Protocols for the field testing

Deliverable D9.1
of the COMMON SENSE project

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COMMON SENSE
MARINE SENSORS - MARINE MONITORING

Acronym: COMMON SENSE
Title: COST-EFFECTIVE SENSORS, INTEROPERABLE WITH INTERNATIONAL EXISTING OCEAN OBSERVING SYSTEMS, TO MEET EU POLICIES REQUIREMENTS
Grant agreement n° 614155

Deliverable 9.1

Protocols for the field testing

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CO Confidential, only for members of the consortium (including the Commission Services)	

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EXECUTIVE SUMMARY

The COMMON SENSE project has been designed and planned in order to meet the general and specific scientific and technical objectives mentioned in its Description of Work (page 77).

In an overall strategy of the work plan, work packages (11) can be grouped into 3 key phases: (1) RD basis for cost-effective sensor development, (2) Sensor development, sensor web platform and integration, and (3) Field testing. In the first two phases WP1 and WP2 partners have provided a general understanding and integrated basis for a cost effective sensors development. Within the following WPs 4 to 8 the new sensors are created and integrated into different identified platforms. During the third phase 3, characterized by WP9, partners will deploy precompetitive prototypes at chosen platforms (e.g. research vessels, oil platforms, buoys and submerged moorings, ocean racing yachts, drifting buoys). Starting from August 2015 (month 22; task 9.2), these platforms will allow the partnership to test the adaptability and performance of the in-situ sensors and verify if the transmission of data is properly made, correcting deviations.

In task 9.1 all stakeholders identified in WP2, and other relevant agents, have been contacted in order to close a coordinated agenda for the field testing phase for each of the platforms. Field testing procedures (WP2) and deployment specificities, defined during sensor development in WPs 4 to 8, are closely studied by all stakeholders involved in field testing activities in order for everyone to know their role, how to proceed and to provide themselves with the necessary material and equipment (e.g. transport of instruments). All this information will provide the basis for designing and coordinating field testing activities.

Type and characteristics of the system (vessel or mooring, surface or deep, open sea or coastal area, duration, etc.), used for the field testing activities, are planned comprising the indicators included in the above-mentioned descriptors, taking into account that they must of interest for eutrophication, concentration of contaminants, marine litter and underwater noise.

In order to obtain the necessary information, two tables were realized starting from the information acquired for D2.2 delivered in June 2014. One table was created for sensor developers and one for those partners that will test the sensors at sea.

The six developers in COMMON SENSE have provided information on the seven sensors: CEFAS and IOPAN for underwater noise; IDRONAUT and LEITAT for microplastics; CSIC for an innovative piro and piezo resistive polymeric temperature and pressure and for heavy metal; DCU for the eutrophication sensor.

This information is anyway incomplete because in most cases the novel sensors are still far to be ready and will be developed over the course of COMMON SENSE. So the sensors cannot be clearly designed yet and, consequently, technical characteristics cannot still be perfectly defined. This produces some lag in the acquired information and, consequently, in the planning of their testing on specific platforms that will be solved in the near future.

In the table for Testers, partners have provided information on fifteen available platforms. Specific answers have been given on number and type of sensors on each platforms, their availability and technical characteristics, compatibility issues and, very important when new sensors are tested, comparative measurements to be implemented to verify them.

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Finally IOPAN has described two more platforms, a motorboat not listed in the DoW, but already introduced in D2.2, and their oceanographic buoy in the Gdansk Bay that was previously unavailable. The same availability now is present for the OBSEA Underwater observatory from CSIC, while their Aqualog undulating mooring is still not ready for use.

In the following months, new information on sensors and platforms will be provided and the planning of testing activities will improve. Further updates of this report will be therefore necessary in order to individuate the most suitable platforms to test each kind of sensor.

Objectives and rationale

The objective of deliverable 9.1 is the definition of field testing procedures (WP2), the study of deployment specificities during sensor development work packages (from WP4 to WP8) and the preparation of protocols. This with the participation of all stakeholders involved in field testing activities in order for everyone to know their role, how to proceed and to provide themselves with the necessary material and equipment.

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The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

1 INTRODUCTION

1.1 Background

The Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000, establishing a framework for Community action in the field of water policy, begins with the statement "*Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such*". Indeed, water is one of our most precious and valuable resources. Therefore of utmost importance is that we learn how to adequately use, protect, and preserve water resources. However, the water is a limited and vulnerable resource. The use of water affects the quality of this resource itself as well as the quality of the environment in a broader sense. Water pollution has been a problem that has accompanied human development and the greatest human achievements. New strategies and new radical approaches are needed to improve the management of water bodies, in terms of increasing the quality and efficient use of freshwater, reducing the undesirable effects of land use and human activities on water quality, and working with local government to identify options and new technologies to assess the chemical and ecological status of water bodies and to develop best practice.

A number of organic and inorganic contaminants, such as petroleum hydrocarbons, other persistent organic pollutants, mercury and heavy metals are considered as priority pollutants in water bodies. New and efficient methods are needed for monitoring the implementation of various EU agreements and national programmes on reduction of water contamination. Relatively recent advancements in the field of the sensing technologies have brought new trends in the environmental field. The progress in micro-electronics and micro-fabrication technologies has allowed a miniaturization of sensors and devices, opening a series of new and exciting possibilities for pollutants monitoring. Moreover, robotics and advanced ICT-based technology (in particular, the extensive use of remote sensing and telemetry) can dramatically improve the detection and prediction of risk/crisis situations related to water pollution, providing new tools for the global management of water resources.

The COMMON SENSE project aims to support the implementation of European Union marine policies such as the Marine Strategy Framework Directive (MSFD) and the Common Fisheries Policy (CFP). The project has been designed to directly respond to requests for integrated and effective data acquisition systems by developing innovative sensors that will contribute to our understanding of how the marine environment functions.

The core project research will focus on increasing the availability of standardised data on: eutrophication; concentrations of heavy metals; microplastic fraction within marine litter; underwater noise; and other parameters such as temperature and pressure. This will be facilitated through the development of a sensor web platform, called the *Common Sensor Web platform*.

This proposal has first provided a general understanding and integrated basis for sensors cost effective development (WP1 and WP2). In WP2 the aim is:

- to obtain a comprehensive understanding and an up-to-date state of the art of existing sensors;
- to provide a working basis on "new generation" technologies in order to develop cost-effective sensors suitable for large-scale production;
- to identify requirements for compatibility with standard requirements as the MSFD, the INSPIRE directive, the GMES/COPERNICUS and GOOS/GEOSS.

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In Task 9.1 (Design, coordination and implementation of the field testing activity) the aim, at month 18, is to start a coordinated agenda for the field testing phase for each platform used for testing the new sensors realized in the framework of the Common Sense project. Field testing procedures (WP2) and deployment specificities defined during sensor development work packages (WP4-WP8) will be closely studied by all stakeholders involved in field testing activities in order for everyone to know their role, how to proceed and to provide themselves with the necessary material and equipment (e.g. transport of instruments). All these will provide the basis for designing and coordinating field testing activities.
Type and characteristics of the system (vessel or mooring, surface or deep, open sea or coastal area, duration, etc) used for the field testing activities will be planned comprising the indicators included in the above-mentioned descriptors taking into account that they must of interest for eutrophication, concentration of contaminants, marine litter and underwater noise. So this will be decided when results from the previous five WPs (4, 5, 6, 7, 8) will be available after the first four months of Tasks 9.1.

1.2 Organisation of this report

This report provides information on the availability of sensors and platforms for eutrophication, microplastics, heavy metals, underwater noise, plus additional new sensors for innovative piro and piezo resistive polymeric temperature and pressure, nanosensors for autonomous pH and pCO_2 measurements.

In order to acquire all necessary information, two different tables with specific questions have been realized and filled by partners: one table for sensor developers and a second for testers, i.e. those partners that will check sensors in situ. The two tables have been defined and realized by CNR.
These two tables will be provided and then described through graphs. Anyway we must underline that further and continuous updates made through usual project channels (web, email or Basecamp) will be necessary as both sensors descriptions and platforms availability are still not necessarily and completely available when this deliverable is prepared.

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2 METHODOLOGY

For a detailed description of the state of the art for each of the descriptors that are going to be measured by the sensors, the reader is referred to deliverable D2.2.

As described in Section 1.1, the aim of task 9.1 is to start a coordinated agenda for the field testing phase for each platform used for verifying the new sensors in the field realized in the framework of the Common Sense project.

Even if we are at the beginning of the second year, we must expect that in some cases new sensors are not clearly defined or developed yet and, consequently, technical characteristics cannot be perfectly defined, especially for their testing in specific platforms. This introduces some lack in the acquired information that will be solved in the next months with continuous updates from both developers and testers.

The same for the availability of platforms that, for some partners, is defined in the next months.

Anyway the easiest way to obtain all necessary information to answer the task was again through two tables in Excel format to fill, one was created for sensor developers and one for those partners that will test the sensors at sea giving access to their platforms.

In COMMON SENSE sometimes sensors developers and testers are the same partner. An example is given by some i.e. UCC and SubCTech straddling the line as integrators, or CSIC.

