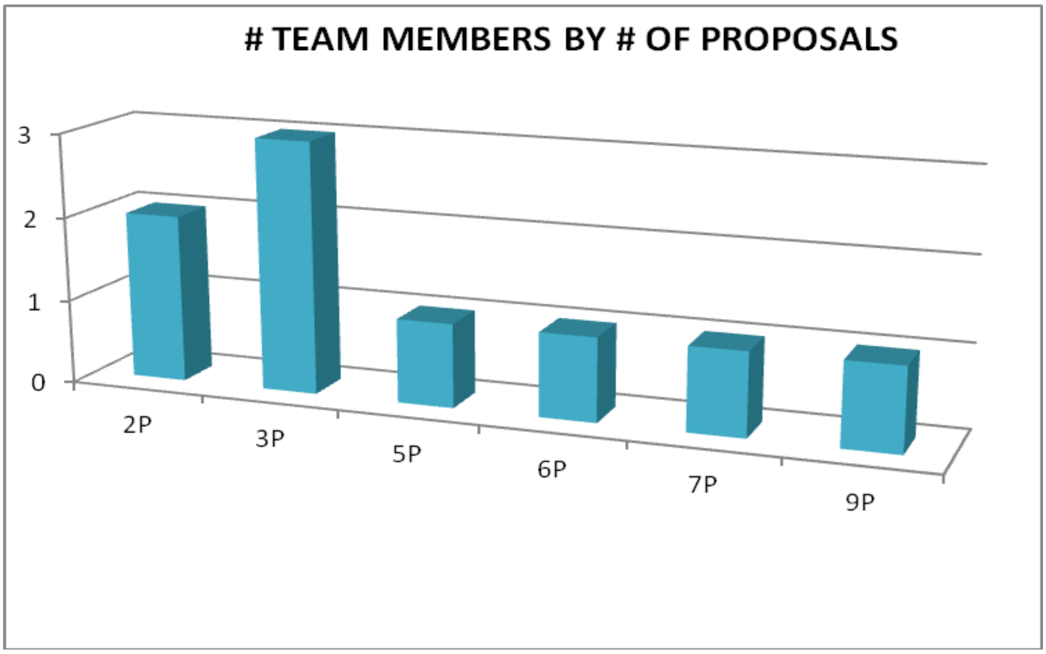

Figure 5. Number of team members per number of proposals.

IV Statistics 1st and 2nd Calls

Some statistics in percentages are provided on received proposals for the first and second calls, according to the theme and domain addressed, as well as user type. Figure 6 shows in the first two graphs to the left that more than half of the proposals were related to science and about a third to technology, the rest to both science and technology.

