D8.4– Demonstration plan

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THE OCEAN OF TOMORROW

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[Deliverable 8.4 – Demonstration plan]

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Abstract

This is an internal guide for the final demonstration of the NeXOS sensors in different platform of the Consortium.
The definition of user scenarios takes existing observing systems and technologies into account and derives the next development steps in regard to technical and economic performance.
The report gives a detailed overview of the different combinations of sensors and platforms, and the missions to be conducted in Work Package 9 (Demonstration).
The missions will be carried out in the Central Atlantic (Task 9.3), the Mediterranean (task 9.1) and in the North Atlantic (task 9.2): the missions are related to the different user scenarios defined in WP1.

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1. COMMON BACKGROUND

This document describes the final Demonstration Plan for the sensors developed in NeXOS.

This plan is used to coordinate the orderly scheduling of events by providing demonstration missions specifications and organizational requirements, in line with the user scenarios developed in Deliverable 1.2:

• Hydrocarbon observations with gliders

• Observations for sustainable fisheries

• Characterising the underwater soundscape, with a focus on areas where human activities are taking place

• Carbon sequestration monitoring with FerryBox

• Detection and characterization of phytoplankton bloom.

Other scenarios may be added but these five scenarios allow for narrowing down the next implementation steps. These scenarios are reproduced in a shortened form in chapter 4.

An important aspect of the sensors developed in the NeXOS project has been multiplatform ability and sensor web enablement. To demonstrate the value of this approach, we have aimed to demonstrate the sensors on a wide range of different platforms. These planned sensor-platform pairings are described in the Description of Work (DoW) for Work Package 9 (Demonstration):

Task 9.1 Demonstrating optics and acoustics in the Central Atlantic on mobile and fixed platforms; Leader:
PLOCAN; Duration: M43-M47

Optical and acoustic sensor systems will be demonstrated on various fixed and mobile platforms in the oligotrophic waters of the Central Atlantic, off the Canary Islands. The regional waters include particularly sensitive areas classified by the IMO, hosting 30 species of cetaceans, subject to intense interactions with human activities (maritime traffic and future oil & gas exploration). Several biogeochemical phenomena of scientific relevance occur in the region as well, e.g. the natural upwelling from deep Atlantic waters towards the East Coast of Africa and the frequent input of aerosols from Saharan dust brought by wind from the East.

Near continuous monitoring of CO2 and pH in the open-ocean are also of interest with reference to the relations between climate change, carbon cycle and ocean acidification. Finally, the PLOCAN test site will be monitored for potential noise sources stemming from the ocean energy converters under test.

SLOCUM glider from PLOCAN will be equipped with Optical sensors O1 and O3, a PROVOR float from NKE will be equipped with passive acoustic sensor A1, and one cabled observatory will be equipped with passive acoustic sensor A2. Additionally, one deep-water open-ocean stand-alone station (ESTOC, 3650m depth) will be equipped with passive acoustic sensors A1 and optical sensor O2 (ship-time to the station is provided at no cost to the project).

The PLOCAN platform, from which most deployments will be performed, will be operational and able to host scientists and stakeholders for the demonstration period. Demonstration will deliver real-time and near real time data to Sensor Web Services. Data streams will be displayed on the screens of the PLOCAN operation room during the final dissemination workshop organised in WP10 and data will be encouraged to be made available through the Global Earth Observation System of Systems without any restrictions (on discovery, access or use).

Task 9.2 Demonstrating optics and acoustics in North Atlantic waters on mobile and fixed platforms; Leader:
REC; Duration: M43-M47.

Optical and acoustic sensor systems will be demonstrated on various fixed and mobile platforms in the cold nutrient-rich waters of the North Atlantic, off the Norwegian Coast. The planning of the experiment may also include the monitoring of waters around an offshore Oil and Gas installation (Troll site platforms) for measurement of noise, chemical compounds, including water contaminants and Green House Gases. All relevant permits will be requested by NeXOS Norwegian partners to the Statoil company one year before the planned demonstration.

The Havila Troll vessel will be used for operations at no cost, as already agreed with the ship operator (See letter of Intent in Annexe). Whale presence will also be monitored, allowing for acquisition of information on potential interactions and behavioural patterns related to human activities. For this demonstration, a SeaExplorer glider from ALSEAMAR will be equipped with Optical sensor O1 and passive acoustic sensor A1, a ASV (SAILBUOY) from CMR will be equipped with optical sensor O3, and a FerryBox system on-board a vessel of opportunity will be equipped with optical sensor O2. Demonstration will deliver real-time and near real time data to Sensor Web Services. Data streams will be displayed on the screens of the PLOCAN operation room during the final dissemination workshop organised in WP10, and data will be encouraged to be made available through the Global Earth Observation System of Systems without any restrictions (on discovery, access or use).

Task 9.3 Demonstrating EAF sensor system and passive acoustics in the Mediterranean Sea; Leader: CNR;
Duration: M43-M47

Demonstration will deliver real-time and near real time data to Sensor Web Services. Combining fisheries, oceanographic and acoustic sensors will provide unprecedented data for interactions between fishing activities, ocean environmental variables and cetacean presence with potential depredation behaviour. The EAF system and the passive acoustics sensor system A2 will equip the FOS/FOOS on board a ship from the Adriatic fisheries fleet. Demonstration will deliver real-time and near real time data to Sensor Web Services. Data streams will be displayed on the screens of the PLOCAN operation room during the final dissemination workshop organised in WP10 and data will be encouraged to be made available through the Global Earth Observation System of Systems without any restrictions (on discovery, access or use).

During the development of the project, there were some changes in the plans for platform/sensor pairing, reflecting the real availability in the consortium and final sensor configuration obtained during the development phase. The new pairings also demonstrates the value of the NeXOS approach, and fulfills the demands of the user scenarios. The present report shows the final selections discussed at the 7th Ordinary project meeting and General Assembly in Toulon, October 2016, and during following teleconferences.

Table 1 represents the matrix of platforms and it describes which vehicles are available in which demonstrator sites. Table 2 is the matrix of demonstration and represents where the sensors will be demonstrated.

Table 1: Matrix of platforms			
Platform name	**Partner owner**	**Type of platform**	**Contact**
ESTOC TB	PLOCAN	STAND ALONE MOORING	carlos.barrera@plocan.eu
WAVE GLIDER	PLOCAN	SURFACE GLIDER	carlos.barrera@plocan.eu
PROVOR	NKE	PROFILER	dmalarde@nke.fr
SEA EXPLORER	ALSEAMAR	GLIDER	lbeguery@alseamar-alcen.com
SAIL BUOY	CMR	SURFACE VESSEL	david.peddie@cmr.no
FERRYBOX	NIVA	VESSEL	lars.golmen@niva.no
FERRYBOX	HZG	VESSEL	jochen.wollschlaeger@hzg.de
FISHING VESSEL	REC	VESSEL	nilsroar@rundecentre.no
FOS/FOOS	CNR	VESSEL	michela.martinelli@an.ismar.cnr.it
OBSEA	UPC	CABLED OBSERVATORY	joaquin.del.rio@upc.edu
TriOS Buoy	➔ See D8.1		

Table 1 with platforms and contact persons.

A1	A2	O1	O2	O3	EAF	PLATFORM	DEMO SITE
MED1						Beacon	MED SEA
					MED3	Fishing Vessel	
	MED2					OBSEA	
NOR1		NOR2				SEA EXPLORER	NORWAY
				NOR3		SAIL BUOY	
		NOR4	NOR4	NOR5		FERRYBOX	
					NOR6	FISHING VESSEL	
		NOR7				Buoy	GERMANY
CAN1		CAN2				WAVE GLIDER	CANARY ISLANDS
CAN3						PROVOR	
CAN4						ESTOC TB	

Table 2: Matrix of Demonstrations

There has been some discussion throughout the project duration about what exactly is meant by demonstration. Is it a test? How does it differ from validation? During the General Assembly meeting in La Seyne-sur-Mer in 2016, the following definitions were agreed upon:

Definition of Demonstration:

- **Verification** – Meet the requirements/specifications. Independent check must be possible
- **Validation** – Fit for purpose, (part of validation process is cost efficiency considering the full life cycle, also including need of personnel for maintenance, cost per data point), deployment under field conditions, use of background data for intercomparison.
- **Demonstration** – Demonstrating impact of the NeXOS system of systems (multifunctional sensor operations), fit for specific purposes or applications, embedded into realistic operational scenarios, mission control services (SWE, SOS), data handling and visualization (interoperability), demonstrating the path from sensor via sensor platform to an end-to-end approach.

2. Sensors to be demonstrated

There are three main types of sensors in NeXOS: Passive acoustic, optical and sensors for Ecosystems Approach to Fisheries (EAF). The latter are essentially optical sensors, but with a new adaptation to new applications.

The different types of sensors to be demonstrated are illustrated in Figure 1 and Figure 2.

The sensors are described in detail in previous deliverables; a brief overview is provided here.

For each type of sensor a number of so called replicas have been produced, based on the same principles, but targeted to be tested and demonstrated on different platforms or in different sea environments.

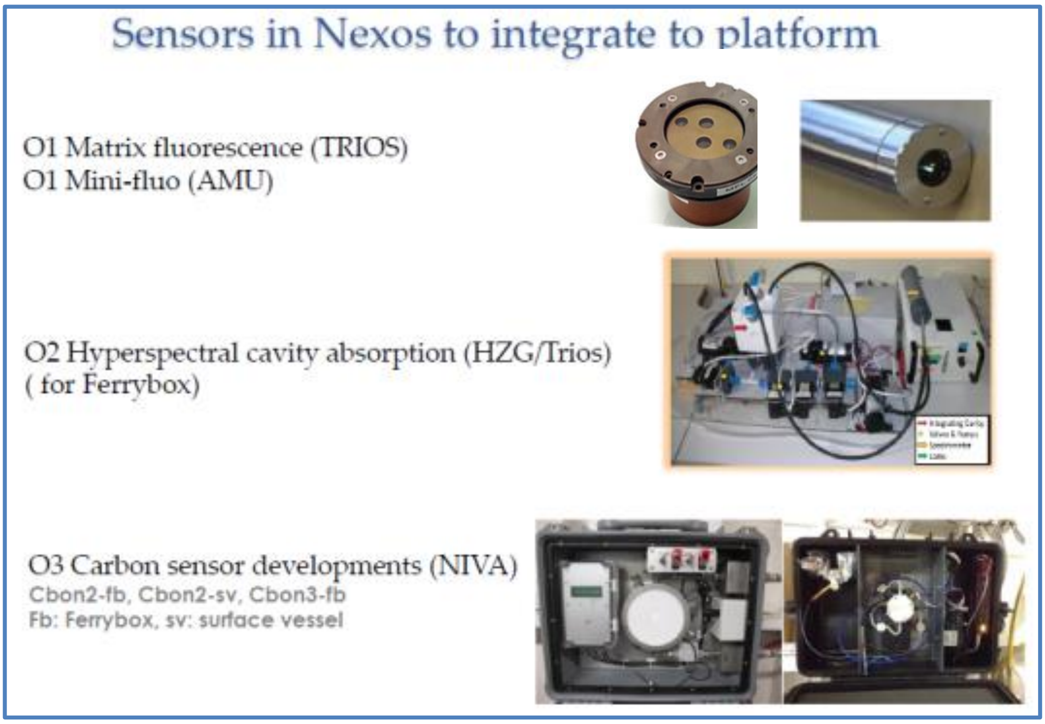

Figure 1: The three main types of optical sensors. Top row, left: MiniFluo from AMU. Right: MatrixFluo from TriOS.