Here below a table that summarizes partner's person in charge for testing and or/developing activities (requested by CNR to each partner during the SC meeting in Sopot, November 2014):

Participant number	Participant short name	Developer - person in charge		Tester - person in charge	
1	Leitat	√	Sergio Martínez Navas		
3	CSIC	√	Concepció Rovira Martí Gich	√	Jordi Salat Emilio Garcia-Ladona Jaume Piera
4	CNR			√	Mireno Borghini Katrin Schroeder
6	DCU	√	Margaret McCaul		
8	FNOB			√	Javier Villalonga
9	IDRONAUT	√	Fabio Confalonieri		
10	IOPAN	√	Zygmunt Klusek	√	Sławomir Sagan Piotr Kowalczuk Miroslaw Darecki
15	CEFAS	√	Mike Challiss	√	Mike Challiss
6	FTM-UCIK	√	Anita Grozdanov		

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In the two distributed Excel tables (in Annex 1 for Developers and in Annex 2 for Testers) the information on deployment methodologies, how to avoid/minimize conflicts with daily professional activities (compatibility issues), calendars and availability, sensor operability, optimization, transmission of data specificities, stakeholders involved (including cooperation issues) and, really important, comparative measurements to be implemented to verify new sensors. It was necessary to keep information to the different sensors to be tested in the different platforms, all listed in the table below:

Sensors for	Sensors deployment and testing activities
1. Eutrophication (nutrients) 2. Microplastics 3. Heavy metals 4. Underwater noise 5. Innovative piro and piezo resistive polymeric temperature and pressure sensors 6. Nanosensors for autonomous pH and pCO_2 measurements	The research platforms that will be used for the field testing of the innovative sensors can be grouped into: (A) Research vessels (regular cruises); (B) Oil platforms; (C) Buoys and submerged moorings; (D) Ocean racing yachts; (E) Drifting buoys, among others that will be approached.

Table 2- Sensors to be deployed and available platforms

3 RESULTS AND DISCUSSION

The two Excel tables have been prepared immediately after the last general meeting in Sopot (Poland) in November 2014 when an updated list of developers and testers with persons in charge for each partner was created. Then a first table has been sent to seven developers (see table in par. 3.1) and received within the beginning of December 2014. This table with the information on new sensors, and the second table, have been sent to ten testers (see table in par. 3.2) that compiled their parts within mid-January. Some updates from developers and testers were received within mid-February.

All the answers have been summarized in Annexes 1 for developers and 2 for testers of this report.
In the following two paragraphs a summary of what filled in the two tables for developers (par. 3.1) and testers (par. 3.2).

The testing activities will officially start in August 2015, before depending by sensors and platforms availability.

3.1 Sensors developers

About Sensor Developers, in the following table the seven responsible partners that filled the Excel table are shown:

Summarising the answers, two developers propose sensors for <u>underwater noise</u>. CEFAS is developing a sensor to be used only near the surface (0-5 m), to be deployed/installed using low noise methods (e.g. fixed quiet *moorings* or maybe also on *drifting buoys*). It offers the possibility to transmit short packets of data or a summary of them. Data type produced, which must mostly be

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processed within the unit, describes sound pressure over time (voltage vs time). The frequency is initially 25 kHz, but potentially up to 192 kHz.

Name	Organisation	Email	Sensor
Mike Challis	CEFAS	mike.challiss@cefas.co.uk	Underwater noise
Fabio Confalonieri	IDRONAUT	confalonieri@idronaut.it	Microplastics (see LEITAT)
Concepció Rovira	CSIC	cun@icmab.es	Innovative T & P
Zygmunt Klusek	IOPAN	klusek@iopan.gda.pl	Underwater noise
Sergio Martínez Navas	LEITAT	smartineznavas@leitat.org	Microplastics
Martí Gich	CSIC	mgich@icmab.es	Heavy metals
Margaret McCaul	DCU	margaret.mccaul@dcu.ie	Eutrophication
Anita Grozdanov	FTM-UCIK	anita@tmf.ukim.edu.mk	pH and pCO2

Table 3 - Persons in charge for sensors development.

IOPAN proposes a sensor for underwater noise that can be installed on a hydroacoustic buoy deployed at depths down to 100 m and has an autonomy of up to 1 month. The weight is about 160 Kg, so it can be put at sea only with a ship crane (with a suspension arm > 6 m and a lifting capacity > 5000 N). There might be some problems in recovering the unit with rough sea states (> 4 Beaufort). Data is stored in the SD memories but it's possible also to install a WIFI channel and download all the data at the end of the cruise. Data types are acoustic pressure time series (frequency depends on the hydrophones installed, usually they sample at 30kHz in each of the four channels) and they must be processed. The output are acoustic pressure time series, in frequency range from 5/100 Hz up to 12 kHz. Final parameters are: Noise spectrum level, statistics of momentary values acoustic pressure of the noise. Possible platforms for testing the sensor are the research vessels *URANIA* from CNR and *OCEANA* from IOPAN.

Two developers describe sensors for microplastics. LEITAT designed a microplastic sensor consisting of three main elements: optical transducer including imaging (multi-spectral camera) and excitation sources (IR light); control board including processor for data acquisition, pre-processing and conversion to required transmission format; sampling system, realized by IDRONAUT, able to collect water samples from water surface. Sensor operation will be automated as much as possible to minimize human operation. Water samples will flow through a transparent channel where microplastics concentration will be measured using optical sensor. Currently, main installation difficulties are related to coupling sensing system and water sampling system, but in some cases, the sensor could be placed directly in water (so that a sampling system is not needed). Main information given by the system: surface microplastic concentration in (mg/litre). Additional discrete sensors are included in the sampling system (turbidity, florescence, CTD, ph, DO). Sampling frequency will be set at 30 minutes. Real time data could be transferred only if required technology is incorporated in the platform. IDRONAUT is developing the system based on Niskin bottles associated with the microplastics analyser from LEITAT. It can be deployed down to a max of 100 m. The sampling system is completed with pressure, conductivity, salinity, temperature, pH, O2, CHL-a and turbidity sensors. The system does not need any particular ship for installation however due to the weight when the niskin bottles are full of water the best is to have a small winch (available on *URANIA* from CNR, *SARMIENTO DE GOMBOA* from CSIC and *OCEANA* from IOPAN). The data acquired can be stored by the water sampling system in the internal memory or transmitted.

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The innovative piro and piezo resistive polymeric temperature and pressure sensor proposed by CSIC does not need any maintenance since it will be inside a small container and the material is stable for years. Periodically, it must be calibrated to assure that the entire device, including the sensing material, is properly working.
Measurements are directly performed by immersion into the water. It can be installed in any platform, since the power needed for the measurement is very low. Data can be stored in USB memory or transmitted by telemetry. The output of one raw data consists of two/four columns of ASCII data containing values of time/data and resistance/temperature (if the calibration of R(T) will be included in the device processing before acquisition). The measurements can be continuous or planned for a specific period of time. The transfer to the data centre could be made in real time by satellite or internet or at the end of the experiment. Data, after calibration, does not need to be processed.

CSIC is also developing a sensor for heavy metals. Measurements will be performed at surface waters that have to be delivered to the measuring setup after filtration. The needed volume is very small (well below 1 ml). The power consumption of potentiostat and pumps for microfluidic is estimated to be below 1-2 W. The sensors do not need maintenance since are single use and an array of them will be available for different measurements. The fluidic system might need maintenance against fouling. The sensor is aimed to be fully automated and therefore low power consumption, in order to be powered by batteries. Sensors will be tested on board of research vessels *(URANIA* from CNR*, SARMIENTO DE GOMBOA* from CSIC and *OCEANA* from IOPAN), where water sampling devices are available (wet lab). Data can be stored in USB memory or transmitted by internet after measurement. This sensor needs several containers: A) two liquid reservoirs with two types of buffer solutions (typically below 1 L each) for conditioning the sample at the pH needed for the analysis of the different heavy metals; B) eventually, three containers with standard solutions of different concentrations for each the heavy metals under study, of typically 20 ml each, if the standard addition method is used (i.e. 3X5=15 containers of 20 ml); C) an additional container to collect the residual liquids containing heavy metals. Regarding the output data (acquisition frequency is about 20 minutes), one raw measurement consists of two columns of ASCII data containing values of Current Intensity and Voltage. The temperature of the measured liquid and the measurement date should also be included in the file (less than 20 kb altogether). In case of using the standard addition method, each measurement would additionally generate three more of these files. Data can be transferred in real time via internet or at the end of the cruise when they must be processed.