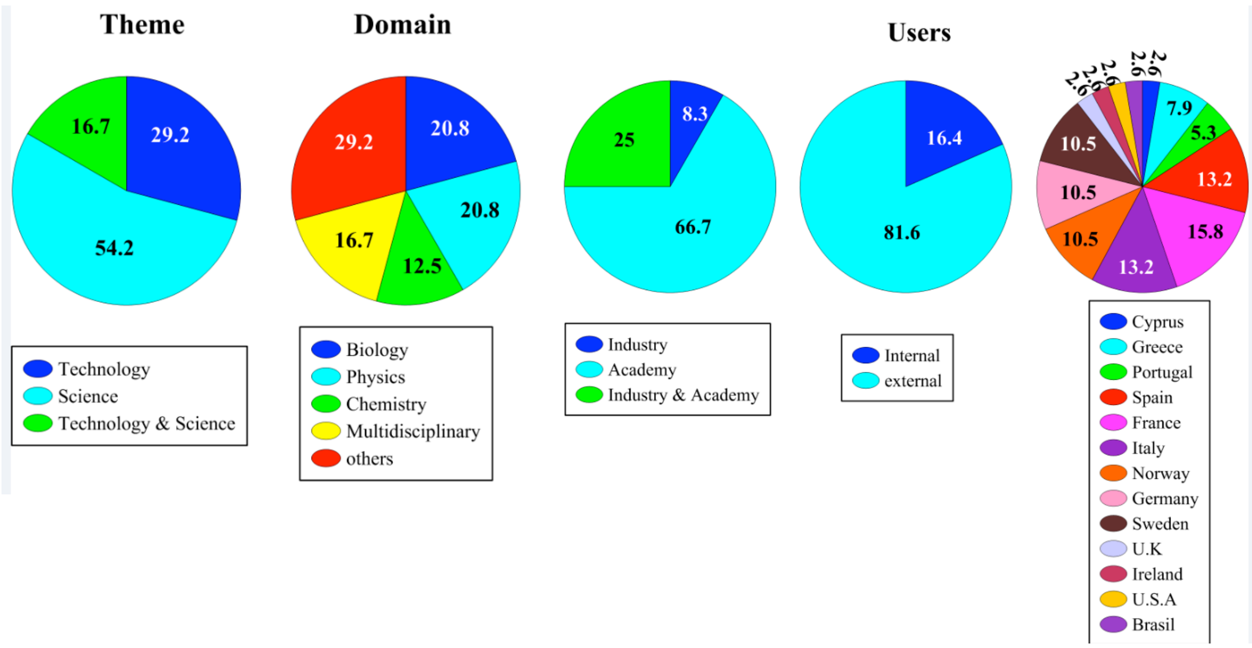

Figure 6. Percentages by theme and domain from the two calls (left), and by users' type and countries (right).

With respect to the origin of the users, 3 graphs (to the right), show that 67% were coming from academia, most of them were external (82%) and there were representatives from 13 countries. It is also worth emphasizing that in 25% of user cases there was collaboration between academia and industry, and in general the higher percentages of participation by countries came from France (15.8%), Italy and Spain (13.2% both of them).

Annex A – Information on approved TNA projects – 2nd call

For each proposal which has passed the evaluation and for which the corresponding observatory has agreed to host the proposed project, we have included the following information: project title and acronym, host facility, modality of access and description of the proposal; text has been directly extracted from the application form received at proposal stage.

Project title and acronym

Shallow Water Hydrophone Array long term Deployment (SWHAD)

Host facility

OBSEA

Modality of Access

MoA2 – Partially remote (the presence of the user is required at some stage, e.g. for installing and uninstalling an instrument)

Description

The missions are devoted to the following scientific and technical objectives

- Define the best position and geometry of the array to get the best deployment according to the type of measurement
- Verify proper functioning of the system
- Set up the acoustic measurement parameters
- Verify resistance to environmental agents
- Validate acoustic measurement of different acoustic source
- Measure hydrophones real performances in shallow water environment
- Validate hydrophones real performance vs. targeted

Project title and acronym

Early Detection of Increased Seismic Activities - EDISA

Host facility

PYLOS

Modality of Access

MoA2 – Partially remote (the presence of the user is required at some stage, e.g. for installing and uninstalling an instrument)

Description

Earthquake-warning systems are based on networks of seismic instruments. Depending on how far from the epicenter you are located such systems can provide ahead warnings of some seconds to minutes which gives limited time to save lives and property. If the earthquake takes place close to land and creates a tsunami losses can become enormous even if advanced well functioning warning systems are in place. The earthquake and subsequent tsunami in Japan in 2011 is an example of this.
Monitoring CO_2 efflux has demonstrated to be a useful tool to forecast precursory signals of volcanic eruptions and seismic events several days ahead of an eruption/earthquake (Padron et al. (2008)).
In this TNA application we propose to combine multi level, gradient measurements of pCO_2 and O_2 close

to the bottom to investigate if this could be an efficient method to quantify and distinguish between "normal" mainly biologically driven processes at the sediment-water interface and events with CO2 dominated release driven by seismic activities.
Similar methods were successfully used and described in Atamanchuk et al. (2015) in a project called QICS where CO2 was deliberately released 10 m below the sediment-water interface to simulate leakage from an underwater CO2 storage site. Multi-parameter measurements (currents, tides, salinity, temperature and particles) in general and pCO2 and O2 in particular combined with multivariate statistical analyzing of the data turned out to be powerful tools to distinguish between natural processes and man-made caused by the CO2 release.
Because of frequent seismic activities the Pylos site should be adequate for methodological development of an early warning earthquake system. In addition the bottom node of the Pylos observatory is already equipped with an Aanderaa SeaGuard instrument to which multiple clusters of CO2 and O2 optodes as well as other sensors can be "plug and play" connected and logged. Furthermore the bottom platform hosts two IR based sensors that measure pCO2 and CH4 one time per day, the former will serve for quality control of the pCO2 optodes. Two advantages of using optode technology are compact size and low power consumption. This opens for connecting multiple nodes to the same battery powered instrument and sample the sensors at high frequency, e.g. every 1 s for shorter periods every hour (advanced sampling schemes is a built in feature in the SeaGuard instruments).
The rationale of placing sensors at different levels just above (0-2 m) the seafloor is that when there is consumption/production of e.g. O2 and CO2 a gradient will be formed that can be used to calculate the consumption/production rates. To do this a transport coefficient (eddy diffusivity) is needed. We suggest estimating this coefficient from periods of fast sampling of the existing Doppler Current Sensor and of multiple highly sensitive pressure sensors placed at different levels.
Another critical aspect is to measure small gradient so that the O2 and pCO2 optodes have to be well intercalibrated, within 1 uM and 2 uatm respectively. We suggest to do this by occasionally placing the sensors at the same level using a simple elevator mechanism that is activated by a simple timer.
If successful this methodological development will not only advance the possibilities of creating compact long-term deployable early warning systems for earthquakes it will also open new possibilities for estimating metabolic rates of sediments.
- Atamanchuk A. et al. (2015) Detection of CO2 leakage from a simulated sub-seabed storage site using three different types of pCO2 sensors. International Journ. Green House Gas Control, 38: 121-134.
- Padron et al. (2008) Changes in the Diffuse CO2 Emission and Relation to Seismic Activity in and around El Hierro, Canary Islands. Pure appl. Geophys., 165: 95–114.