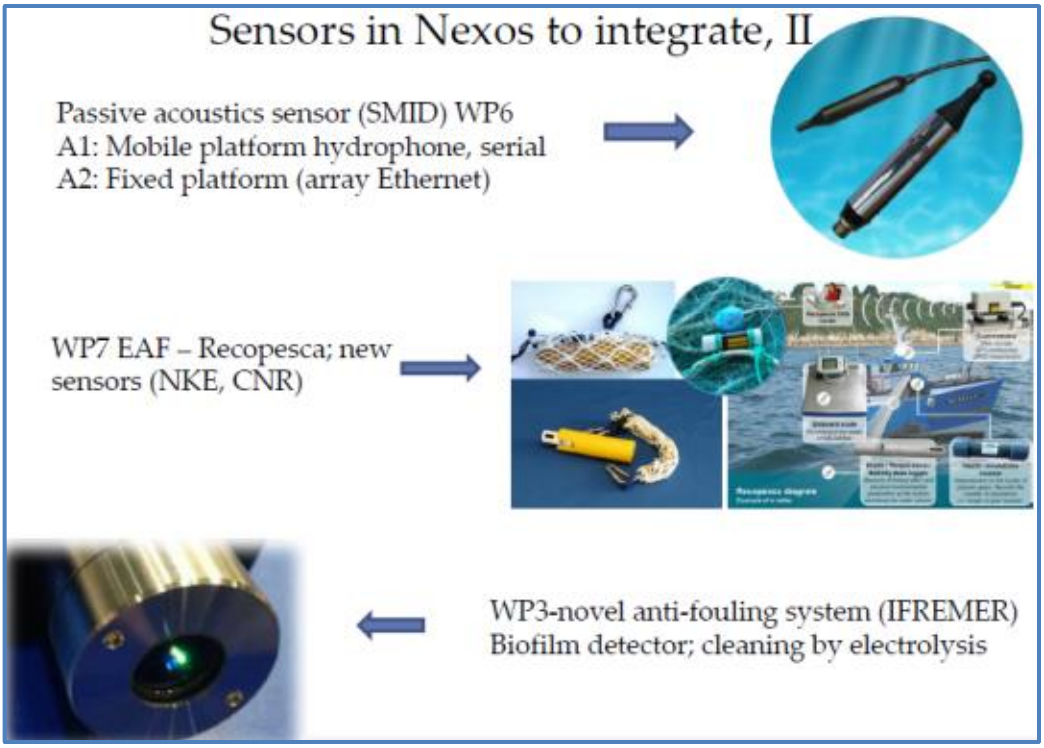

Figure 2: The Passive Acoustic sensors and EAF sensors in NeXOS. In addition, the anti-fouling system is included.

2.1. A1 – Passive acoustic sensor

A1 consists of one hydrophone and two A/D converters, simultaneously sampled, with different gain to detect, in the same time, acoustic source levels from 50 dB to 180 dB re 1µPa in the frequency range from 1Hz to 50kHz.

The signals are sampled by two 16-bit SAR converters controlled by an ARM microcontroller, which handles the proper data processing (mathematical operations).

In order to avoid aliasing problems a switched capacitor filter digitally controlled by the Micro Controller Unit (MCU) has been added in the chain after the amplifier stage.

The MCU processes the sampled data and transmits the results on an EIA RS-232 serial port.

A1 is equipped with a real time clock useful to tag temporally sampled data, and is additionally equipped with a Pulse per Second (PPS) input for the GPS link.

The innovation of the A1 sensor consists in the integration of all the functions listed in the following chapters. As compared to the hydrophones available on the market, the new hydrophone key enhancements are:

- larger dynamic range for both low and high sound level monitoring
- programmable gain amplifier stage to configure the analog signal conditioning stage
- open source for add-on programming by users willing to modify functionalities
- pre-processing of acoustic data for real-time open-ocean measurements
- plug and play OGC Puck Enabled for easier installation
- low power consumption allowing for small vehicle integration

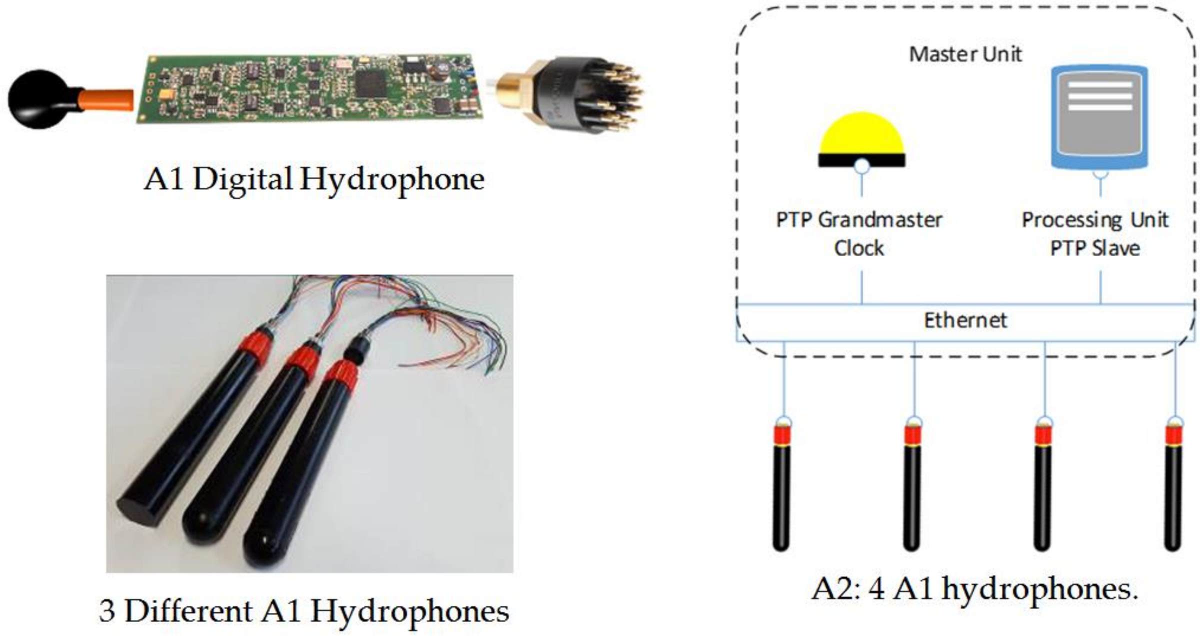

Figure 3: The A1 and A2 sensors.

2.2. A2 –Passive acoustic array

A2 is a digital passive acoustic transducer array, its output (raw signal) will be pre-processed by a master unit (details are specified in WP3). The A2 array is properly equipped with positioning sensors (pan, tilt, and compass) to allow the detection and tracking of noise sources. A2 will allow the integration of additional oceanographic sensors (to measure sound velocity, temperature, depth) for real-time propagation modelling. All signals (acoustic, position, oceanographic) are digitized and made available on a serial output line for proper transmission and pre and post- processing. The acoustic array A2 is composed by four acoustic devices, called the A2hyd. In many respects, A2hyd are similar to A1 and therefore described in the previous chapter. The Signal Conditioning Unit (SCU), the A/D Converter (ADC) and the MicroController Unit (MCU) components are unchanged.

2.3. O1 - Matrix-fluorescence

As part of Task 5.1, two different sensors based on matrix-fluorescence were developed: the MatrixFlu from TriOS (Fig. 4) and the MiniFluo from AMU (Fig.5). Target species were dissolved organic and inorganic material, including hydrocarbons (PAHs) that give off fluorescence after excitement. The AMU sensor was from a pre-development in NeXOS, taken in as it provided a relevant alternative and kick-start, relative to the TriOS sensor.

The NeXOS approach (WP5) was to develop sensors with efficient reconfigurable algorithms and an iterative cycle of improvement of the mechanical, electronic and optical properties. Optimizing power consumption was one important factor. The small-size casing, connections and externals were made to facilitate easy integration on autonomous mobile platforms. The first approach was to assemble existing single wavelength sensors to enable parallel development of algorithms to be used as an initial approach on board autonomous platforms (Deliverable 5.2).

Figure 4: The TriOS MatrixFluo UV sensor. A similar VIS version for visible light was developed.

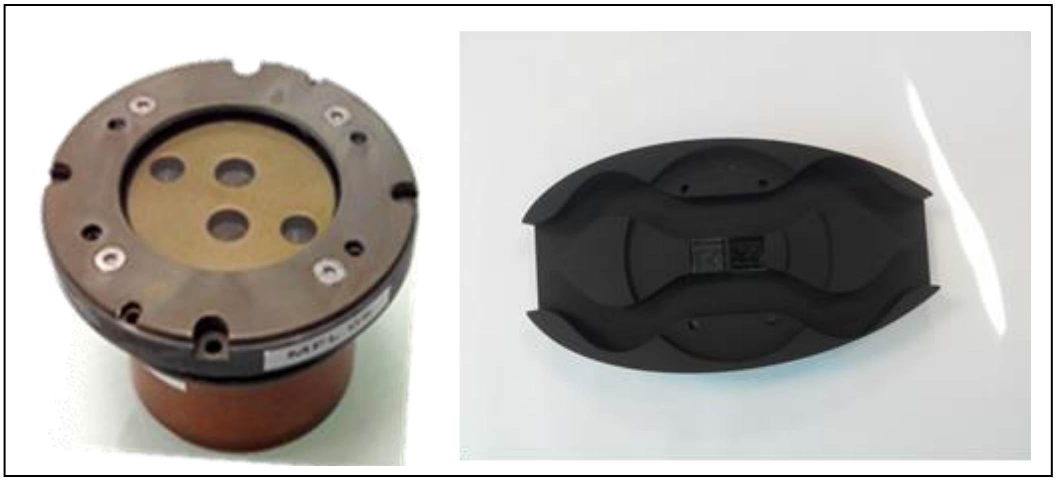

Figure 5: The MiniFluo-UV sensor from AMU: Housing (left) and cap top (right).

2.4. O2 - Flowthrough cavity absorption sensor

Reference is made to Deliverable 5.3 for technical details and measurement principle. The cavity sensor is based on a prolonged path of the induced light inside the chamber by multiple reflections and multiple passes across the sample. Furthermore, because the light is reflected multiple times on the cavity wall, it travels several times through the sample, which enhances its chance of being absorbed. The sensitivity of the instrument is thus substantially enhanced by this increased optical path length. A further advantage is that light loss due to light scattering on particles can be neglected as the light is “trapped” within the integrating cavity and the measured light loss can be completely attributed to absorption. An example for such an integrating cavity device is the point-source integrating cavity absorption meter, the PSICAM, was developed more than 20 years ago.

This type of multi-spectral sensor is useful for phytoplankton group identification. Several spectrally different groups of phytoplankton can be determined reliably, such as various forms of cyanobacteria. The detection or identification is highly dependent on the algorithms applied in the signal processing and the availability of reference spectra. The sensor has a great potential for harmful algal bloom (HAB) detection.

The existing OSCAR-G2 by TriOS (Figure 6, now commercially available) and the Hyperspectral Absorption Sensor (HyAbS) by HZG are both based on the cavity absorption principle. Both are compact, stand-alone integrating cavity devices and both are already automated for long-term usable flow-through system (type FerryBox). In NeXOS, the final sensor is a combination of the two mentioned sensors.