The last sensor described is that for eutrophication, proposed by DCU, to be used in surface waters (0-3 m depth). The targeted maintenance interval is 1 month – implying that the storage capacity of reagent, calibration and waste storage containers will be sufficient for this period. Sensors operate using battery power, which may need to be supplemented by energy harvesting, e.g. using solar panels on buoys. Data can be stored by flash memory chips or removable memory (e.g. SD cards). Data storage is required on the platform regardless of deployment scenario to provide data redundancy; e.g. in the event of communications failure. Possible means of data transmission include satellite, GSM, Wifi/Wimax, short range transmission such as ZigBee, BlueTooth, or via directional antennae in function of the deployment location. The data transmission mode is determined by the deployment location and the local transmission coverage. Possible platforms for deployment of the sensors include *research vessels*, *buoys*, *underwater moorings*, *ocean racing yachts*, *fishing vessels* or other *vessels of opportunity*. The primary output data is nutrient concentrations. The raw data is transmitted in the form of a series of light intensity readings. Each measurement also includes a temperature reading and a date stamp. Data storage capacity is determined by the selected mode of

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storage – e.g. 16 Gb for SD card, megabyte range for flash memory chips. Due to the small size of data generated for each individual measurement, this is not expected to represent a significant limitation.
Data logging can be used if sensors are to be deployed in scenarios where none of the possible transmission modes are available. Raw data is transmitted in the form of a series of light intensity readings and need to be initially converted to absorption values, and then to concentration values.
The final data to be stored and displayed is in the form of nutrient concentrations.
Raw data also provides additional information on sensor performance and allows cross-referencing with data stored on board the sensor (e.g. allowing reliability of transmitted data to be validated).
The data management system should also allow for additional features such as event detection, event classification (identification of false positives/negatives) and data smoothing (for display purposes).

The nanosensors for autonomous pH and pCO_2 measurements will be designed for deployment in surface waters (0-5 m). Their maintenance interval will vary depending from sampling frequency. The sensors optimization is going on and it will be probably ready by August 2015 when task 9.2, with field testing, will start so these two sensors can be tested only on moored surface platforms and not research vessels like URANIA, OCEANIA and SARMIENTO DE GAMBOA as previously thought, even if this will be decided in the next months after laboratory tests.
Over 400 electrodes have been ordered so several types of sensors based on PANI/Graphene and PANI/MWCNT nanostructures will be realized in order to extend application methods, but the plans are to start with four pieces for each type. A strong collaboration with other COMMON SENSE SME partners will be necessary in order to produce the sensor device.

3.2 Sensor testers

In the Excel table for Sensor Testers, partner that have to test sensors through their platforms, below the ten responsible partners are listed:

Name	Organisation	Email
Mike Challis	CEFAS	mike.challiss@cefas.co.uk
Katrin Schroeder	CNR	katrin.schroeder@ismar.cnr.it
Mireno Borghini	CNR	mireno.borghini@sp.ismar.cnr.it
Javier Villalonga	FNOB	jvilallonga@fnob.org
Jordi Salat	CSIC	salat@icm.csic.es
Emilio Garcia-Ladona	CSIC	emilio@icm.csic.es
Jaume Piera	CSIC	jpiera@cmima.csic.es
Piotr Kowalczuk	IOPAN	piotr@iopan.gda.pl
Sławomir Sagan	IOPAN	sagan@iopan.gda.pl
Miroslaw Darecki	IOPAN	darecki@iopan.gda.pl

Table 4- Sensor Testers

The research platforms for the field testing that will be available (by partners indicated in brackets) are the following:

A. Research vessels
Research vessel URANIA (CNR)
Research vessel OCEANIA (IOPAN)

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Research vessel SARMIENTO DE GAMBOA – SdG (CSIC)
Research vessels – Motorboat (IOPAN)

B. Oil platforms
The oil platform on the Southern Baltic (IOPAN)
Casablanca (W. Mediterranean) - Preliminary contacts. Still not available (CSIC)

C. Buoys and submerged moorings
Oceanographic buoy in Gdansk Bay (IOPAN)
Oceanographic submerged moorings in the Mediterranean (CNR)
Deep moorings at the continental slope and canyons of the NW Mediterranean (ICM-CSIC)
Smartbuoys (CEFAS)
Aqualog (undulating mooring). Still not ready for use (CSIC)
OBSEA Underwater observatory (CSIC)

D. Ocean racing yachts
IMOCA Open 60 boats (FNOB)

E. Drifting buoys.
Drifting buoys (ICM-CSIC)

Three developers proposed research vessels to test their sensors.
CNR gave the availability of its **R/V URANIA** for all sensors, whose number is obviously strongly dependent on their size and characteristics, as they should be mounted on the frame of the CTD/rosette system or downflow of the on-board seawater pump. The sensor for microplastics is proposed to be tested on nets but it must have autonomous power. The maintenance of sensors is daily when on board. The availability in terms of time for R/V Urania is in 2015, if not modified, two 15-days long cruise available in August and/or October 2015 (see the updated calendar for 2015 at http://www.cnr.it/sitocnr/UPO/gestione/infoce/navi/UPOcampagne2015ura.html and in Table 1 below what was online at mid-March 2015).
CSIC gave the availability of its **R/V SARMIENTO DE GAMBOA** to test the following sensors: (1) eutrophication, (2) microplastics, (3) heavy metals, (4) underwater noise, (5) innovative piro and piezo resistive polymeric temperature and pressure sensors, (6) nanosensors for autonomous pH and pCO_2 measurements even if these last cannot be mounted on vessels but only on fix platforms if sensors will maintain the actual characteristics (we take anyway the availability just in case of a different sensors configuration). All kind of sensors can be tested but actually it is not possible to know if all can be tested at the same time as the calendars of cruises is not yet available.

Ports	Departure / Arrival	days	Cruise name	Scientific person in charge	Institute
Palermo / La Spezia	04/08 to 17/08	14	VENUS3	MIRENO BORGHINI	ISMAR, LA SPEZIA
Messina / Napoli	21/10 to 06/11	16	ICHNUSSA2015	ALBERTO RIBOTTI	IAMC, ORISTANO

Table 5 - The CNR cruise calendar of the R/V Urania valid for the year mid-2015 early 2016. Before July 2015 the vessel is not available due to maintenance. In red the two cruises of the two CNR institutes in La Spezia and Oristano, partners in COMMON SENSE.

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Also The **R/V OCEANIA** of IOPAN is available to test the sensors for (1) microplastics, (2) heavy metals, (3) underwater noise, (4) innovative piro and piezo resistive polymeric temperature and pressure sensors, (5) nanosensors for autonomous pH and pCO_2 measurements. The number of sensors that can be installed depend on the mounting/cabling systems of sensors. Five winches are available, two with cable line. There is no strong restriction on number of instruments/winches operating simultaneously, unless sounding depth is higher than 50 m. Once on board there is the possibility of constant maintenance. The calendar is available in the Table 6 below (downloaded at March 2015) and the following internet address http://www.iopan.pl/oceania.html. The availability of the vessel is when colours are blue in the table.

IOPAN gave also the availability of a **Motorboat** to test sensors with the limitation that all the cages/packages shall not exceed dimension 80x80x80 cm and a weight limit of 50 kg. One winch is available, with a sounding depth of up to 50 m. Once on board there is the possibility of constant maintenance. Effective work can be performed up to 2 B, wind up to 6 m/s, wave up to 1 m. Operations are possible in the Gulf of Gdańsk area and the Vistula river. On demand, two weeks notice is required. The platform is operational from March till mid-Nov.

PLAN REJSÓW s/y "Oceania" w 2015 roku

STYCZEŃ		LUTY		MARZEC		KWIECIEŃ		MAJ		CZERWIEC		LIPIEC		SIERPIEŃ		WRZESIEŃ		PAŹDZIERNIK		LISTOPAD		GRUDZIEŃ	
1		1	ZOLOWY + EKOLOG. (13 dni)	1		1		1	LOGICZNY + SURFAKT. (10 dni)	1		1	AREX	1	AREX	1	OPTYCZNY + EKOLOG. (11 dni)	1	HYDROLOGICZNY + AKUSTYCZNY (11 dni)	1		1	LOGICZNY (12 dni)
2		2		2		2		2		2		2		2		2		2		2		2	
3		3		3	OPTYCZNY (10 dni)	3		3		3		3		3		3		3		3	OPTYCZNY (8 dni)	3	
4		4		4		4		4		4		4		4		4		4		4		4	
5		5		5		5		5		5		5		5		5		5		5		5	
6		6		6		6		6		6		6		6		6		6		6		6	
7		7		7		7	AKUSTYCZNY (9 dni)	7		7		7		7		7		7		7		7	
8		8		8		8		8	EKOL. (3 dni)	8		8		8		8		8		8		8	
9		9		9		9		9		9	AREX	9		9		9		9		9		9	
10		10		10		10		10		10		10		10		10		10		10		10	
11		11		11		11		11		11		11		11		11		11		11		11	
12		12	przeglądy	12		12		12		12		12		12		12		12		12		12	
13		13		13		13		13	CHEMICZNY (10 dni)	13		13		13		13		13		13		13	
14		14		14		14		14		14		14		14		14		14		14		14	
15		15		15		15		15		15		15		15		15	MODUM 2 (13 dni)	15	AEROZOLOWY (14 dni)	15		15	
16		16	HYDROLOGICZNY (10 dni)	16		16		16		16		16		16		16		16		16	PINBAL	16	
17		17		17	MODUM 1 (13 dni)	17	BIOOPTYCZNY + PChZM (9 dni)	17		17		17		17		17		17		17		17	
18		18		18		18		18		18		18		18		18		18		18	EKOLOG.	18	
19		19		19		19		19		19		19		19		19		19		19		19	
20		20		20		20		20		20		20		20		20		20		20		20	
21		21		21		21		21		21		21		21		21		21		21		21	
22		22		22		22		22		22		22		22		22		22		22		22	
23		23		23		23		23	PODSATELITARNY (10 dni)	23		23		23		23		23		23		23	
24		24		24		24		24		24		24		24		24		24		24	HYDRO-	24	
25		25		25		25		25		25		25		25		25		25		25		25	
26		26		26		26		26		26		26		26		26		26		26		26	
27		27		27		27		27		27		27		27		27		27		27		27	
28		28		28		28	HYDRO-	28		28		28		28		28		28		28		28	
29	AERO-			29		29		29		29		29		29		29		29		29		29	
30				30		30		30		30		30		30		30		30		30		30	
31				31				31				31		31				31				31	

ZESTAWIENIE DNI REJSOWYCH:

styczeń...............	3
luty.....................	20
marzec	23
kwiecień	21
maj	29
czerwiec	23
lipiec	31
sierpień	24
wrzesień	24
październik	25
listopad	19
grudzień	5
OGÓŁEM:	247

- niedziele
- święta wolne od pracy
- soboty

opracowano: 06.11.2014 r.