Project title and acronym

Increase available power on oceanographic buoy and transmit AIS message with selected buoy parameters (INPOW-AISPAR)

Host facility

PYLOS

Modality of Access

MoA2 – Partially remote (the presence of the user is required at some stage, e.g. for installing and uninstalling an instrument)

Description

Using moored oceanographic buoys as platform for a wide range of sensors measuring meteorological, oceanographic and biological parameters frequently provides excellent input to long term planning purposes as well as day to day operational issues (weather forecasting, red tide or oil in water incidents). However, many modern and sophisticated sensors demand access to more power. Also from an operational point of view it will be beneficial to increase the available power on the buoy, thereby reducing the number of planned maintenance surveys and thus reducing the project cost.
In order to increase the available power from the buoy, we will implement the following tasks:

- One half of the existing buoy hull will be replaced by a new hull containing fuel cells.
- For the fuel cell system we will test/verify the output, including performance in hot weather. A new water based cooling system will be developed and tested.
- Wind turbine and its performance will be tested
- A new software enabling "intelligent monitoring" (i.e. automatic change to various configurations controlled by a pre-set criteria)...to increase user value and possibility of saving energy.

In addition, the oceanographic buoys may be equipped with an AIS (AtoN) unit to notify passing vessels about the buoy position to minimize the risk of interference. The message from the AIS unit may in addition contain selected parameters measured by the buoy, thus passing vessels may get information on winds, waves and currents as measured by the buoy. The AIS message is also accessible by the general public, who may use the buoy information for their professional need as well as for recreational purposes.

By implementing the AIS message with ID 8 in the data logger software, this goal may relatively simply be achieved. The message format is fixed and may accommodate the following parameters:

Wind (speed, direction, gust), air temperature, humidity, dew point, air pressure, visibility, water level, current profile (speed, direction), waves (height, period, direction), water temperature, precipitation and salinity. The total number of parameters is about 30.

Project title and acronym

Improving mooring design using integrated load cell and transmitting AIS message with selected buoy parameters (IMLOC-AISPAR)

Host facility

E1-M3A

Modality of Access

MoA2 – Partially remote (the presence of the user is required at some stage, e.g. for installing and uninstalling an instrument)

Description

The oceanographic buoys are moored to the sea bed to ensure it stays close to its nominal position. The water depth may range from shallow water to Deep Ocean of several thousand meters. The mooring will be subject to the environmental forces at the deployment site (winds, waves, current profile) and must be designed accordingly to ensure the buoy stays put. The mooring design process involves both general experience and various computer tools to reach the final mooring design.

We do however see that some combinations of water depth and environmental conditions are difficult for the numerical tools and the experience from similar states are limited.
By using a load cell below the buoy connected to the data logger to measure the actual pull in the mooring can help overcome this limitation. The load cell may be programmed to provide the min and max load over a given time period, such as every 15 min. Data from the load cell will contribute to the general experience and allow fine tuning of the numerical tolls utilized in the mooring design process. Furthermore, the buoys may be equipped with an AIS (AtoN) unit to notify passing vessels about the buoy position to minimize the risk of interference. Experiences of the past have shown that in case of a mooring line failure the station can drift for several miles and can be a potential danger for nearby vessels.

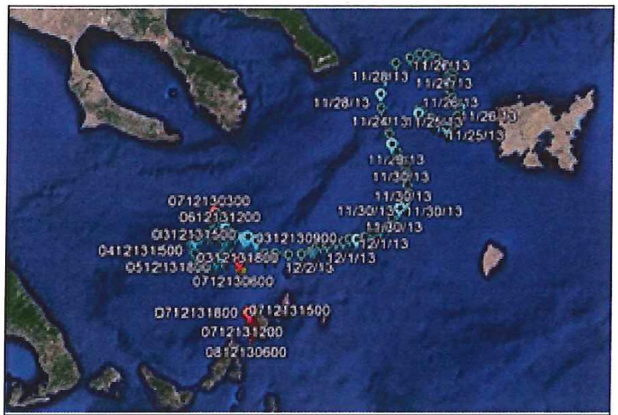

Fig.1 Poseidon system Athos station drifting after mooring line failure.