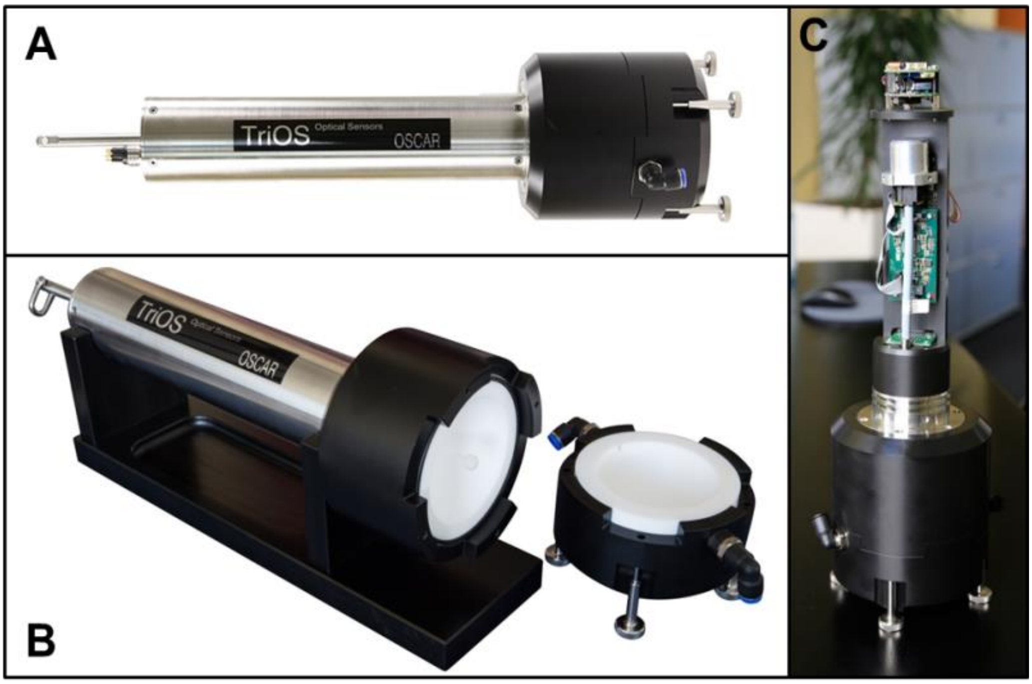

Figure 6: Design of the OSCAR-G2 (a.k.a NeXOS O2). (A) Closed housing. (B) With opened cavity (C) With opened housing. The Illustration is from Deliverable 5.3.

2.5. O3 - Carbon system sensors

The carbon sensors are modular, integrated systems-of-systems, in that they each contain two (Cbon2) or three (Cbon3) sensors relevant to determine the dissolved carbon amount and dissociation in seawater. For practical applications, the combinations are integrated in a closed box, see Figure 7.

The sensors are all optical (spectrophotometric), however, some are in combination of other measurement principles as well. The Automated Flow-through Embedded Spectrophotometry unit for pH measurement (NIVA) is based on a miniature flow-through arrangement and absorbance detection at 435nm and 596nm. Water line is derived from the main water loop .e.g. in a FerryBox setup and is in parallel with the CO_2 extraction branch. The light source is based on commercial LEDs controlled by custom electronics and D/A converters that accurately set light levels.

In the pCO_2 sensor by Franatech CO_2 is extracted from the liquid phase (seawater) by means of a silicone semi permeable membrane supported by a titanium disc. The gas is conveyed by a miniature pump housed in the CO_2 sensor case and recirculated in a gas loop. Temperature is measured behind the membrane while pressure is measured by the CO_2 detector. The system can operate in free running or discrete mode according to instruction from the remote user. CO_2 is continuously monitored, while pH is measured when the sampling interval has elapsed. A toggle valve will stop the flow to the AFtES (automated, flow-through, embedded, spectrophotometry) branch and a sequence of indicator injections will be used to evaluate the pH of the sample based on absorbance measurements (blank: seawater, post injection: seawater + dye).

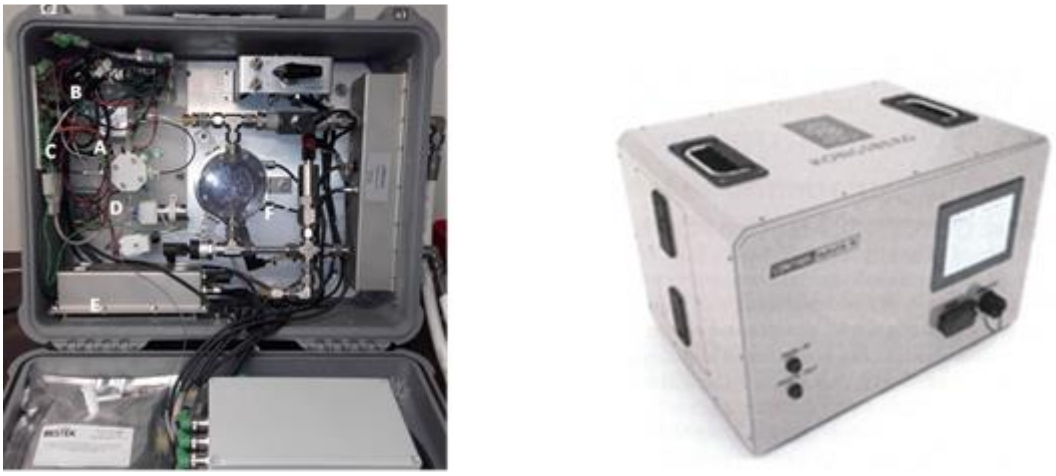

Figure 7: Left: The combined pH and pCO2 sensor system (NIVA/Franatech). Right: The KM CONTROS underway alkalinity analyser.

The external total alkalinity detection box (CONTROS Hydro-FIA TA) is connected by the serial port to the FerryBox control unit to form the Cbon3 sensor unit. The system (the first to be commercially available) has been developed by KM CONTROS (Kongsberg Maritime) in collaboration with HZG and is self-contained in an autonomous box, sized (480 x 400 x 320) mm, thus achieving a modular approach along ferry-box installations. TA detection is based on the wet chemical flow-through measuring system. A seawater sample is acidified using diluted HCl. After acidification, the generated CO_2 in the sample is removed by means of a membrane based degassing unit (open cell titration). The accompanying change in pH is measured spectrophotometrically using an indicator dye. See Deliverable 5.4 for more details.

2.6. The EAF sensors

EAF stands for Ecosystem Approach to Fisheries management, where voluntary fishing vessels apply sensors to their gear and space on their wheelhouse roof for an autonomous data collection and transmission unit to relay data to shore. This has been demonstrated in the RECOPESCA project network, developed by IFREMER from 2007, with a set of EAF sensors. The original sensors included sensors for measuring catch per effort, along with CTD (Conductivity, Temperature, Depth) and turbidity.

NEXOS has aimed to improve existing RECOPESCA probes by means of new additions to measure oxygen and fluorescence (as a proxy of chlorophyll a) according to the general sensor system requirements.

In NEXOS, two new probes have been developed by NKE, a dissolved oxygen and a chlorophyll-a sensor, see

8. These are integrated with standard CTD sensors. The new EAF probes will comply with the needs of the scientific community and the constraints by the fishing vessels and gear. Deliverable 7.3 explains more on the technical aspects.

For more information on EAF, see: http://www.fao.org/fishery/eaf-net/about/en

For more information on the existing EAF-RECOPESCA system and sensors, see: http://www.ices.dk/sites/pub/CM%20Doccuments/CM-2008/R/R1608.pdf

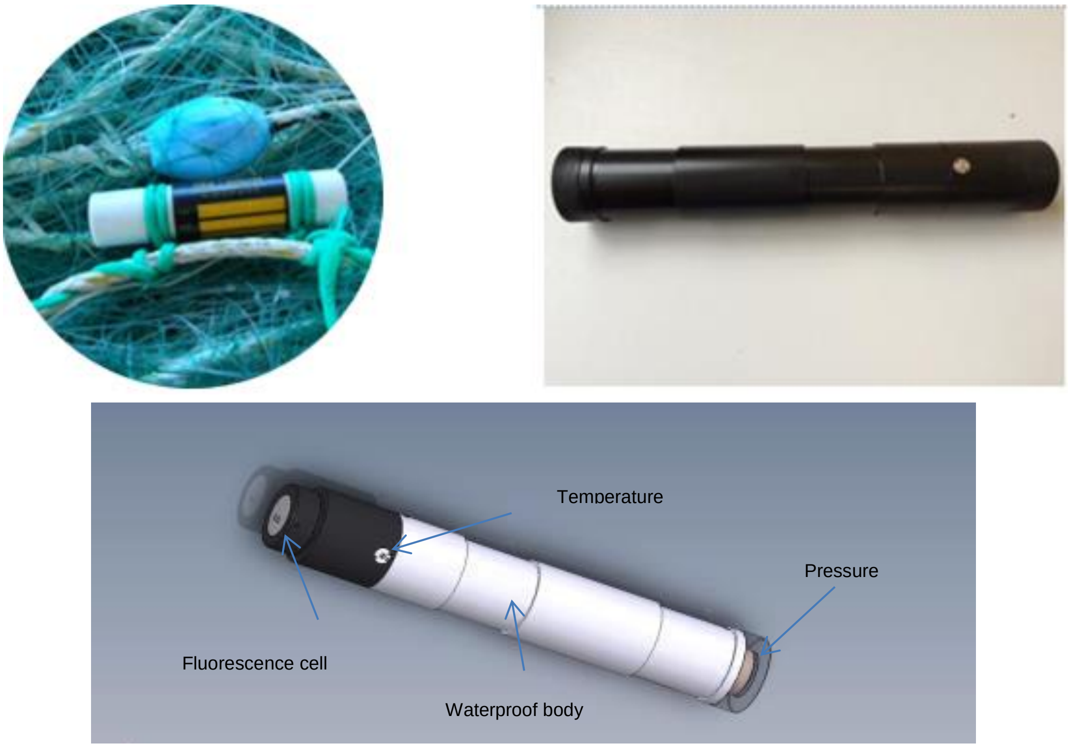

Figure 8: Top left: EAF sensors fixed to a net. Top right: The STPO2 (Salinity-Temperature-Pressure-Oxygen) prototype for RECOPESCA system. Bottom: The prototype STP-fluorescence sensor, both by NKE.

3. Platforms for demonstration

An overview of the selected platforms is given in this Chapter. No new platforms were developed in NeXOS; only necessary modifications were made to host the sensors. Figure 9 - Figure 13 show an overview of the platforms or platform types.

Some of the platforms are unique and are one of its kind; others are industry products on the commercial market.

Provided in this chapter is a brief explanation of each platform (platform type), with included Internet addresses as appropriate.

Figure 9: Platforms for demonstration; mostly optical sensors.

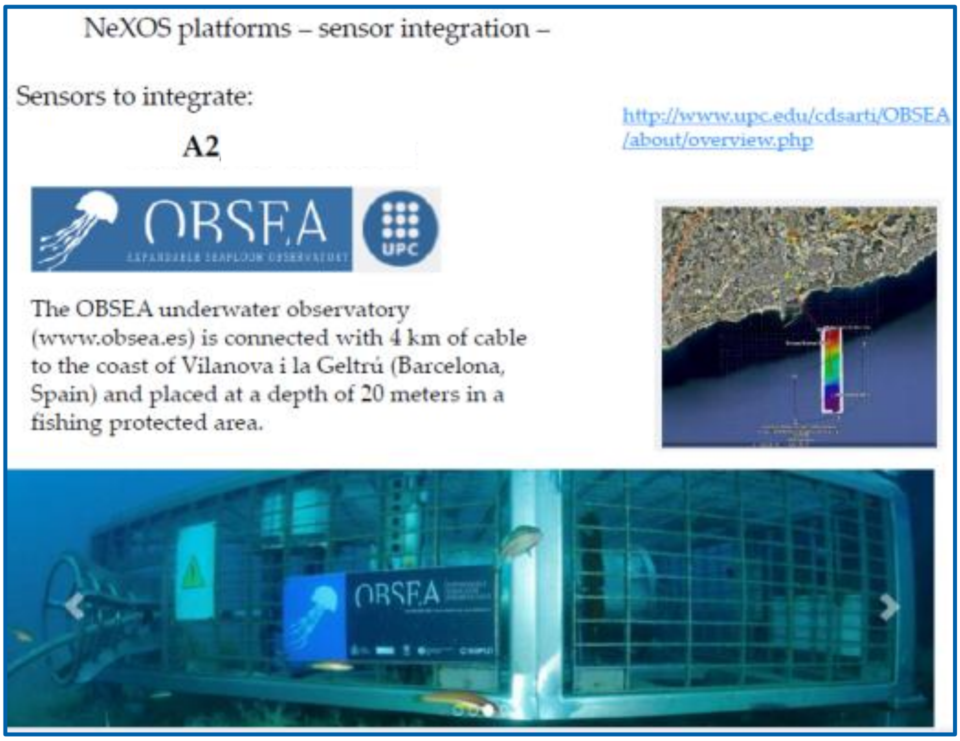

Figure 10: The OBSEA platform (cabled observatory) used for demonstrations.