Table 6 - The IOPAN cruise calendar (in Polish) of the R/V OCEANIA valid for the year 2015.

CSIC suggests the use of the **oil platform Casablanca** (western Mediterranean) but despite preliminary contacts, it is not available yet. The sensors, that could be mounted, are of eutrophication, innovative piro and piezo resistive polymeric temperature and pressure sensors, nanosensors for autonomous pH and pCO_2 measurements. Sensors could be attached to the platform somewhere underwater or to a pump if not submersible, using either batteries or power from this platform.

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IOPAN proposes the access to an **oil platform in Gdansk Bay** with specific limitations on size and weight, but this access is subject of an agreement with the platform administration. There is the possibility to install only a limited number of sensors due to security limitations. Maintenance may be possible at a monthly scale. The installation of potential new sensors must be preceded by prior agreement with the platform administrator. There will be safety and security issues specific for oil drilling sites.

CEFAS for **smartbuoys** specifies that a fixed silent mooring is likely to be used for the first deployment of sensors for underwater noise. The aim is for the package to be small enough to permit deployment tests on a Glider or USV as these platforms can move to new areas of interest without the need to ships to deploy them. Comparative background noise tests will be required in this case. The noise sensor will need to be mounted in such a way to avoid pickup from the mooring, so the hydrophone will need to be mounted using bungy type cord or similar to prevent coupling (vibration) to the main platform. Size may be a constraint for prototype units. The sensor for underwater noise will be calibrated prior to deployment, significant shift can be observed just prior to deployment in the field using a piston phone.

On the three CNR underwater **moorings in the Mediterranean**, all sensors can be mounted but their number at the same time strongly depends on their dimension, weight and depth pressure limit. Sensors will be mounted along the mooring possibly at different depths between 400m and 150 m depth. The length of the mooring line cannot be extended. The number of sensors to be mounted at the same time strongly depends on the dimension and weight of these sensors There are three mooring lines available (two in the Sicily Strait and one in the Corsica Channel). There are other instruments on the mooring lines, whose position cannot change. Due to strong currents, tested sensors should not be too heavy and big. Each mooring is planned to be recovered and redeployed every six months, during an oceanographic cruise. The calendar of each year of the ship time will be known in December of the year before (for deployments in 2016, we will need to wait until December 2015 to know the exact dates), but usually we access the platforms in spring and in autumn.
CSIC's deep moorings at the continental slope and canyons of the NW Mediterranean can be used for the installation of heavy metals sensors, Innovative piro and piezo resistive polymeric temperature and pressure sensors, nanosensors for autonomous pH and pCO_2 measurements. Several sensors can be mounted at the same time if they provide enough power in batteries. Moorings maintenance is once a year or less. Moorings must be adapted to sensors and batteries (acoustic releases, weight, wire, buoyancy, etc.).

In addition CSIC suggests the **Aqualog undulating mooring** but at the moment it is not yet ready for use. On this platform, several sensors could be installed like Eutrophication, Heavy Metals, Innovative piro and piezo resistive polymeric temperature and pressure sensors, nanosensors for autonomous pH and pCO_2 measurements, with a monthly maintenance. Sensors will be powered by the system or by internal batteries.

CSIC also proposes the **OBSEA underwater observatory**. For this platform the sensors that can be installed are the same as for Aqualog. Sensors will be powered by the system or by internal batteries. Maintenance can be done when necessary.

FNOB offers the **ocean racing yacht - IMOCA Open** with 60 boats to install sensors for the study of Microplastics and Eutrophication. As they are racing boats, the installation depends on the sensors

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size and needs. The sensors can be mounted into the systems provided that they fit inside the boat (for example water treatment or water treatment engine cooling circuit). The platform is relocatable depending on the needs and viability. Sensors need to be powered by the system or internal batteries. The amount of sensors depends on their size. Size may be a constraint for prototype units.

CSIC finally offers **drifting buoys** for sensors of eutrophication, microplastics, heavy metals, innovative piro and piezo resistive polymeric temperature and pressure sensors, nanosensors for autonomous pH and pCO_2 measurements. All sensors can be installed if they provide enough battery power. There will be no maintenance since it is an expendable platforms.

3.3 Comparative measurements to be implemented to verify new sensors

When any new instrument or sensor is realized, its in-situ validation is essential through comparison of acquired data with, for example, other already available sensors or instruments or with samples analysed in a laboratory. This allows the user to verify the quality of the data and, consequently, the validity of the sensor/instrument proposed.

This aspect is mandatory during the activities of the field testing in COMMON SENSE and was part of the table from Testers whose answers follow for each considered sensor and based on its available information.

CEFAS proposed for underwater noise sensors mounted on a fixed silent mooring a calibration prior to the deployment. Significant shifts can be observed just prior to deployment in the field using a piston phone. It also proposes to mount this sensor on a glider or USV being more likely to be used for trials to reduce the likelihood of background noise. Also in this case the sensor will be calibrated prior to deployment and calibration can be validated in the field using a piston phone.

Also CNR proposes a fixed deep mooring available for sensor for innovative piro and piezo resistive polymeric temperature sensors to be compared with already installed on CTDs similar sensors of temperature and pressure. But the use of a calibration bath prior its use on the mooring could be a good opportunity in checking the new sensors. For microplastics measurements CNR can do the comparison through the counting in laboratory of microplastics collected at the same time by the use of a manta-trawl, driven by a winch mounted on the R/V URANIA, where the sensor could be installed on. This is an opportunity to verify once the new sensor, and consequently information, will be available. Again CNR proposes to use the new eutrophication sensors to be compared with nutrients data from the analysis in laboratory of water samples gathered at different water depths.
FNOB thinks to use microplastics and eutrophication sensors on ocean racing yachts and calibrate them prior to deployment.

CSIC has available several different platforms where all kind of new sensors can be mounted a previously described. On vessels, OBSEA underwater observatory and drifting buoys measurements can be verified with "standard sensors" (e.g., temperature, pressure, pH, pCO2) or laboratory analyses (e.g., eutrophication, microplastics). For underwater noise this will be done through an hydrophone. On oil platforms and moorings (also the undulating Aqualog even if actually not available yet) the validation will be done also during maintenance operations.

Finally also IOPAN can use several platforms like a research vessel, a motorboat and an oil platform in the Gdansk Bay. For the first two platforms, sensor/s data may be compared with others sensors available like optical, laboratory measured biooptics and CTD (Nov. '15 only). The comparison for

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sensors on the oil platform are with those available in the water like fluorometer and temperature sensor.

3.4 Stakeholders involved (including cooperation issues)

Within the activities of WP1, a questionnaire was prepared by the CNR which was addressed to the observational systems functioning in operational or pre-operational mode in the European seas. It aimed to gather all the information on the technical characteristics (location, type of sensors installed, maintenance, etc.) and the acquired data (size, time of acquisition and transmission, type of use, etc.) of the system to be described.

The stakeholder involvement and cooperation was sought through the submission of this questionnaire to the public administrations, national and local bodies, environmental agencies, fishers, etc. In Italy respondents included the Italian Agency for Environmental Research and several local environmental agencies which provided valuable information regarding available instrumentation and platforms used for the sea monitoring. This will be detailed and integrated with respondents from other countries within WP1 activities.

All stakeholders as such identified, and more indirectly, has been contacted in order to close a coordinated agenda for the field testing phase for each of the platforms relevant to WP9 activities.