The message from the AIS unit may in addition contain selected parameters measured by the buoy. Thus passing vessels may get information on winds, waves and currents as measured by the buoy. The AIS message is also accessible by the general public, who may use the buoy information for their professional needs as well as for recreational purposes.

By implementing the AIS message with ID 8 in the data logger software, this goal may relatively simply be achieved. The message format is fixed and may accommodate the following parameters:

Wind (speed, direction, gust), air temperature, humidity, dew point, air pressure, visibility, water level, current profile (speed, direction), waves (height, period, direction), water temperature, precipitation and salinity. The total number of parameters is about 30.

Project title and acronym

Corrosion Resistance, Biofilm and Protection Data In Deep Seawater (DeepCorr)

Host facility

MOMAR

Modality of Access

MoA2 - Partially remote (the presence of the user is required at some stage, e.g. for installing and uninstalling an instrument)

Description

Today, the exploration and exploitation of seabed presents promising prospects for many industries. Indeed, more and more attention turns to the sea, with the objective to discover this little-known world and / or to exploit mineral and petroleum resources. For this, the use of reliable materials and resistant to corrosion is necessary. The durability of metallic structures exposed to natural seawater is often linked to the efficiency of protective systems which consist mainly of cathodic protection and/or material resistant to corrosion. The use of non-resistant materials and/or unsuitable cathodic protection may induce loss of performance, important costs of service and possible environmental and human disasters.

The objectives of this project are to:
1/ Collect relevant environmental parameters influencing corrosion
2/ Assess the corrosion resistance of different materials
3/ Collect cathodic protection data

Project title and acronym

Upwelling characterization with autonomous underwater vehicle (upAUV)

Host facility

OBSEA

Modality of Access

MoA3 – In-person (the presence of the user is required/ recommended during the whole access period)

Description

Autonomous Underwater Vehicles (AUVs) are being incorporated to Ocean Observing Systems worldwide as multisensory platforms capable of high spatiotemporal resolution sampling. Propelled AUVs, such as CSIC's Iver2 AUVs, often incorporate Doppler (DVL) sensors for accurate underwater navigation (no GPS available). These sensors can also perform current profiling (ADCP), although their measures' accuracy has not been thoroughly studied. Underwater gliders (more widespread than propelled AUVs) are now being installed ADCPs for current profiling. These gliders need to navigate with pitch (nose inclination) values ranging from 15-30º, which may yield erroneous current measurement values.
One of the objectives of the experiments is to evaluate the measurements of the AUV (provided by CSIC) by comparing against a moored ADCP (OBSEA). The AUV should navigate at different pitch angles, speeds, on the surface,… in order to identify what navigation modes are valid for using AUVs as current measurement instruments.
The other objective is to characterize the currents during upwelling processes that occur in the area in springtime [J. Antonijuan et al., 2015]. The AUV or AUVs (CSIC can operate 2 AUVs at a time) could provide a different perspective of the process as now it has been studied only with one moored ADCP (OBSEA). The AUVs, sampling at 1Hz and moving at speeds of 2 m/s could provide a high resolution and fairly synoptic currents map of the area.

Project title and acronym

SEISMIC AND ACOUSTIC noise analysis at ESTOC site (SEACOUT)

Host facility

ESTOC

Modality of Access

MoA2 - Partially remote (the presence of the user is required at some stage, e.g. for installing and uninstalling an instrument)