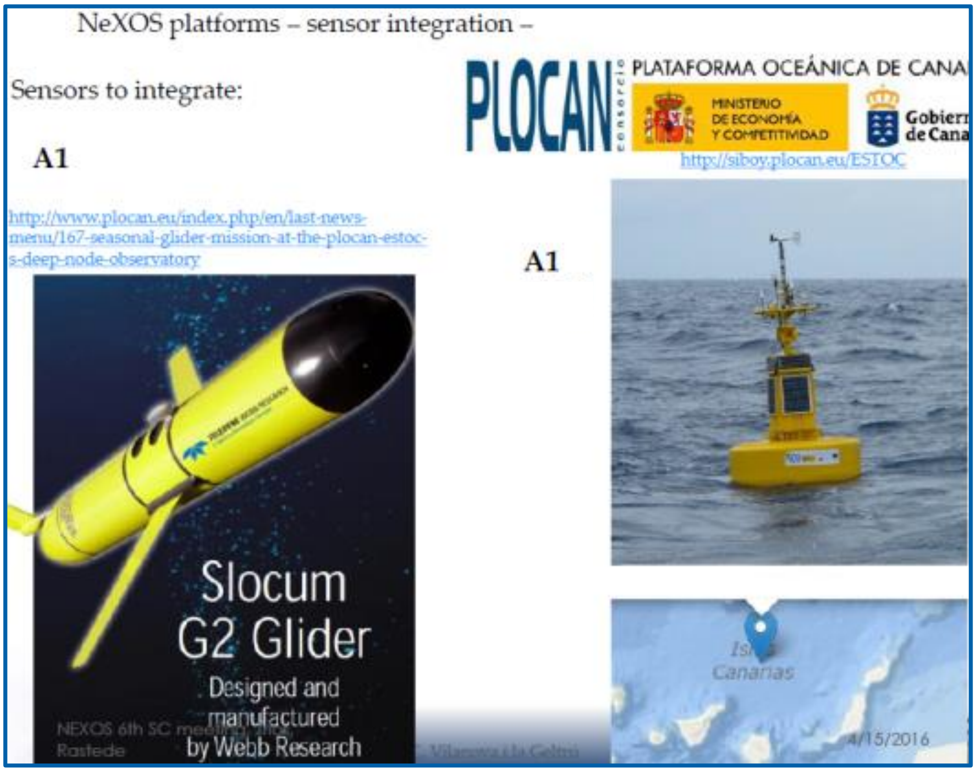

Figure 11: The Slocum Glider and the ESTOC moored system operated by PLOCAN.

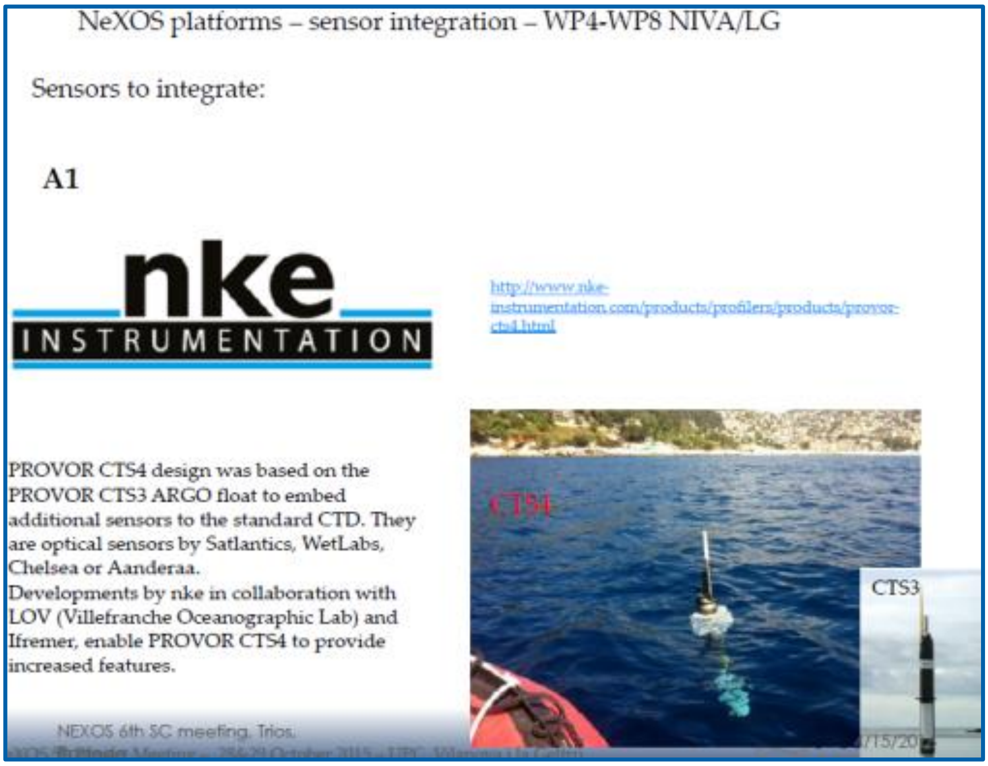

Figure 12: The Provor/Marvor platform, a drifting float, which will demonstrate Acoustic sensors.

3.1. Sailbuoy (CMR)

Figure 13: The Sailbuoy by CMR, Norway.

This wind-powered autonomous surface vessel (ASV) was developed by CMR in Norway; now provided by the subsidiary Offshore Sensing Ltd, it will be used for validating and demonstrating a carbon sensor system.

This vessel can stay for months at sea; it navigates the oceans autonomously and transmits data at regular intervals.

The Sailbuoy can be used for a wide variety of ocean applications: from measuring ocean and atmospheric parameters to tracking oil spills or acting as a communication relay station for subsea instrumentation.

The Sailbuoy track can be followed in real-time on a computer, tablet or smart phone.

For more information, see: http://www.sailbuoy.no/

3.2. The Alseamar SeaExplorer Glider

The SeaExplorer vehicle moves through the water by varying its buoyancy, resulting in very long endurance and stealthy actuation. It resurfaces regularly to transmit information back to the operator including its GPS position, scientific data and internal parameters.

Its modular design includes an independent payload section located at the front of the vehicle. This section can be changed rapidly between two missions. It features two large compartments: a hyperbaric and a wet section.

Sensors include Pumped CTD, Oxygen, Turbidity, Chlorophyll, Backscatter CDOM, Hydrocarbon Fluorescence, and Acoustic Detector & Recorder.

The SeaExplorer does not have wings nor external moving parts, which facilitates easy launch and recovery operations and reduces the risk of entanglement (plastic debris, seaweed, etc.). In addition, the absence of any outside moving parts limits any risks of leaks.

For more information, see:

http://www.alseamar-alcen.com/unmanned-vehicles/sea-explorer-high-performance-glider

Figure 14: The SeaExplorer glider by ALSEAMAR, France.

3.3. The OBSEA cabled observatory (UPM)

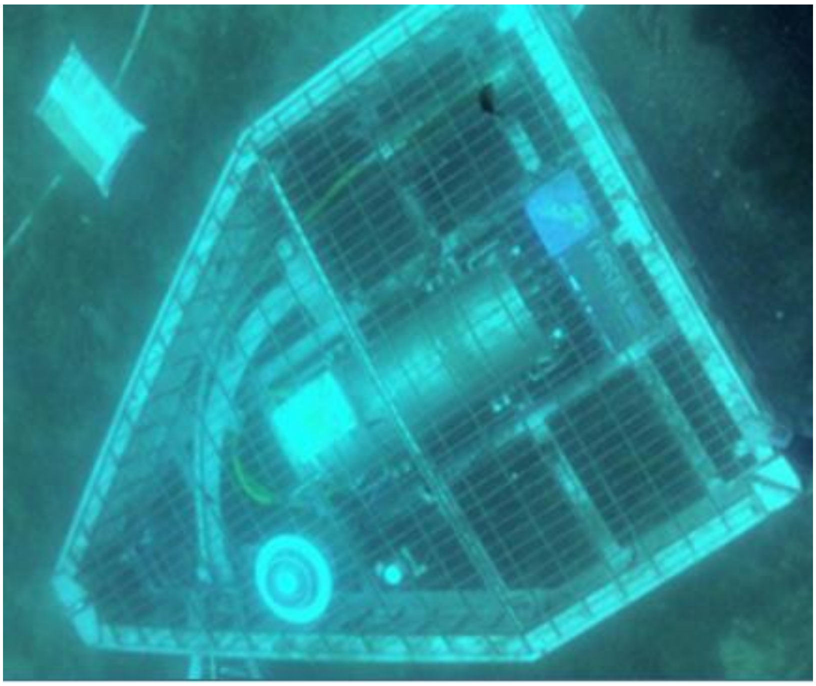

Figure 15: Photo of the underwater sea observatory OBSEA, operated by UPC.

The OBSEA underwater observatory (www.obsea.es) is connected with 4 km of cable to the coast of Vilanova i la Geltrú (Barcelona, Spain) and placed at a depth of 20 meters within a protected fishing area.

The main advantage of the cabled observatory is the capacity to feed the station from land with up to 3.6kW and the high bandwidth communication link of 1Gbps. This link gives the information in real time and avoids the drawbacks of battery powered systems. The implemented solution is an optical Ethernet network that continuously transmits data from the connected oceanographic instruments.

The Ground Station provides power to feed all the devices and the fiber optic link to establish communications; simultaneously from land, alarms and data storage are managed.

With a length of 1000 meters, the terrestrial cable connects the Ground Station to the Beach Manhole where the submarine cable begins its route to the node location located 4 km from the coast and 20 meters deep.

Furthermore, there is also a surface buoy connected to the platform that can host sensors as well.

For more details, see: http://www.obsea.es/

3.4. FerryBox – Norway (NIVA)

Figure 16: The Norwegian vessel M/V «Colour Fantasy», operating between Oslo and Kiel.

NIVA's FerryBox system is used for the collection, analysis and presentation of water quality data from near-surface in combination with information from sensors installed on board ships (VOS) sailing along fixed routes with data from environmental satellites and collected water samples. This automatic monitoring system has been developed and partly financed by NIVA, with support from national and international research projects.

Once every minute, the FerryBox system measures temperature, salinity, oxygen, chlorophyll and particle content at a depth of four metres along the fixed route of a vessel. This amounts to about one measurement every 500 metres.

Some of the ships with FerryBox equipment additionally carry advanced instruments for measuring solar radiation and reflection from the ocean surface. The data is transmitted to NIVA in real-time.