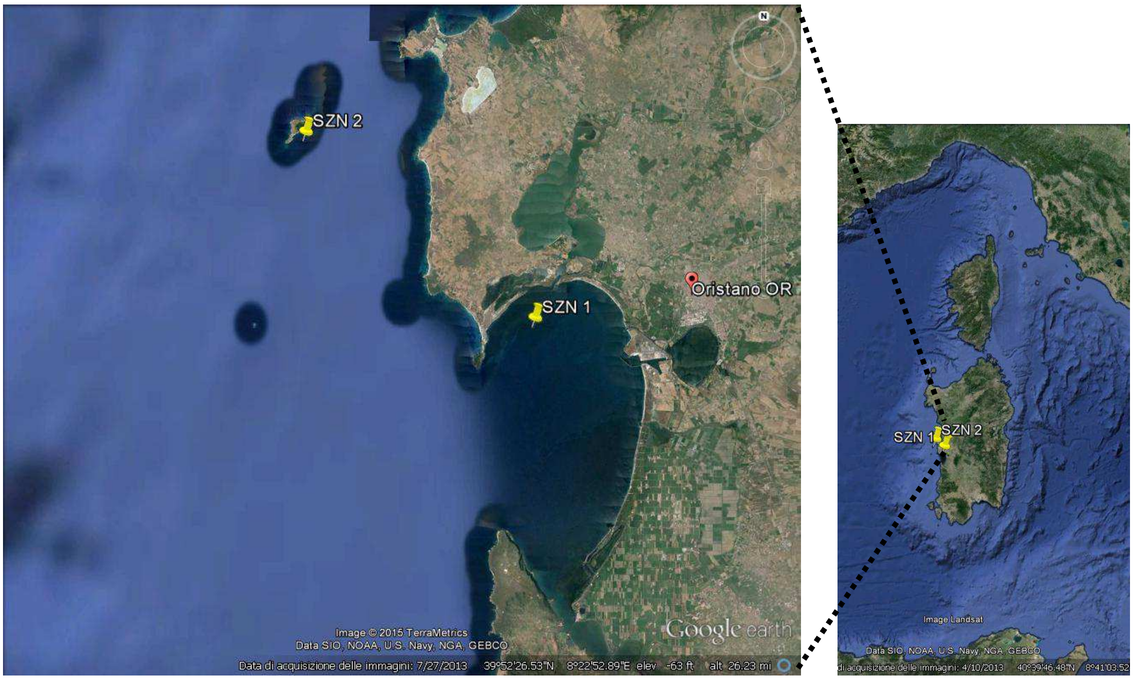

Figure 1 - The planned moored buoy inside (SZN 1) the Oristano Gulf from the local MPA. It should be in shallow waters (the bottom at 12-15 m depth) and relatively protected by Mistral (NW) wind.

This will also enable better cooperation between key sectors by ensuring effective management and transfer of this new knowledge and technology, resulting in efficient uptake of results by stakeholders and end-users as part of WP10 activities. Some stakeholders have been given their

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availability like Dr. Inga Lips from the Marine Systems Institute of the Tallinn University of Technology in Estonia, in agreement with LEITAT, and the Dott. Giorgio Massaro, Director of the Marine Protected - MPA “Sinis – isola di Mal di Ventre” in Cabras (Oristano – Italy), that plans to deploy one moored buoy inside the Gulf of Oristano (western coast of Sardinia, western Mediterranean; see Fig. 1) with maximum depths ranging between 12 and 15 m and the possibility to connect sensors with Real Time communication. A common agreement with CNR will be formalized in the following months.

A)


B)

Figures 2 – A) The orange symbol indicates the position of Ny-Ålesund; B) the scientific base hosting several European and extra-European institutes.

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Then CNR researchers are verifying, through the Department of Earth and Environment of CNR in Rome, the possibility to use the CNR Arctic base “Dirigibile Italia”(further information on the base at http://www.polarnet.cnr.it) in Ny-Ålesund (78°55' N, 11°56' E, Norway; see Figs. 2A/B), north-western part of the island of Spitsbergen in the Svalbard archipelago, for testing some of the sensors in extreme cold conditions in order to check their environmental limits at sea.

Finally, CNR with the Universities of Cork and Dublin will participate to the international conference OCEANS’15 in Genova (Italy) next mid-May 2015. A paper and a poster/oral presentation will be prepared on COMMON SENSE activities and new sensors. It will be the place where the participation of stakeholders to testing activities will be particularly stressed. CNR did the same promotion of the COMMON SENSE project at the JERICO Science Days meeting held at Ifremer in Brest on 29 - 30 of April 2015.

4 CONCLUSIONS

During the last meeting in Sopot (Poland) in November 2014 several developers underlined that the first sensors would be available not before June 2015 while the last in the first months of 2016. This report has been realized with information kept from developers and testers at the beginning of the second year of the project (November – December 2014) with updates from a few sensors a couple of months later (January – February 2015). In order to obtain the most information as possible for this deliverable the table for testers was sent to partners after having collected info from developers. All this to say that lacks in the description of sensors were expected but we hope to solve in the next months. Then this lack is also visible in the answers from testers for two reasons: the present unavailability of some platforms listed at the beginning of the project; the missing information from developers.

Apart this the deliverable 9.1 is very important because starts an essential exercise of strict collaboration between developers and testers in distributing new information between partners in order to plan future testing activities. This helps in creating a cohesive group of work that is an added value to the project and in reaching success results.

Further updates of the information are necessary, both for developers on sensors characteristics and for testers for platforms availability, and will be realized in order to individuate the most suitable platforms to test each kind of sensor, its management and validation. This will be done through direct contacts between partners (via WP9 coordination) and periodic requests from CNR.

This report is referred to the development done within COMMON SENSE project and all the deployment platforms are referred, and we should to consider that, due the inter collaboration between Oceans of Tomorrow projects; a spreadsheet to compile information regarding sensors and platforms from Oceans projects (specially 2013.2) is shared. So it is possible that some sensors produced in the framework of the COMMON SENSE project will be deployed in a platform from other projects and vice versa.

In the following Table 3 the above information on the corresponding sensor/platform is summarized:

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SENSORS Available / PLATFORMS available/Key person	Eutrophication (DCU) M. McCaul	Microplastics (LEITAT + IDRONAUT) J. Saez + F. Confalonieri	Heavy metals (CSIC) M. Gich	Underwater noise (CEFAS) M. Challis	Underwater noise (IOPAN) Z. Klusek	Innov. piro & piezo resistive polymeric Tem & Pres sensors (CSIC) C. Rovira	Nanosensors for pH & pCO2 (FTM-UCIK) A. Grozdanov
R/V URANIA (CNR) M. Borghini / K. Schroeder	x	x	x		x	x	
R/V SARMIENTO DE GAMBOA (CSIC) J. Salat	x	x	x	x		x	
R/V OCEANIA (IOPAN) S. Sagan	x	x	x		x	x	
Motorboat (IOPAN) P. Kowalczuk	x	x	x		x	x	
Oil Platform (CSIC) E.Garcia-Ladona	x					x	x
Oil Platform in Gdansk Bay (IOPAN) M. Darecki	x	x	x		x	x	x
B&SM – Smartbuoys (CEFAS) M. Challis				x			
B&SM – Mediterranean Moorings (CNR) M. Borghini / K. Schroeder	x	x				x	
B&SM NW Mediterranenan deep continental moorings (CSIC) J. Salat			x			x	
B&SM – Aqualog (CSIC) E.Garcia-Ladona (NOW NOT READY FOR USE)	x		x			x	
B&SM – OBSEA observatory (CSIC) J. Piera (PRELIMINARY CONTACTS)	x		x			x	
Ocean Racing Yacht – IMOCA Open 60 boats (FNOB) J. Vilallonga	x	x					
Expendable ocean instruments, Drifting Buoys (CSIC) J. Salat	x	x	x			x	x

Table 7 - information on the corresponding sensor/platform. RV stands for Research Vessel and B&SM for Buoys and Submerged Moorings.

5 ACRONYMS

RV Research Vessel

B&SM Buoys and Submerged Moorings

APPENDICES/ANNEXES

Annex 1 - Table for Sensor Developers

Annex 2 - Table for Sensor Testers

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Annex 1 - Table for Sensor Developers