Description

Seismometers measure earth motion in the Earth's crust. About 90 percent of all natural earthquakes occur underwater, where great pressure (depth} and cold temperatures make measurements challenging. An ocean-bottom seismometer (085} is a seismometer that can be deployed on the seafloor for weeks or months, their sensors can record earthquakes, volcanic eruptions, tremors or any acoustic event regardless of their origin but depending on the sensor characteristics, essentially the frequency range. Physically, seismic noise consists mostly of surface waves. Low frequency waves (below 1 Hz) are generally called microseisms; high frequency waves (above 1 Hz} ore called microtremors. The objective is to analyze the environmental noise in the area of ESTOC site, with the primarily aim to identify and / or differentiate regional seismic and biological sources of acoustic generation and wave propagation of the ocean noise, and to improve the performance of the 0BS. Blue and fin whales produce very loud calls at frequencies as low as 20Hz (Wilcock, 2012). Passive acoustic monitoring using 0BS is usually used to study seismicity for long periods of time (typically months} but it is also an important tool for studying the distribution and abundance of large whales in the oceans, characterizing their behavior and habitat usage (seasonally), and assessing how they are impacted by anthropogenic sounds (Zimmer, 2011). In this study we will focus on two different sources in the 1 to 50 Hz range records: : low-frequency calls of whale species, blue and fin whales, and the spectra of volcanic tremors dominated by frequencies around 10Hz.
To achieve this we envisaged to deploy a small array of 4/6 short period four standard components 085 (i.e. 3 components geophone OYO GS-11D, 4,5 Hz and a HighTech HTI-01-PCA(hydrophone) to monitor ambient noise around the E5TOC site for a period of 6-9 months.
Using an array of several OBS's recording simultaneously the ambient noise allows to improve our understanding of the acoustic record wave field and its origin, and to derive physical properties of the oceanic crustal structure when required. Noise sources will be investigated through probability density functions (PDF) of the power spectral density (P50), which provides information on the generation and propagation of seismic noise in the study area (Core/a et al., 2014). The locations and tracking of sounds generated by marine mammals will be performed using a seismological hypo central location code (Gaspà et al., 2006).

References

Corela, C., G. Silveira, L. Matias, M. Schimmel and W. Geissler (2014}. AGU Fall meeting, Abstract ID: 21865.
Gaspà Rebull 0., Diaz Cusi J., Ruiz Fern6ndez M., Gallart Muset 1.,(2006),, J Acoust Soc Am. 120{4}:2077-85.
Wilcock, W.S.d:, . Tracl. Acoust. Sac. Am. 132, 2408-2419 (2012).
Zimmer, W. X. Z. (2011). Passive Acoustic Monitoring of Cetaceans. Cambridge Uni. Press, New York.

Project title and acronym

Larval **O**ccurrences in **O**pen **O**cean: **C**onnectivity studies in the East **At**lantic and West M**ed**iterranean (LO^{3}CAted)

Host facilities

Station M, PAP, ESTOC, TENATSO/CVOO and DYFAMED

Modality of Access

MoA2 – Partially remote (the presence of the user is required at some stage, e.g. for installing and uninstalling an instrument)

Except Cape Verde which is:
MoA1 – Remote (the presence of the user is not required at any time during the access period)

Description

Despite the increasing effort over the past decades to improve our knowledge on marine ecosystems, their immense diversity of organisms and processes, particularly in the deep sea, remains largely undisclosed. From the changing perspective of the oceans as a vast and intrinsically continuous domain, mostly immune to human action, understanding connectivity has emerged as an imperative to comprehend the resilience of marine organisms and habitats to natural and anthropogenic impacts, and to inform stakeholders and decision-makers on science-based options for management and conservation [Mengerink et al. 2014]. In recent years, integrated multidisciplinary approaches, incorporating high-resolution biophysical modeling, genetic and geochemical markers have been increasingly applied to assess spatial scales of dispersal and connectivity [Hilario et al. 2015]. However, knowledge gaps in both the physical and biological processes regulating larval dispersal, settlement and recruitment are hindering the understanding of deep-sea connectivity. Biological controls of larval dispersal include the reproductive effort of adults, which determines the timing and number of larvae in the water column, and also larval development and behavior. All these components define how larvae interact with the oceanic circulation and influence the timing, distance and trajectory of larvae among habitats. Moreover, the processes involved in finding suitable habitats and settlement cues are largely unknown for deep-sea benthic organisms. With the primary goal of advancing our general knowledge of connectivity in the deep sea, this proposal will focus on vertical distributions and settlement of deep-sea larvae along the continental margin of Europe and Northern Africa.

Project title and acronym

Currentmeter intercomparison in a shallow water Environment (CISWE)

Host facility

OBSEA

Modality of Access

MoA2 – Partially remote (the presence of the user is required at some stage, e.g. for installing and uninstalling an instrument)

Description

Nortek has developed new technology called AD2CP and registered under the patent US 20080289433 A1. Nortek instruments are well recognized worldwide for their reliability and high accuracy, so the transition to the new product line must be supported by a number of test and inter comparisons.

Many of them are already done near the manufacturing facilities (Oslo, Norway), but as long as these instruments will be supplied all around the world, the different test have to be done in a wide spectrum of measurement sites.

Obsea observatory fulfills the requirements for one of the projected tests. The temperature in the Mediterranean area is higher, waves are shorter and currents are lower (under 0.2 m/s)