The system can activate sampling of water from predetermined sites. Sampling can also be triggered by NIVA during a voyage as necessary. NIVA downloads data from the environmental satellite ENVISAT. This data is processed and presented together with data from the ships.

NIVAs FerryBox routes include the routes Oslo – Kiel (Color Fantasy, see photo), Bergen – Kirkenes (Trollfjord) and Tromsø – Longyearbyen (Polarbjorn).

For more details, see: http://www.niva.no/en/miljoedata-paa-nett/FerryBox-og-satellittdata

3.5. FerryBox –Germany (HZG/UNOL)

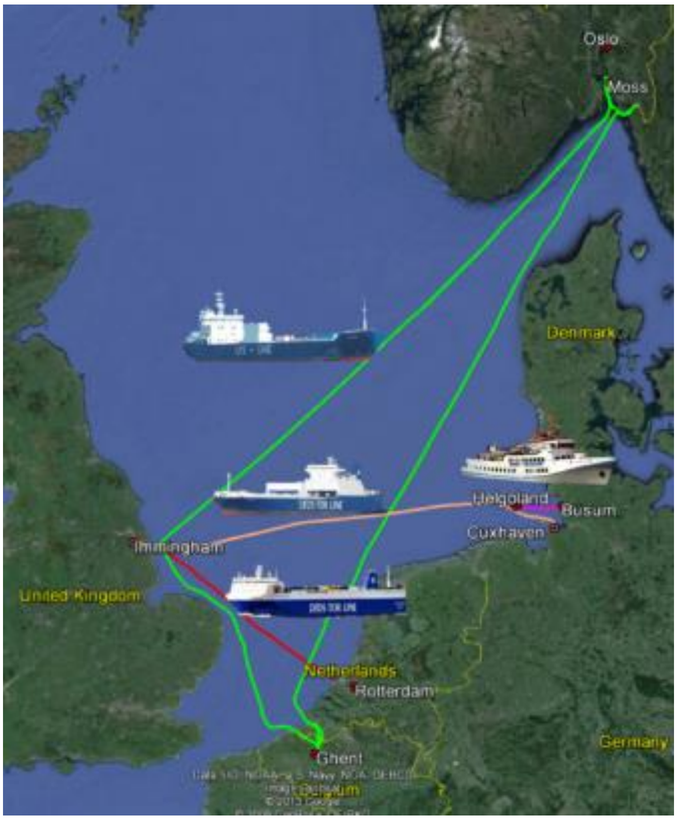

Figure 17: Map showing FerryBox routes in the southern North Sea, operated by HZG and UNOL.

HZG together with UNOL also operates FerryBox systems and routes: HZG also coordinates the European FerryBox network. UNOL has a system mounted on the R/V Heincke.

FerryBoxes are automated measurement systems used to determine physical and biogeochemical parameters in surface waters. They are either mounted on 'ships of opportunity', such as ferries or container ships that serve regular routes across the North Sea (see the map) or are operated as fixed installations (Cuxhaven, Spitsbergen, and the measurement platform FINO3).

Water is pumped from a subsurface intake into the measuring circuit containing multiple sensors. The system is equipped with an automated self-cleaning and antifouling mechanism. All processes can be controlled remotely via satellite from land. Data is transmitted and made available to users after each transect.

The automated regular recordings by the FerryBoxes enable detailed investigations of physical and biogeochemical processes; for instance, the recordings are assimilated into models.

For more information, see:

https://www.hzg.de/institutes_platforms/cosyna/observations/FerryBox/index.php.en

3.6. Fishing vessels for EAF

Figure 18: Italian and Norwegian fishing vessels for the EAF system.

The EAF system with the pairs of sensors for DO and Fluorescence measurements will eventually be demonstrated on fishing vessels (photo) in the Mediterranean and in Norway.

In Italy, they will be integrated in one bottom trawler already equipped with the FOOS system and operating in a fishing area close to the city of Ancona. Data will be transmitted via GPRS from the vessel to the CNR data centre in Ancona.

In Norway, demonstrations will be carried out during the coastal cod fishery, and later, during summer, in a fjord.

For more information on EAF, see: http://www.fao.org/fishery/eaf-net/about/en

3.7. The Provor float (NKE)

This is a drifting float, developed by NKE, a French company. It can undulate, carrying sensors, between the surface and large depths at slow speed. The vertical speed is controlled by the buoyancy of the float and the horizontal speed is controlled by the ambient ocean currents.

For more details about the Provor float, see: http://www.argo.ucsd.edu/Arvor_Provor_AST12.pdf

3.8. Wave Glider (PLOCAN)

Powered by wave and solar energy, the Wave Glider is an autonomous, unmanned surface vehicle (ASV) that operates individually or in fleets delivering real-time data for up to a year with no fuel. With the latest advancements in energy harvesting and propulsion, combined with a payload and sensor open architecture, the Wave Glider is a persistent mobile data-gathering platform able to travel tens of thousands of miles collecting data in the most demanding conditions while delivering this data in real-time. The Adaptive Modular Power System is designed to accommodate power-hungry payloads (e.g., sonar) and support a wide array of sensors. With powerful computational capabilities for real-time on-board processing of large volumes of data at sea, the Wave Glider can transmit “just the answer” back to shore, therefore, representing a big step forward in unmanned ocean monitoring and exploration.

The Wave Glider is designed for long-term operations, providing a truly 24×7 platform for up to

12 months with no fuel, emissions or crew.

It is planned to use the Wave Glider as a platform that will carry an acoustic (A1) and optical (O1) sensors in the Canary Islands operations.

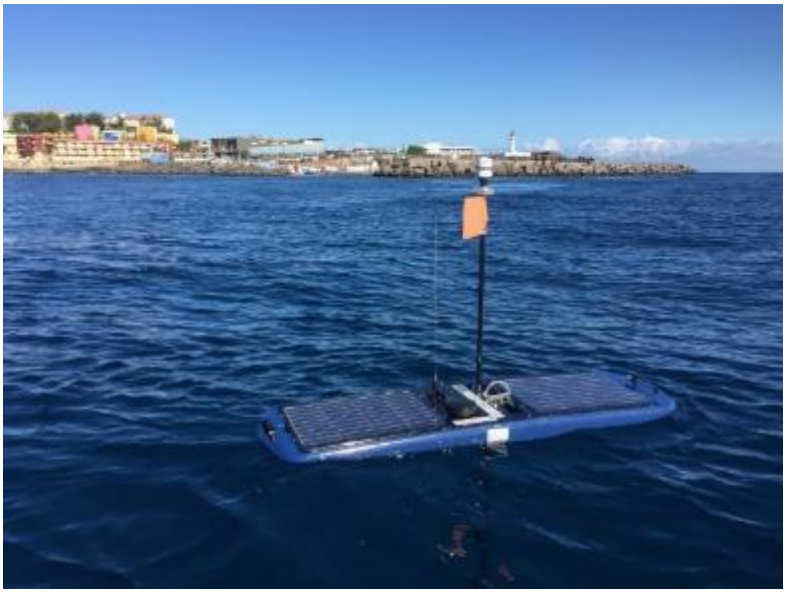

Figure 19: The Wave Glider operated by PLOCAN.

For more details about the Wave Glider, see: https://www.liquid-robotics.com/

3.9. ESTOC Buoy (PLOCAN)

The ESTOC-buoy is a moored surface-autonomous ocean-platform with open architecture able to integrate on-demand science-payloads according to needs in both coastal and open-ocean locations.

The buoy is 2 meters in diameter and 4 tonnes of weight.

It is planned to use the ESTOC buoy to carry an acoustic (A1) sensor for the Canary Islands operations.

Figure 20: The ESTOC buoy, moored in deep water off Canary Islands.

For more details about the ESTOC-buoy, see: http://siboy.plocan.eu/

3.10. TriOS Buoy (TriOS)

The TriOS-Buoy is a moored surface buoy for environmental monitoring of water quality in small lakes, reservoirs or rivers. A demonstration unit is located in a small lake at the TriOS buildings in Rastede, Germany (see red arrow in Figure 21).

The buoy carries an SOS enabled data controller that sends the data via WLAN to the main facilities to link it with the SOS server at 52north.

The buoy will be used to connect both, the VIS and the UV matrixFlu (O1-Fluorescence).

Figure 21: TriOS facilities overview (left) and place of deployment (red arrow). TriOS built buoy for deployment of sensors (right).

4. User scenarios

Demonstration is meant to be customer focused; highlighting the sensors in a way an end user might use it. To aid the sensor developers, and the demonstration partners, five user scenarios were developed early on in the project. These can be found in the appendix of Deliverable 1.2. Due to their central relevance for the demonstration missions, they have been reproduced in a shortened and updated format below. Many of the demonstration mission plans refer to a relevant user scenario, making them an invaluable background when reading the demonstration mission descriptions.

4.1. HC-Glider: Glider application for hydrocarbons (HC) in water detection.

Purpose

Polycyclic aromatic hydrocarbons (PAH) are a major component of oil and represent a strong pollutant for the marine environment. When oil enters the water, either by natural or anthropogenic sources, some components dissolve in the water and are not detectable by visual means. This is also the case for ‘produced water’, a by-product of oil and gas exploration. Other parts of a subsea seep or leakage will result in small bubbles (gas, mostly methane) and droplets (oil) rising towards the surface.

This scenario takes into consideration a small to medium seep/leakage of gas, oil and mixed forms evolving from the seafloor or a subsea structure, e.g. pipeline. The scenario does not reflect a major leakage like the Deep-Water-Horizon incident, as this is easily sensed by other available subsea production monitoring techniques. However, a possible plume of dispersed oil floating in a specific density layer can be of interest and will be investigated.

The application of a glider is aimed at the detection and possible quantification of the seep/leakage by means of a combination of sensors. Glider operation is of specific interest enabling a long-term operation of profiling from sea surface to near seabed in a defined marine region (e.g. box or transect). As application, platform gliders will be in focus, however, since the focus of NeXOS work is the sensor development; other platforms may be utilized during the sensor testing, such as (coastal und multisensory) floats, wave gliders, fixed stations, moorings or underway systems. As for floats, they have the potential to support the overall objective of detecting and surveying a subsea hydrocarbon emission, e.g. by deploying a significant number of HC-floats in an area of interest, thus mapping quasi-synoptically.

Study areas recommended and envisioned are, the Norwegian Sea where oil & gas operation is of major relevance, the southern North Sea and the Mediterranean Sea (Bay of Marseilles – France, Gulf of Gabes – Tunisia) both intensely influenced by anthropogenic activities. The studies will include short-term application (3-10 days) on gliders to demonstrate mapping capacities as well as long term operation (weeks to month) to test for stability on other platforms.

Required sensors

(HC1) Matrix-fluorescence sensor (NeXOS innovation) and MiniFluo-UV sensor, to sense fluorescence signal from dissolved PAH in water and natural CDOM fluorescence level at different wavelength combination (as described in D 5.2 and D5.5)

(HC2) CTD-O_2 - Conductivity, temperature, depth and dissolved oxygen sensor (package) to measure standard oceanographic parameters for water mass identification (depth D from pressure p, temperature T, salinity S from C, T, p), biological activity and degradation processes (dissolved oxygen), and glider operation (depth).

(HC3) Sensor to quantify turbidity/backscatter as a result of suspended particulate matter (SPM) or other sources of backscatter in the water column. Since turbidity is possibly interfering with fluorescence signal strength, this sensor is used to correct for these effects.