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Your name	Your email	Your Organisation	Select sensor type	Please describe sensor technical characteristics (depth, maintenance, power, etc.) that can be useful to understand the best platform for the installation.	Installation methodology and difficulties	Adequacy of Sensors: sensor operability, optimization, transmission of data specificities.	Special needs?	Stakeholders involved?	Suggestions on platform (see above between A. and G.)	What type of data will your sensor produce?	What is the frequency of measurements of your sensor	Can you be more specific (e.g., measurement every 15 to 30 min)	What limitations are there on the volume of data that can be collected and transmitted by the core logging system (size of data packages, frequency of transmissions)?	How do you think the sensor data will be transferred to the data centre? (e.g., real time, at the end of the cruise) and using what technology (satellite, internet, etc.)?	Do your sensor data need to be processed after acquisition? If so, what are the final parameters (data) that will be stored in the COMMON SENSE central database?	What are the requirements in terms of delivering and managing your sensor data?	HOW MANY sensors will be available for testing and WHEN?
Mike Challiss	mike.challiss@cefas.co.uk	15 - CEFAS	Underwater noise	Depth 0-5m Maintenance - unknown at present, likely to be dictated by power consumption, which is also unknown at this stage	To be deployed / installed using a low noise method e.g. fixed quiet moorings. Periodic biofouling	Short packets of data or summary data are all that can be sensibly transmitted. Most initial data analysis will need to be done within the unit allowing this summary to be provided to the central logger for transmission. This communication platform needs to have an intelligent interface, in the event connection is lost it allows the data packets to recommnece from where the link is dropped rather than restarting from the beginning. The summary data will be saved to hard drive locally for shore based download and anaysis.		Cefas Dropsense (central collection of data and transmission) ICM-CSIC (drifting buoys, Lagrange)	C. Smartbuoy systems (via fixed silent moorings or gliders / other USVs) E. Drifting Buoys - maybe	Voltage vs time describing sound pressure over time, as raw data file, or converted to e.g. WAV file	Initially 25kHz, but potentially up to 192kHz		See above	Summary data in real time, on a programmed duty cycle, backed up by onboard storage	Yes. Processed sound files, sound pressure and frequency over time		We hope to collect some initial data sets (locally stored) from a single noise sensor early in 2015 to allow further signal analysis and development of noise algorithms. Note : these data will not be summary data that are to be sent to the common logging platform for transmission to shore, this will come much later, probably late 2015/16, when we better understand how the noises will be classified / captured
Concepció Rovira	cun@icmab.es	03-CSIC	Innovative piro and piezo resistive polymeric temperature and pressure sensors	The sensor, concerning the material, can be installed in any platform. It is too early to determine the best platform since we should develop with other partners the sensor device. The sensors do not need maintenance since will be inside a small container and the material is stable for years. Only time by time it will be necessary to realize again the calibration in order to be sure that the entire device in which the sensing material is included is properly working. The measurements will be performed directly by immersion on water. The power needed for the measurement is very low: (1-5 microμW, (current 10 μA). .Range of ice point resistance: R = 10-20 kΩ for a sensing area ~ 2x3 mm2 (with weak semiconductor behavior); -Temperature range: -50ºC	It will depend on the device prepared. It is difficult to be more specific at this stage, but in general it will be as any thermometer with resistance change as output.	Data can be stored in USB memory or transmitted by telemetry.	Fabrication of appropriate holders with containers for the temperature sensors.	Depending on the zone where field tests are performed, the local Environmental Authorities, ships of opportunity, environmental agencies, NGO...	In any platform	The output of one raw measurement consists of two/four columns of ASCII data containing values of time/data and resistance/temperature (if the calibration of R(T) will be included in the device processing before acquisition).	Can be continuous or programmed for a specific period of time		No limitations	It could be made in real time via satellite or internet or at the end of the cruise	No, if the calibration of R(T) will be included in the acquisition package.The raw data is the resistance vs time (the intensity -around 10-50 μA - should be stable in time).	Deliver sensor information and observations on the web, Allow users to subscribe to sensor alerts and notifications	We have already the firsts two protopipes of temperature sensors with good stability and hope to have them protected for testing in platforms in the first semester of 2015. We need the collaboration of other partners (Subtech, UCC, Tyndall) to develop the devices.
Zygmunt Klusek	klusek@iopan.gda.pl	10 - IOPAN	Underwater noise	Autonomic Hydroacoustic Buoy, deploying depth up 100 m, four hydrophones, sampling frequency 30 kHz in each channel, autonomy up to 1 month, storage 2 micro-SD 64 GB weight ~160 kg, Looking up echosounder - 119 kHz, compass and inclinometer	From ship crane, no difficulties with deploying, problems with fishing out of the buoy when sea state > 4 B	Possible WI-Fi channel, data usually stored on SD cards	ship crane with the suspension arm > 6 m, lifting capacity >5000 N	(Ecology organisations, universities, meteo observations, marine mammal hearing groups)	URANIA (CNR), OCEANIA	Acoustic pressure time series, in frequency range from 5/100 Hz (depending on the hydrophone type - used Reson TC 4032/4033) up to 12 kHz. Bubble entrainment depth when using looking up echosounder Buoy orientation in space	4*30 kSamples/sec	every 1-3 sec	Size of data packages - depending on the time serise usually in one second package noise, also echo profile and position in space (compass+inclinometer)	At the end of the cruise, WI-Fi channel possible	Data must be processed. Final parameters are: Noise spectrum level, statistics of momentary values acoustic pressure of the noise. Indicators for MSFD Descriptor 11.1 and 11.2	Allow advanced users to remotely plan sensor tasks (e.g., schedule measurements, etc.)	

Jose Saez	jasaez@leitat.org	01 - LEITAT	Microplastics	The sensor will consist of 3 main elements: -An optical transducer including imaging (multi-spectral camera) and exitation sources (IR light) -A control board including processor for data acquisition, preprocessing and converstion to required transmission format. -A sampling system able to collect water samples from water surface. Sensor operation will be automated (as much as possible) to minimize human operation.	Installation methodology still need to be defined but some potential difficulties are foreseen: - installation in vessels shells have been dismissed. -Water samples will flow through a transparent channel where microplastics concentration will be measured using optical sensor. -Currently, main installation difficulties are related to coupling sensing system and water sampling system. -In some cases, the sensor could be places directly in water, then, sampling system will not be needed. -Updates will be provided when information will be available.	Spectarl imaging and FT-NIR require important processing capabilities. Due to this fact and to sensor complexity, a dedicated control board will be developed. Then, required memory and data formatting can be included in this board. An interface with the sensor hub must be defined to allow integration with the rest of the sensors. Then, data could be sent to the sensor platform for data transmission.	As a dedicated electronic board will be developed, system integration should be easily achieved by an agreement on: data format, transmission rates, communication protocols.... Integration in floating platforms will present additional difficulties due to the reasons mentioned before.	Sensor developer: Snelloptics Electronic board developer: Leitat Sampling system developer: Idronaut Definition of testing methodology and integration requirements: Leitat, snelloptics, Idronaut, CSIC, FNOB, UCC	A, C and D.	Main information: Surface Microplastic concentration in (mg/litre). Additional discrete sensors are included in the sampling system: turbidity, florescence, CTD, ph, DO2. Other measurements: location, date and time are also needed but not included in the sensor by itself.	Every few minutes	30	No special limitations are foreseen in this topic.	Both options will be possible. It will depend on how the maritime experts request data (real time, historical....). Real time data could be transferred only if required technology is incorporated in the platform.	Sensor data will be processed in the dedicated electronic board. Additional processing might be needed to joing sensor data with other inputs like: GPS coordinates, water temperature, data and time...	Deliver sensor information and observations on the web, Allow advanced users to remotely plan sensor tasks (e.g., schedule measurements, etc.) , Allow sensors to be discovered through a search interface	Due to sensor complexity, very few prototype units will be available (1 to 3). According to project schedule, sensors will be ready on month 30 (April 2016)
Fabio Confalonieri	confalonieri@idronaut.it	09 - IDRONAUT	Microplastics (with LEITAT) - realization of the water sampler for LEITAT sensor for microplastics	Sampling system based on niskin bottles, associated with the micro-plastics analyser. Details of the system has not been discussed with the LEITAT and SNELLOPTICS partners. Preliminary information from the project foresees that the sampling system can be deployed downto max 100m. The system power will be 12VDC about 500mA when running, negligible when in stand-by between measurements. The sampling system will be completed with traditional sensor to measure: pressure, conductivity, Salinity, temperature, pH, O2, CHL-a and turbidity. There is no preference on the Platform for the installation, however due to the weight when the niskin bottles are full of water the best is to have a small winch.	The water sampler can be deployed using a rope, coax. cable or multiconductor cable. The difficoulty is the weight when the niskin bottles are full of water.	The Water sampling system can store acquired data and bottle status in the internal memory or transmitt them by means of rs232/rs485 or telemetry interface.				The parameters will be: Pressure, temperature, conductivity, salinity, pH, Dissolved Oxygen, Turbidity and Chlorophyll-a, and data and time of acquisition. All parameter are numbers.	Every few seconds		Not jet defined	Not jet defined	No, data will be in Engineering format.	Deliver sensor information and observations on the web, Allow advanced users to remotely plan sensor tasks (e.g., schedule measurements, etc.)	
Martí Gich	mgich@icmab.es	03 - CSIC	Heavy metals	The measurements will be performed on surface waters that have to be delivered to the measuring setup after filtering. The needed volume is very small (well below 1 ml). The consumption of the potentiostat and pumps for microfluidic is estimated to be below 1-2 W. The sensors do not need maintenance since are single use and an array of them will be available for the different measurements. The fluidic system might need maintenance against fouling.	The sensor is aimed to be fully automated and therfore low power consumption in order to b epowered by batteries. Since it will be placed on Research Vessels, the water sampling could be an issue	Data can be stored in USB memory or transmitted by internet after measurement but we don't know by which means (UCC: comment on that)	Several containers will be needed: A- Two liquid reservoirs with two types of buffer solutions (typically below 1 L each) for conditioning the sample at the pH needed for the analysis of the different heavy metals. B- Eventually three containers with standard solutions of different concentrations for each the heavy metals under study, of typically 20 mL each if the standard addition method is used (i.e. 3X5=15 containers of 20 ml). C-An additional container to collect the residual liquids containing heavy metals.	Depending on the zone where field tests are performed, the local Environmental Authorities as well as volunteeers and NGOs or environmental agencies+I9	Research Vessels URANIA, OCEANIA and SARMIENTO DE GOMBOA	The output of one raw measurement consists of two columns of ASCII data containing values of Current Intensity and Voltage. The temperature of the measured liquid and the measurement date should also be included in the file (less than 20 kB altogether). In the case of using the standard addition method each measurement would additionally generate three more of these files.	Every few hours	once a day	No limitations	It could be made in real time via internet (see above) or at the end of the cruise. (UCC: comment on that)	Yes, the raw data is an intensity vs voltage and a final processing (of eventually several of these datasets if standard addition method is used) will be needed before obtaining the heavy metal concentrations in water.	Deliver sensor information and observations on the web	We are planning to have the 3 heavy metal plattforms prepared to measure once a day during a onth for the research vessels of CNR, IOPAN and CSIC for summer 2015.