4.2. Sensors for fishery management on board small volunteer vessels or research vessels.

Purpose

The aim is to address the lack of data available to precisely determine spatial distribution of catch and fishing effort, and to make an environmental characterization of the fishing area. The scenario is issued from the French project, RECOPESCA, and the Italian initiative, FOS/FOOS funded by national projects; which will equip a sample of voluntary fishing vessels in the two countries, representative of the fishing fleet, with sensors on the fishing gears. These sensors record environmental data, such as temperature, salinity and turbidity, supporting those on fishing effort and catches. The objective of both the initiatives is to establish a network of such sensors to collect data for scientific purposes to improve assessment of resources and fisheries diagnostics on fisheries and to collect the environmental data required for an ecosystem approach to fisheries management (EAF). This participative approach encourages a partnership between scientists and fishermen. The integrated observation systems provide innovative tools to collect multidisciplinary data. The data is useful for fisheries, in both the regulation and planning of operations, and for use by both biologists and physical oceanographers. Equipping fishing vessels in this manner provides an opportunity to obtain widely distributed data from open-ocean to near coast in all weather conditions. This approach presents significant challenges since the devices must be sufficiently robust to be fixed on fishing gears, self-powered, affordable and autonomous (not requiring intervention of the fisherman).

The vessels targeted are representative of the entire fleet, so the sensors developed must be modular and flexible.

The RECOPESCA probes include:

- A **temperature-depth (TD) recorder**, a **temperature-conductivity-depth (TCD)** recorder and a **temperature-turbidity-depth (TTD) recorder**. In addition to measuring these environmental parameters, they record the duration of immersion of the fishing gears (active or passive) giving indication of fishing time.
- A specific sensor, the “turns-counter”, has been specifically developed to equip the passive gear (gill nets, pots or lines) hauler to measure the number or length of passive gears hauled at each fishing operation.
- An “anti-rolling” weigh-scale, which records the catch per species and fishing operation.

Each sensor is equipped with a radio device to transfer the data to an on-board **receiver**, the “concentrator” (containing the GPS device), that sends the data to central databases. There is automatic transmission of the data to land through GPRS, once the vessel is within range of GPRS network, without need for human intervention. This approach (quasi real time) can quickly track dysfunction, interruption or loss of sensors.

The concentrator contains a GPS device to locate the areas of fishing activity. Recopesca relies on existing operational data centre for its computing infrastructure, such as for *Coriolis*, for operational oceanography and the Fisheries Information System (FIS) for France (can be used for testing purposes in other European countries).

The Italian FOOS is a multifunction system able to collect data from the fishing operation and send them to an inland datacentre, but also to send useful information (forecasts etc.) back to the fishermen through an electronic logbook with an *ad hoc* software embedded. In addition to other sensors and the capability to record catch data, the FOOS incorporates part of the RECOPESCA system (TD and CTD recorders and an *ad hoc* modified version of the NKE concentrator).

These collecting systems represent an innovative tool to collect data and contribute to the existing information systems. It is complementary to other methods of gathering information. The collected data can contribute to fisheries research projects and assessments, especially within the framework of an ecosystem approach to fisheries.

The NeXOS project extends this approach to a European scale and adds new features. The need for measurements of **oxygen** and **chlorophyll** for coastal oceanographic research was identified. These measurements would enable the study of eutrophication in near-coast areas where data is sparse. Developing these devices presents a technical challenge since the probe must be small and inexpensive. Additionally, the devices must operate on board fishing vessels for at least a **6 month period**, so energy consumption and time-drift must be minimized.

Extension of the scenario: Some oceanographic vessels are used for the stock evaluation and research in halieutics. They may be equipped with Recopesca systems. In this case, some data users are on board the ship and may correlate this data from these sensors with the data (echo sounders, position, mapping sounder, hydrology) acquired on board in the same time. The interfacing of the concentrator with the data storing and distributing systems of the future generation (NeXOS WP4 in cooperation with EUROFLEETS2 I3 project) will open new tracks for the researchers.

Required sensors

The oxygen measurement to be defined in deliverable D7.2. and chosen accordingly.

The fluorescence measurement to be defined in deliverable D7.2. and chosen accordingly.

Since turbidity is possibly interfering with fluorescence signal strength this sensor is used to correct for these effects. (TTD sensor).

Salinity is a key parameter to understand what are the water masses involved; conductivity is measured in addition on some sites. (CTD sensor).

4.3. Characterising the underwater soundscape with emphasis on areas where human activities are taking place.

Why: Interactions between human activities such as maritime traffic, oil and gas exploration, mining, wind farm piling, military operations, etc. produce noise that adds to the natural ambient soundscape. This added noise may interfere with marine fauna such as marine mammals and fish in various ways, depending on the characteristics of added noise, the medium, and the sensitivity of the species present in the area. Activities such as Environmental Impact Assessments of energy exploitation activities, and fossil or renewables, are also in need of reliable information: reliable information is needed in this respect to advise to what extent added noise may be a concern, how to mitigate it and monitor the effects. Finally, this would contribute to the assessment of the environmental status of the area, in agreement with Descriptors 1 and 11 of the Marine Strategy Framework Directive, contributing to biodiversity assessment via the detection of species producing sounds and the assessment of underwater ambient noise descriptors, before and after human activities have taken place.

What: Characterisation through measurements of ambient noise down to a few Hz and up to above 20 kHz. Sounds and records of the presence of species of interest that may be affected. Waveforms, functionalities such as detection and pattern recognition (identification) and localisation are features of potential interest. MSFD underwater sound Good Environmental Status (GES) descriptors will be assessed.

Where: The Canary Islands, the Norwegian Sea or the Mediterranean Sea are examples of European marine regions or areas where some of the above activities take or will take place and where several aquatic species use sound for navigation, communication and foraging. The scenario applies to any area where there is concurrent use of marine space between human and acoustically sensitive species.

When: Minimal requirements are derived from the need of baseline measurement before the activity starts (years ideally to capture seasonality, but months in practice), the need to monitor the area during the activity and after the end of the activity (a minimum of two years ideally).

Other added values could/would be

- the capacity to detect and monitor rain and wind through passive acoustics. Besides the meteorological interest, this is also useful for profilers to detect ice-free areas and surface for transmission.
- the capacity for free drifting devices to be localised through the RAFOS system.
- Monitor acoustic behaviour of mammal species.
- Monitor fish and other species acoustics.
- Monitor ocean technology systems for acoustic diagnosis (oil& gas and CCS leaks).
- Detect certain types of geohazards generating sounds in the 1-10Hz frequency range.
- Attain more information on underwater soundscapes.
- Attain more information on an animal’s sensitivity to sound.
- Attain more information on how to establish/improve mitigation measures.

How: Sampling Strategy

Here we propose to focus on sound amplitudes received at a distance of a minimum of 100m, considering that such distance generally still makes it possible to make estimates of high amplitude sources, and on frequencies that are not too attenuated, remain above ambient noise at 100m. Sampling high frequency has a direct impact on the technological requirements, costs and operations. For highly constrained platforms, frequency limit has been set to 30 kHz, mainly for technical reasons and considering the above strategy. A sleep mode and recording cycle configuration functionalities also need to be implemented for long period autonomous recordings.

Required sensors

For small autonomous platforms, a compact low-power passive acoustics sensor system, enabling on-platform measurement and characterisation of underwater noise and several soundscape sources, aimed for platforms with limited autonomy and/or communication capability (Deliverable 6.3).

For buoys (moorings) or cabled systems, one or more (array) passive acoustics sensor system, enabling real-time waveform streaming from cabled observatories, or on-platform measurement and characterisation of underwater noise and several soundscape sources for buoys with limited transmission capacity. The array would allow for direction of arrival capacity, therefore, making salinity, temperature and depth desirable ancillary variables.

4.4. Quantification of the carbon cycle system of Arctic and coastal seas

Purpose

Why:

The diverse sources and sinks of carbon and their complex interaction (strong input from the rivers, high biogeochemical induced conversion rates etc.) in the coastal ocean are still poorly understood. On the other hand, it is well known that carbon cycling in the coastal waters plays an important role in the global carbon cycles and budgets. To fully quantify the complete carbon system in seawater it is necessary to determine at least two (preferable three) of the following five variables (all can be measured directly); pH, total alkalinity (AT), inorganic carbon (CT), carbonate ion (CO_3^{2-}) and the partial pressure of CO_2 (pCO_2). Depending on the specific situation, a combination of either pCO_2- CT (or AT), or pH - AT (or CT) can be used. Highly reliable measurements are required to resolve the carbonate system with adequate accuracy. The combination of pH and pCO_2 unfortunately has strong anti-correlation, which leads to high uncertainties for the calculated parameters. Knowledge of the complete carbonate chemistry allows the determination of possible feedbacks (e.g. impacts on marine biology and chemistry) to the rising CO_2 concentration in the atmosphere and thus the CO_2 exchange at the air-sea interface.

Methane detection has been recently extensively under survey: the Arctic region is indeed one of the many natural sources of this greenhouse gas. Large quantities of methane are stored in the Arctic in natural gas deposits and permafrost. Permafrost degrades on warming, thus large releases of methane from these sources may arise as a result. Assessing the connections between ocean acidification and increased dissolved methane in seawater will be essential to track global changes and possible threats to Arctic ecosystem.

What:

Measuring of a combination of pCO_2, pH, AT/(CO_3) in surface waters together with parameters characterising the water body (e.g. T, S) as well as the biogeochemical processes such as Chl-a (including algal groups) and oxygen is a good approach. Focus will be on the biogeochemical processes in coastal regions and the question of the role of the coast as source or sink of atmospheric CO_2 and the acidification processes in the Arctic. The latter has the highest demand on accuracy regarding the carbon variables.

Where:

1. Shelf seas and coastal area with focus on biogeochemical processes

2. Arctic seas with focus on acidification issues and climate studies

When:

For at least one year in order to capture seasonal effects and variability.

How:

Time series preferably on transects in order to cover a whole area at least for one year. FerryBoxes are the eligible tools to carry on such extensive monitoring. NIVA and HZG have already installed and are operating unattended monitoring systems on ships of opportunity for many years and NIVA, HZG and Franatech are working of sensor prototypes suitable for such deployment. Further development within the NeXOS project will be to implement the new integrated module of pCO_2, CH_4, pH and AT.

Power requirements limit the number of sensors that can be deployed on other platforms. For remotely operated vessels like profiling gliders and autonomous surface crafts like sailing boats, Wave Gliders, there will be developed a CO_2 and CH_4 module with less power consumption. This module will have less accuracy due to present technology available.

Sampling Strategy:

The ultimate scope of surveying strategy aims to understand fluxes of carbon at the sea-air interface. Based on current modelling capacity, sampling frequency and spatial coverage should be chosen to keep an error on prediction of 0.1Pg of C. This means an uncertainty on pCO_2 fluxes - $\delta(\Delta pCO_2)$ - that changes according to the area, between 2,5 and 5µatm. Sampling frequency and spatial coverage also depend on the area being investigated, 15 times/year and evenly spaced between 2 to 20 degrees, have been demonstrated to be effective on carbon flux evaluation and prediction.

Coastal processes are characterized by higher temporal and spatial variability than open ocean acidification processes, thus requiring increased sampling frequency (1 or 2 times/week).

Required sensors

General

In order to assess the carbonate speciation in seawater two of four variables should be measured (pCO_2, CT, AT, pH). In addition, a new method using UV detection achieves direct CO_3-ions detection. Preferably a combination of both pCO_2 and CT (or AT) or pH and AT should be taken in account. pCO_2 and pH are a “weak” pairing, yet data analysis and reduction might help in stretching the overall accuracy obtained with this pairing.

Ferrybox module

A CH_4 sensor will be built into the pCO_2 system using the same water flow and mechanics in the Franatech-FerryBox system. This is combined with the pH (NIVA/HZG) and AT module (HZG). The data are integrated into one common software module using Labview and made available through the FerryBox systems of data transmission.