Margaret McCaul	margaret.mccaul@dcu.ie	06 - DCU	Eutrophication	Sensors will be designed for deployment in surface waters (0-3 m depth) Targeted maintenance interval is 1 month – implying that the storage capacity of reagent, calibrant and waste storage containers will be sufficient for this period. The maintenance-free interval will vary depending on sampling frequency. Sensors will operate using battery power, which may need to be supplemented by energy harvesting e.g. using solar panels on buoys. The target for battery lifetime without energy harvesting will be 1 month also.	Installation method will vary depending on the platform to be used and the deployment scenario (depth, sea conditions, accessibility etc.) Technical advice and support on mountings etc. will be required from partners with more expertise/experience in carrying out marine sensor deployments.	Analytical specifications of the sensors are yet to be determined. Sensors will be designed for deployment in surface waters (0-3 m depth). Applicable temperature range of the sensors will need to be assessed. Data storage can be implemented using Flash memory chips or removable memory (e.g. SD cards). Data storage will be required on the platform regardless of deployment scenario to provide data redundancy e.g. in the event of communications failure. Possible means of data transmission include satellite, GSM, Wifi/Wimax, short range transmission such as ZigBee, BlueTooth, or via directional antennae. The deployment location and coverage will determine the choice of data transmission mode.	Additional needs may be identified as the project progresses.	Relevant environmental agencies (depending on deployment location) NGOs Vessels of opportunity	Possible platforms for deployment of the sensors will include: A. Research vessels - Researc+J7h vessel URAN+J8IA (CNR) - Research vessel OCEANIA (IOPAN) - Research vessel SARMIENTO DE GAMBOA – SdG (CSIC) C. Buoys and submerged moorings - Oceanographic buoy in Gdansk Bay (IOPAN) - Oceanographic submerged moorings in the Mediterranean (CNR) D. Ocean racing yachts F. Fishing vessels Other vessels of opportunity Selection of the most appropriate platforms will require further information on the characteristics of the various platforms, as well as relevant features of the sensors and platform which are yet to be determined.	The primary output will be nutrient concentrations. The raw data will be transmitted in the form of a series of light intensity readings. Each measurement will also include a temperature reading and date stamp.	Hourly		Data storage capacity will be determined by the selected mode of storage – e.g. 16GB for SD card, megabyte range for flash memory chips. Due to the small size of data generated for each individual measurement, this is not expected to represent a significant limitation. Data transmission capacity will vary depending on the mode of transmission – e.g. SMS is limited to 160 7-bit characters, Sat. Comm. may charge by transmission duration and/or data size.	Possible means of data transmission include satellite, GSM, Wifi/Wimax, short range transmission such as ZigBee, BlueTooth, or via directional antennae. The deployment location and coverage will determine the choice of data transmission mode. Data logging will be utilised if sensors are to be deployed in scenarios where none of the possible transmission modes are available.	Raw data in the form of light intensity readings will be acquired and transmitted. The raw data will need to be converted initially to absorption values, and ultimately to concentration values. The final data to be stored and displayed will be in the form of nutrient concentrations. Raw data should also be stored as it provides additional information on sensor performance and allows cross-referencing with data stored on board the sensor (e.g. allowing reliability of transmitted data to be validated). The data management system should also allow for additional features such as: • Event detection • Event classification (identification of false positives/negatives) • Data smoothing (for display purposes)	Deliver sensor information and observations on the web, Allow users to subscribe to sensor alerts and notifications, Allow advanced users to remotely plan sensor tasks (e.g., schedule measurements, etc.) , Allow sensors to be discovered through a search interface	
Anita Grozdanov	anita@tmf.ukim.edu.mk	FTM-UCIM	Nanosensors for autonomous pH and pCO_2 measurements	This sensor will be designed for deployment in surface waters (0-5 m). The maintenance interval will vary depending from sampling frequency.	Installation method will depend from the platform to be used. Also, there are stil open questions about the water sampling: it will be flow water or water container? Technical consultations will be done with the partners who produced the electrodes that will be used for this sensor.	Sensor optimization is going on activity.	Additional needs may be identified as the project progresses.	Depending on the zone where field tests are performed, the local Environmental Authorities as well as volunteeers and NGOs or environmental agencies	Research Vessels of the COMMON SENSE patners like URANIA, OCEANIA and SARMIENTO DE GAMBOA	Resistivity Changes due to the variation of pH of the water and pCO2 values	Hourly	every 1 hour	No specific limitations	The same way like the other sensors from this project because we have discussed for one common way.	Raw data in the form of resistivity changes due to the different pH and pCO2 value of the marine water.	Delivering on the screen printed electrodes.	We have ordered 400 electrodes and we are planning to produce various types. At the beguning, 4 pices from each type. We will need collaboration of other SME partners in the COMMONSENS in order to produce the sensor device.

Annex 2 - Table for Sensor Testers

The COMMON SENSE project has received funding from the European Union's Seventh Framework Program (Ocean 2013-2) under the grant agreement no 614155.

Your name	Your email	Your Organisation	Please select platform	If your answer to the previous question is "Other" or under categories F or G, then please specify.	Platform Characteristics: Which sensors can be mounted on the available platform?	Describe how to mount new sensors on platforms.	Platform Characteristics: How many sensors of each type can be mounted at the same time on each platform?	Platform Characteristics: Frequency of platform maintenance?	Please describe compatibility issues	Please describe calendars and platform availability	Special needs?	Stakeholders involved?	Comparative measurements to be implemented to verify new sensors
Mike Challiss	mike.challiss@cefas.co.uk	15 - CEFAS	C. Buoys and Submerged Mooring - Smartbuoys (CEFAS)	A fixed silent mooring is likely to be used for the first deployment. The aim is for the package to be small enough to permit deployment tests on a Glider or USV as these platforms can move to new areas of interest without the need to ships to deploy them. Comparative background noise tests will be required in this case.	Underwater Noise	The noise sensor will need to be mounted in such a way to avoid pickup from the mooring, so the hydrophone will need to be mounted using bungy type cord or similar to prevent coupling (vibration) to the main platform	1off	N/A deployed for fixed duration then recovered	Size may be a constraint for prototype units	Made available to suit noise programme	N/A	Cefas IOPAN	The sensor will be calibrated prior to deployment significant shift can be observed just prior to deployment in the field using a pistonphone.
Mireno Borghini - Katrin Schroeder	mireno.borghini@sp.ismar.cnr.it - katrin.schroeder@ismar.cnr.it	04 - CNR	C. Buoys and Submerged Mooring - Oceanographic submerged moorings in the Mediterranean (CNR)		Eutrophication, Innovative piro and piezo resistive polymeric temperature sensors	Sensors will be mounted along the mooring possibly at different depths between 400m and 150 m depth	the number of sensors to be mounted at the same time strongly depends on the dimension and wieght of these sensors. The length of the mooring is about 250 m, from the bottom at about 450 m depth, so any suitable depth can be chosen. There are three mooring lines of this type available	the platform will be recovered and redeployed every six months, approximately	there are other instruments on the mooring lines, which position should not change. Due to strong currents, not to heavy and big sensors can be installed. The length of the mooring line cannot be extended.	the platforms are accessed every 6 months with an oceanographic vessel. The calendar of each year of the ship time will be known in December of the year before (for deployments in 2015, we will need to wait until December 2014 to know the exact dates), but usually we access the platforms in spring and in autumn.	Autonomous or analogic exit and power	None	The comparison will be done with already installed similar sensors of temperature
Javier Vilallonga	jvilallonga@fnob.org	08 - FNOB	D. Ocean Racing Yacht - IMOCA Open 60 boats (FNOB)		Microplastics and Eutrophication measurements	The sensors can be mounted into the systems provided and fit inside the boat (for example water treatment or water treatment engine cooling circuit). Relocatable depending on the needs and viability. Powered by the system or batteries	The amount of sensors depends on the size of these, as it is an IMOCA 60 racing boat	IMOCA 60 Boat with maintenance crew	Size may be a constraint for prototype units	Impossible to confirm at the present moment	None at the moment	None at the moment	The sensor will be calibrated prior to deployment and calibration can be validated by the crew maintenance if possible.
Mireno Borghini - Katrin Schroeder	mireno.borghini@sp.ismar.cnr.it - katrin.schroeder@ismar.cnr.it	4 - CNR	A. Research Vessel - URANIA (CNR)		Microplastics measurements	Sensors could be mounted on the mouth of a net for microplastics or downflow of the on-board seawater pump.	The number of sensors is strongly dependent on their size, to be mounted on nets specific for microplastics already used for this purpose.Also the sensor mounted in parallel but with a flow-meter to compare the data for volume of filtered water.	daily, while on board	The issues depend on the size and the characterstics of the sensors. If on nets for microplastics, the sensor must have autonomous power and small size.	The cruise calendar for 2015 will be known in December 2014, and approximately 2 cruises, 15-days long each, will be available in late spring and autumn.	For testing with manta-trawl the analysis of the water will be important at the same depht (0-30 cm) but also at other dephts, depending on the purpouse.	None. Sensor developers can be embarked if requested.	The comparison will be done through the counting in laboratory of microplastics collected at the same time by the use of a manta-trawl where the sensor could be installed