Gilder module

One module of CO_2 and CH_4 from Franatech will be developed and will be used on autonomous glider vessels either profiling or surface.

Additional sensors

In order to understand the underlying biogeochemical processes parameters such as dissolved oxygen and Chlorophyll-a will give supported information and if possible to be measured in addition. These are achievable in the FerryBox-module. Further characterisation of algal components (PSICam) can be helpful in order to get more reliable conversion from chlorophyll-A to biomass.

4.5. Detection and characterization of phytoplankton blooms

Purpose

Phytoplankton is a key element of marine pelagic food webs. Phytoplankton blooms are regularly occurring events in various regions of the sea, which are characterized by high accumulation of phytoplankton biomass, and often dominated by one or few species. The mechanisms of bloom formation are not completely understood. Exacerbated proliferation of phytoplankton is often the result of nutrient imbalance in the marine environment, making reliable predictions of these events not yet possible. The impact of these harmful phytoplankton blooms on human activities can be in a range from annoying (discolouring of water, production of foam, smell etc.) to harmful (production of toxins, physical harm of fish gills, hypoxia due to bloom decay and biomass degradation). Therefore, the latter events were also termed harmful algae blooms (HABs). Depending on the type, phytoplankton blooms can have severe effects on aquaculture, human health, and tourism.

The identification and characterization of phytoplankton blooms by microscopy or molecular methods is, although accurate, time consuming and takes place mostly when the bloom is already visible by the naked eye. Thus, there is demand for rapid, automatable methods continuously monitoring the development of phytoplankton in the water, both in terms of biomass and taxonomic composition.

In this scenario, phytoplankton blooms will be detected and characterized by optical means, since these kinds of methods allow fast and cost-effective measurements. Phytoplankton and its pigments have an effect on the inherent optical properties of the water, especially on its absorption characteristics. By hyperspectral measurement of water constituents absorption coefficients (~2 nm resolution), phytoplankton biomass can be estimated more accurately than by conventional *in situ* fluorescence measurements. Furthermore, the high resolution enables the detection of features in the absorption spectra, which provides information about the dominant phytoplankton group present. Although this approach does not provide information as detailed as manual investigations, it has the advantage of performing measurements in high frequency, since the water is analysed in flow-through mode. Because biomass development and taxonomic composition are monitored simultaneously, indications can be given whether a developing bloom might be harmful or not. A concurrent measurement of environmental parameters can help to identify potential driving factors for bloom formation and facilitate the development of future pre-warning systems.

Potential areas where this scenario is applicable are all regions with commonly occurring harmful algal bloom events, especially near fish farms or recreational areas (e.g. the Baltic Sea, lakes). Of course, also areas of high scientific interest can be investigated in this way. Observations should be continued over at least one year to cover seasonal development and variability of the phytoplankton community. Small areas could be monitored over the whole period using a fixed platform, while on larger areas transects should be routinely observed in appropriate intervals.

Required sensors

1.) **Hyperspectral absorption sensor** based on an integrating cavity (NeXOS innovation) for continuous absorption measurements in flow-through mode. The obtained data provide proxies for Chl-a and total suspended matter concentration required for tracking phytoplankton biomass development. Features in the absorption spectra are used to detect the dominant phytoplankton group in the investigated water mass.

2.) **Conductivity and temperature sensor package** for measuring standard oceanographic parameters for water mass identification, correction of the absorption measurements and for identification of potential drivers for bloom formation.
3.) **Oxygen sensor** for measuring biological activity of phytoplankton and indicating subsurface phytoplankton biomass.
4.) **Nutrient analyser** (NO_2^-, NO_3^-, PO_4^{3-}, NH_4^+, $Si(OH)_4$) for further identification of potential bloom driving factors.
5.) **(*Optional*)** Fluorescence measurements at different excitation/emission wavelengths providing data for phytoplankton group discrimination in addition to the absorption-based approach.

5. Demonstration Mission details

The following forms have been defined with the purpose to create a control strategy in order to organize the work to be done in preparation of the Demonstration missions at the end of the project.

These demonstration plans mainly include the equipment that will be required during the mission, evaluation tasks, and the works that will be developed by each of the partners within the mission.

This plan document is a live document, with changes made and details added as time progresses and according to weather conditions. The forms are designed to be compact, to allow for easy overview.

5.1. Mediterranean Sea missions

5.1.1. MISSION MED1: MED SEA A1.e

User Scenario:	Characterising the underwater soundscape with emphasis on areas where human activities are taking place. User scenarios can be found in chapter 4.3
Location:	Adriatic Sea - Italy
Platform:	Senigallia beacon http://rmm.an.ismar.cnr.it/index.php/meda-senigallia
Sensor	A1 hybrid with serial and Ethernet port
Mission start date:	1. July 2017
Mission end date:	15. September 2017
Partners involved:	CNR, SMID
Manager partner:	CNR
Contact Person:	Stefania Sparnocchia, Michela Martinelli
Dissemination activity:	June 2017, pictures and underwater footage will be taken when the sensor will be installed on the platform

Mission description:
The A1 will be installed on the Senigallia beacon, which is set in the coastal area, close to the fishery zone.

Once received, the instrument it will be prepared for installation (software and cables check etc…). A trip to the beacon is planned in order to do the installation, and a scuba diver will place the sensor on the beacon. A brief period of trial is planned in order to verify data transmission. Then the collected data will be sent to the NeXOS Sensors web service.
Outcomes:
Series of acoustic data on the presence of marine mammals in the area and human noise helpful to explore the interactions with fishery activities and environmental parameters.
Schedules and Milestones
- mid May: the sensor and the cable is planned to arrive at CNR - mid June: trials on the remote automatic operations and communications - end of June: installation on the platform -end of June/July: the data will be sent to the NeXOS Sensors web service
Issues & Risks:
Delays due to missing sensor or weather. Communication issues. Lack of fishing activity close by in the relevant period.

5.1.2. MISSION MED2: MED SEA A2

User Scenario:	Localization and tracking of a mobile target using A2. User scenarios can be found in chapter 4.3
Location:	Vilanova i la Geltru (Barcelona, Spain)
Platform:	OBSEA
Sensor	A2
Mission start date:	7. June
Mission end date:	15. September
Partners involved:	UPC, PLOCAN, SMID, CTN
Manager partner:	UPC
Contact Person:	Ivan Masmitja and Joaquin del Rio
Dissemination activity:	A short video will be prepared with the filmed images during the offshore tests. June 5-15.

Mission description:
The A2 system will be connected to OBSEA. A small boat with GPS reference will be moving around OBSEA executing different paths. The boat will generate a sound pattern. The A2 system has to be able to identify the position and tracking of the mobile.
Outcomes:
The expected results of this demonstration mission: Scientific data and knowledge, ability to use the sensor/platform, increased awareness and interest among potential users/stakeholders.
Schedules and Milestones

- Milestones: Starting after A2 reception at UPC.
  - Week 1: Communication tests with A2 at UPC-facilities
  - Week 6: Visualization of the track points of an acoustic mobile source.

Issues & Risks:
Delays due to A2 replica manufacturing process. Delays due to algorithms for path tracking optimization. OBSEA constraints due to technical problems. Weather conditions not allow performing tests when planned.

5.1.3. MISSION MED3: MED SEA EAF4&6

User Scenario:	Sensors for fishery management on board small volunteer vessels or research vessels. User scenario can be found in Chapter 4.2
Location:	Adriatic Sea – Italy
Platform:	FOOS (Fishing vessel equipped with sensors)
Sensor:	EAF
Mission start date:	23. May 2017
Mission end date:	15. September 2017
Partners involved:	CNR-ISMAR, IFREMER, NKE
Manager partner:	CNR-ISMAR
Contact Person:	Stefania Sparnocchia & Michela Martinelli

Dissemination activity:	The collected data will be processed and organized in maps to represent horizontal fields of measured parameters. The material is planned in the form of documents (printable pdf) and as web-news. Collection of photograph and video footage. Suggestion: organize a page dedicated to the demonstration in the NEXOS website. For EAF, see for instance the JERICO FP7 web product at the following link http://www.jerico-ri.eu/previous-project/service-access/targeted-operation-phase/top-2-data-and-maps-from-sensors-on-board-fishing-vessels/adriatic-sea-fishery-and-oceanography-observing-system/

Mission description:
The pair of EAF sensors for DO and Fluorescence measurements will be mounted on one bottom trawler fishing vessel already equipped with the FOOS system: the vessel will operate in the central Adriatic Sea. Data will be transmitted via GPRS in near-real time from the vessel to the CNR data centre in Ancona and then transferred in delayed mode (rate to be defined according to data compatibility) to the NEXOS Sensor Web Service for visualization.
Outcomes:
The expected results of this demonstration mission: Scientific data and knowledge, ability to use the sensor/platform, increased awareness and interest among potential users/stakeholders.
Schedules and Milestones
- February: the sensors and concentrator arrived at CNR and the integration on the platform started - March: test on the remote automatic operations and communications - April: the data will be sent to the NeXOS Sensors web service –
Issues & Risks:
Unexpected technical problems (failure of the measure, not reliable measurements, communications or data transmission problems). The planned dates may vary because of delays in the integration phase; the delivery of the sensors was planned before, thus the testing phase just started in February. The national regulation on fishery states a closure period during the summer varying from year to year, there will be a stop period in between.

5.2. North Atlantic missions

5.2.1. MISSION NOR1: NORWAY A1.2

User Scenario:	Characterizing the underwater soundscape with emphasis on areas where human activities are taking place. User scenarios can be found in chapter 4.3
Location:	Norwegian Sea
Platform:	SeaExplorer
Sensor:	A1.2
Mission start date:	15. June 2017
Mission end date:	15. July 2017
Partners involved:	ALSEAMAR, PLOCAN, SMID, CTN
Manager partner:	REC
Contact Person:	Nils-Roar Hareide, Karsten Kvalsund, Eric Delory and Simone Meme
Dissemination activity:	Video of demonstration likely for June 15-17. Other items include social media tracking.