Mireno Borghini - Katrin Schroeder	mireno.borghini@sp.ismar.cnr.it - katrin.schroeder@ismar.cnr.it	04 - CNR	A. Research Vessel - URANIA (CNR)		Eutrophication and innovative piro and piezo resistive polymeric temperature and pressure sensors	Sensors will be mounted on CTD probes or on the rosette if with an autonomous power	The number of sensors is strongly dependent on their size, to be mounted on the frame of the CTD/rosette system. One can be mounted on nets (ex. for microplastics)	daily, while on board	The issues depend on the size and the charachtersitics of the sensors. They can be mounted on the frame of CTD/rosette system, or downflow of the on-board seawater pump. If on nets, ex. for microplastics, the sensor must has autonomous power.	In 2014, if not modified, a 15-days long cruise will be available in November/December 2014. The cruise calendar for 2015 will be known in December 2014, and approximately 2 cruises, 15-days long will be available.	Autonomous or analogic exit and power	None. Sensor developers can be embarked if requested.	The comparison will be done through analysis in laboratory of water samples at different depths for nutrients and with already installed similar sensors of temperature and pressure on CTDs
Jordi Salat	salat@icm.csic.es	03 - CSIC	A. Research Vessel - SARMIENTO DE GAMBOA – SdG (CSIC)		Eutrophication, Microplastics, Heavy Metals, Underwater Noise, Innovative piro and piezo resistive polymeric temperature and pressure sensors, Nanosensors for autonomous pH and pCO2 measurements	Eutrophication, Heavy metals, temperature, pressure, pH and pCO2, and problably microplastics, can be attached to a CTD or to a pump. I assume that underwater noise must be attached to some device that could be towed.	Oceanographic Research Vessel. All kind of sensors can be tested	none	none	not yet	none	none	Measurements can be verified with "standard sensors" (e.g., temperature, pressure, pH, pCO2) or laboratory analyses (e.g., eutrophication, microplastics). I assume that there exist some hydrophone suitable to validate underwater noise
Emilio Garcia-Ladona	emilio@icm.csic.es	03 - CSIC	B. Oil Platform - Other (please specify below)	Casablanca (W. Mediterranean) Preliminary contacts. Still not available	Eutrophication, Innovative piro and piezo resistive polymeric temperature and pressure sensors, Nanosensors for autonomous pH and pCO2 measurements	They can be attached to the platform somewhere underwater or to a pump if not sumbmersible, using either batteries or power from ths platform	Still not agreed	Still not agreed	Under research	Still not agreed	Under research	Oil company (Repsol) Marine authorities	With standard sensors or analyses (see above) when installed and during maintenance
Jordi Salat	salat@icm.csic.es	03 - CSIC	C. Buoys and Submerged Mooring - ICM-CSIC deep moorings at the continental slope and canyons of the NW Mediterranean		Heavy Metals, Innovative piro and piezo resistive polymeric temperature and pressure sensors, Nanosensors for autonomous pH and pCO2 measurements	If submersible, they can be attached to the moorings, using batteries	several sensors provided enough power in batteries (see maintenance)	Fixed. Once a year or lower	Not known	Not yet	Mooring has to be adapted to sensors and batteries (accoustic releases, weight, wire, buoyancy, etc)	none	With standard sensors or analyses (see above) when installed and during maintenance
Emilio Garcia-Ladona	emilio@icm.csic.es	03 - CSIC	C. Buoys and Submerged Mooring - Other (please specify below)	Aqualog (undulating mooring). Still not ready for use	Eutrophication, Heavy Metals, Innovative piro and piezo resistive polymeric temperature and pressure sensors, Nanosensors for autonomous pH and pCO2 measurements	If submersible, they can be mounted to the Aqualog provided they fit inside. Powered by the system or batteries	Autonomous platform wire connected to a laboratory	Relocatable. Around once a month.	Still not known	Still not known	Under research	UPC (Politechnical University of Catalonia)	With standard sensors or analyses (see above) when installed and during maintenance

Jaume Piera	jpiera@cmima.csic.es	03 - CSIC	C. OBSEA Underwater observatory		Eutrophication, Heavy Metals, Innovative piro and piezo resistive polymeric temperature and pressure sensors, Nanosensors for autonomous pH and pCO_2 measurements	If submersible, they can be installed into the OBSEA. Powered by the system or batteries	Autonomous platform wire connected to a laboratory	When necessary	still not known	Not yet	still not known	UPC (Politechnical University of Catalonia)	With standard sensors or analyses (see above) when necessary
Jordi Salat	salat@icm.csic.es	03 - CSIC	G. Expendable ocean instruments, manned vessels and further available platforms (please specify below)	It should be: E. Drifting buoys (ICM-CSIC) but for any reason the E option is missing in the window above	Eutrophication, Microplastics, Heavy Metals, Innovative piro and piezo resistive polymeric temperature and pressure sensors, Nanosensors for autonomous pH and pCO_2 measurements	If submersible, they can be mounted into the systems provided they fit inside. Powered by the system or batteries	Several sensors provided enough battery power	None. Expendable platforms	Still not known	Not yet	To be studied according to sensors' charactеritics	Ships of opportunity. E.g. Marine Rescue agencies Fishing vessels Yacht clubs etc	With standard sensors or analyses (see above) when installed
Mike Challiss	mike.challiss@cefas.co.uk	15 - CEFAS	C. Buoys and Submerged Mooring - Smartbuoys (CEFAS)	Glider or USV is more likely to be used for trials to reduce the likelihood of background noise	Underwater Noise	The noise sensor will need to be mounted in such a way to avoid pickup from the mooring, so the hydrophone will need to be mounted using bungy type cord or similar to prevent coupling (vibration) to the main platform	1off	N/A deployed for fixed duration then recovered	Size may be a constraint for prototype units	Made available to suit noise programme	N/A	Cefas IOPAN	The sensor will be calibrated prior to deployment and calibration can be validated in the field using a pistonphone.
Sławomir Sagan	sagan@iopan.gda.pl	10 - IOPAN	A. Research Vessel - OCEANIA (IOPAN)		Microplastics, Heavy Metals, Underwater Noise, Innovative piro and piezo resistive polymeric temperature and pressure sensors, Nanosensors for autonomous pH and pCO_2 measurements	depend on mounting/cabling of sensors. Five winches are available, two with cable line. There are no strong restriction on number of instruments/winches operating simulatainously,unless sounding depth >50 m.	depend on mounting/cabling of sensors. Five winches are available, two with cable line. There are no strong restriction on number of instruments/winches operating simulatainously,unless sounding depth >50 m.	constantly, while on board	Power supply 230V, cable line (1 wire + shield), cable line (7 wires + shield). Detailed tech specification of connectors upon request. Distance from the lab to the farthermost deployment point is~30 m. WiFi at all areas, with satellite internet link.	Exact cruise calendar for 2015 will be known at the end of Dec. 2014; cruises: Gdansk - Tromso, 9th of June '15, 7 days. Possibliity to embark Tromso - Gdansk, mid-Aug, ~7 days, if request made before Feb.2015. Nov 2015, Baltic, 10-days; Cruise plan will be available at http://www.iopan.pl/oceania.html	if reqested for Tromso legs, the advance permission from S,N, D, DK authorities are required	None. Sensor developers embarkment is expected.	Sensor/s data may be compared with others sensors available: optical, lab measured biooptics, CTD (Nov. '15 only).
Piotr Kowalczuk	piotr@iopan.gda.pl	10 - IOPAN	A. Research vessels - Motorboat		All; the cage/package shall not exceed dimension 80x80x80 cm; weight limit: 50 kg	One winch available, sounding depth up to 50 m.	One winch available, sounding depth up to 50 m.	constantly, while on board	Power supply 230V, effective work can be perofmed up to 2 B, wind up to 6 m/s, wave up to 1m. Operations possible on Gulf of Gdańsk area and Vistula river.	on demad, two weeks notice required. Operational from March till mid-Nov.	none	None. Sensor developers embarkment is expected.	None
Miroslaw Darecki	darecki@iopan.gda.pl	10 - IOPAN	B. Oil platforms in Gdansk Bay		All; the cage/package size and weight limited unknown at the moment - subject of agreement with platform admin.	limted number of mounted sensors due to security limtation	limted number of mounted sensors due to security limtation	depends on third party transport availability and weather conditions, average once a month	Power supply 230V, in water instruments have to be suspended on a cable from platform located 25 meters above the water	platform operated the whole year; easiest access during spring and summer seasons	installation of potential new sensors must be preceded by prior agreement with the platform administrator - safety and security issues specific for oil drilling site.	None. Sensor developers embarkment is expected.	available in-water: fluorimeter, Temperature sensor.