Mission description:
The main objective is to demonstrate the capability to integrate the A1 sensor on the SeaExplorer, and to demonstrate the possibility to transfer the data from the glider to the SOS server. From a scientific point of view, it can be relevant to carry out the NOR1 mission at the same location than the NOR 2 Pre-Demo in Troll (Statoil platform), as both sensors (A1.2 and O1) will be integrated on the same platform.
Outcomes:
The expected results of this demonstration mission: Scientific data and knowledge, ability to use the sensor/platform, increased awareness and interest among potential users/stakeholders.
Schedules and Milestones
Integration – 15 January 2017 to 17 February 2017 Lab test – 20 February 2017 to 3 March 2017 Sea trials – 6 March 2017 to 12 May 2017

Shipping - 15 May 2017 to 9 June 2017 Demo – June to July 2017 Reporting – 3 July 2017 to 30 September 2017
Issues & Risks:
Weather conditions Vessel collision Problem on the glider Dysfunction of the Acoustic sensor

5.2.2. MISSION NOR2: NORWAY O1 mini

User Scenario:	HC-Glider: Glider application for hydrocarbons in water detection. See chapter 4.1
Location:	Norwegian Sea
Platform:	SeaExplorer
Sensor:	O1 MiniFluo
Mission start date:	15. June 2017
Mission end date:	15. July 2017
Partners involved:	ALSEAMAR, AMU, REC, 52N
Manager partner:	REC
Contact Person:	Nils-Roar Hareide, Karsten Kvalsund, Madeleine Goutx
Dissemination activity:	Video of demonstration likely for June 15-17. Other items include social media tracking. Interview on NOR2 pre-demo and demo results – Peer review publications
Equipment:	SEA EXPLORER Glider MiniFluo sensor
Link to detailed plan:	(The linked plan relates to a pre-demo. An updated version will be made for the actual demo) https://docs.google.com/viewer?a=v&pid=sites&srcid=cGxvY2FuL

	mV1fG5leG9zfGd4OjVhZWIyZTY4MjAxYzVjNzA

Mission description:
The mission will be carried out at the Troll Oil Field in The North Sea. The glider will be deployed and picked up from the stand-by vessel, Havila Troll. A previous NOR2 pre-demo was carried out in Nov-Dec 2016 in order to validate the O1 MiniFluo sensor in real conditions. Both sensor (A1.2 and O1 MiniFluo) will be deployed on the same platform (glider SeaExplorer) during NOR1/NOR2 demonstration mission, June 2017. Survey plan is available in separate document: (The linked plan relates to a pre-demo. An updated version will be made for the actual demo) https://docs.google.com/viewer?a=v&pid=sites&srcid=cGxvY2FuLmV1fG5leG9zfGd4OjVhZWIyZTY4MjAxYzVjNzA
Outcomes:
The expected results of this demonstration mission: Scientific data and knowledge, ability to use the sensor/platform, increased awareness and interest among potential users/stakeholders.
Schedules and Milestones
Hardware and Software Development : 3 January 2016 to 17 March 2017 Factory Test and validation – 20 March 2017 to 31 March 2017 Integration tests – 10 April 2017 to 28 April 2017 Sea trials – 2 May 2017 to 12 May 2017 Shipping - 15 May 2017 to 9 June 2017 Demo – June to July 2017 Reporting – 3 July 2017 to 30 September 2017
Issues & Risks:
Weather conditions Failure in MiniFluo communication with the 52N SOS server.

5.2.3. MISSION NOR3: NORWAY O3.2-Cbon2-sv (sailbuoy)

User Scenario:	Scenario document: Quantification of the carbon cycle of Arctic and coastal ocean. See chapter 4.4
Location:	North Sea
Platform:	SailBuoy

Sensor:	O3.2-Cbon2-sv
Mission start date:	Pre-demo: 20 April. Demo: 15. June 2017
Mission end date:	Pre-demo: 21 April Demo: 15. July 2017
Partners involved:	NIVA, CMR, REC, UNOL, IEEE.
Manager partner:	CMR
Contact Person:	Geir Pedersen (CMR), Gaute Lied (CMR) David Peddie (Offshore Sensing), Emanuele Reggiano (sensor)
Dissemination activity:	Videos and interviews considered for April 21 and April 22 in fjord near Bergen Television, newspapers Internet (SWE), social media, video Demonstration in fjords for press, television and newspapers WP9 D 9.2 Deliverable
Equipment:	SailBuoy autonomous surface vessel. O3 sensor Cbon2-sv system, with pH (NIVA) and underwater pCO_2 (Franatech) combined. PUCK installed in SailBuoy computer. SWE enabled, visualization services from 52N and access to visualization by demo targets (people)

Mission description:
The mission will be carried out west of Bergen in the North Sea. The SailBuoy will be deployed and retrieved by Offshore Sensing. Schedule: 20-21 April: Pre-demo with dissemination activity near shore 15th June - 15th July: Deployment offshore in the North Sea Place: Lat: N60°00', Lon: E3°20' The SailBuoy will be programmed to keep station at the deployment point, but a transect line to follow can be defined if necessary. This waypoint is out of the way of oil platforms and offshore operations. The area has varying currents of around 1 knot, sometimes more. Due to varying currents and uncertainty regarding the wind, it is best to keep away from the platforms. Assessment procedure of measurements against periodical discrete water sampling. Any

samples should be preserved and shipped to NIVA Oslo.
Outcomes:
The expected results of this demonstration mission: Scientific data and knowledge, ability to use the sensor/platform, increased awareness and interest among potential users/stakeholders. Basis for transition to operational capability
Schedules and Milestones
A list of main events, with dates if possible
Issues & Risks:
Weather conditions Havila Troll busy with other operations

5.2.4. MISSION NOR4: NORWAY O2

User Scenario:	Detection and characterization of phytoplankton blooms. User scenario can be found in chapter 4.5
Location:	Norwegian coastal sites and fjords
Platform:	FerryBox (HZG) on research cruise HE491
Sensors:	O2.1, O1.2, O1.4b,
Mission start date:	08.07.2017, Bremerhaven (GER)
Mission end date:	27.07.2017, Trondheim (NOR)
Partners involved:	UNOL, HZG, NIVA, REC, IEEE
Manager partner:	UNOL, HZG, NIVA
Contact Person:	Jochen Wollschläger (UNOL/HZG), Oliver Ferdinand (UNOL), Oliver Zielinski (UNOL), Wilhelm Petersen (HZG),
Dissemination activity:	One day approx. on July 18th to 20th close to Runde harbour - Photos. Video documentation incl. data visualization on board. Internet (SWE) online (satellite) or harbour based data upload. On-vessel display and news. Conference contribution. WP9 D 9.2 Deliverable.

Equipment:	Existing FerryBox system operated by HZG. Latest version of the HyAbS, compared to PSICAM and/or OSCAR-G2. Fluorescence sensors MatrixFlu-VIS (O1.2), MatrixFlu-UV (O1.4b), https://docs.google.com/viewer?a=v&pid=sites&srcid=cGxvY2FuLmV1fG5leG9zfGd4OjdhYmFkNWE5ZGY2ZGZkYjc SWE enabled through the existing FerryBox computer.

Mission description:

Demonstration of overall performance of optical sensor systems in flow through setup.

Both O2 developments, sensors HyAbS and OSCAR-G2 will be connected to a FerryBox system.

In addition, the O1 sensors MatrixFlu can be adapted by flow-through cells and connected to FB system.

Transect from German Bight towards Norwegian area: visiting Norwegian coastal sites and fjords. This enables for

- sensor data comparison from former (2015) expedition from similar sites on HyAbS system,
- performance comparison of HyAbS to reference system PSICAM,
- performance comparison of both NeXOS developments HyAbS and OSCAR-G2,
- measuring performance of fluorescence sensors MatrixFlu to internal CDOM and Chlorophyll-a data from FB,

and end-to-end demonstration from current sensor measuring process to implementation of data sets into SOS service.

Outcomes:

The expected results of this demonstration mission: Scientific data and knowledge, ability to use the sensor/platform, increased awareness and interest among potential users/stakeholders.

Schedules and Milestones

08.07.2017	start of Heincke HE491 transect at Bremerhaven, Germany
18.-20.07.17	one day of demonstration activities close to Runde harbour
27.07.2017	end of HE491 at Trondheim, Norway

Issues & Risks:

planned cruise of RV Heincke by UNOL can possibly adapted towards demonstration, capacity and feasibility have to be checked first Added sensor O3 Cbon3-FB availability to be checked

5.2.5. MISSION NOR5: NORWAY O3.1 –Cbon3-fb

User Scenario:	Scenario document: Quantification of the carbon cycle of Arctic and coastal ocean. Carbon sequestration monitoring with FerryBox. A user scenario can be found in chapter 4.4
Location:	Oslo-Kiel: Skagerrak-Kattegat-Kieler Förde
Platform:	FerryBox Color Fantasy. http://www.colorline.com/kiel-oslo/cruise-to-oslo
Sensor:	O3.1 –Cbon3-fb
Mission start date:	01 May 2017
Mission end date:	15. September 2017
Partners involved:	NIVA, Franatech, HZG, UNOL, REC, IEEE
Manager partner:	NIVA
Contact Person:	Emanuele R. Reggiani, Kai Sørensen
Dissemination activity:	Photos of installation in ship will be taken by Emanuale and team. These will be used in the NeXOS video. Also video of data on a screen will be captured - Internet (SWE; 52N) needed FerryBox system dissemination WP9 D 9.2 Deliverable
Equipment:	Fully integrated Carbonate sensor system (pH, pCO2, AT). With CH4 sensor operation capability (option). O3 sensor-cbon3 system (NIVA – Franatech -HZG). PUCK integrated on FB computer. SWE enabled.

Mission description:
The MV Color Fantasy runs on a two-day schedule from Kiel to Oslo and back. The vessel already has a FerryBox system on-board, maintained and operated by HZG and NIVA. The Cbon3-fb carbon system equipment will be integrated in the existing FB system, using the same computer and main pumps and water flow. See the Integration plan/report. Assessment procedure of measurements against periodical discrete water sampling. Samples should be preserved and shipped to NIVA Oslo.
Outcomes:
The expected results of this demonstration mission: Scientific data and knowledge, ability to use the sensor/platform, increased awareness and interest among potential users/stakeholders.
Schedules and Milestones
A list of main events, with dates if possible
Issues & Risks:
Dissemination, visits on-board, depending on permits and timing.

5.2.6. MISSION NOR6: NORWAY EAF.3 DO and EAF.5 FLUO

User Scenario:	Sensors for fishery management on board small volunteer vessels or research vessels. User scenarios can be found in chapter 4.2
Location:	West Norway Coastal Waters
Platform:	Fishing vessel “Vester Junior”
Sensor:	EAF
Mission start date:	15.06.17
Mission end date:	15.09.17
Partners involved:	IFREMER, NKE, REC
Manager partner:	REC
Contact Person:	Nils-Roar Hareide and Karsten Kvalsund
Dissemination activity:	Video will be captured along with interviews. Television, newspapers. Special demonstrations in sheltered fjord areas for press, television and newspapers. (15.06-17.06)

Mission description:
The coastal vessel "Vester Junior" (SF-210-V) from Måløy (West Norway) has been chosen as demonstration vessel. Owner is Bjørn Andre Weltzien Årdal from Måløy. The vessel will be fishing with tangle nets for monkfish during summer 2017. In August, he will fish with pots for wrasses. The vessel is member of the "Norwegian Reference Fleet" and will be reporting fishing activity, landings, species composition, fish length, etc. to the Norwegian Institute of Marine Research every day. During the period of 15.6.-27.6.2017, demonstrations will be carried out in Norwegian fjords and the gear will be deployed near land in order for easy access to the demonstrations activity.
Outcomes:
The expected results of this demonstration mission: Scientific data and knowledge, ability to use the sensor/platform, increased awareness and interest among potential users/stakeholders.
Issues & Risks:
Delays due to EAF DO and Fluorescence sensors replica manufacturing process. Unexpected technical problems (failure of the measure, not reliable measurements, communications or data transmission problems).

5.2.1. MISSION NOR7: TriOS buoy and O1.1 and O1.3

User Scenario:	Additional Scenario -
Location:	TriOS facilities, Rastede, Germany
Platform:	TriOS BUOY
Sensor:	O1.1, O1.3
Mission start date:	15.06.2017
Mission end date:	15.08.2017
Partners involved:	TriOS, UNOL
Manager partner:	TriOS
Contact Person:	Harald Rohr, Karin Munderloh, Oliver Zielinski, Oliver Ferdinand

Dissemination activity:	Not decided yet

Mission description:

The TriOS-Buoy is a moored surface buoy for environmental monitoring of water quality in small lakes, reservoirs or rivers. A demonstration unit is located in a small lake at TriOS facilities in Rastede, Germany. The buoy carries an SOS enabled data controller that sends the data via WLAN to the main facilities to link it with the SOS server at 52N, Muenster, Germany.The buoy will be used to connect both, the VIS and the UV MatrixFlu (O1-Fluorescence).

Demonstration period will be approximately 15.6.-15.8.2017. While sensors have been validated prior, continuous *in situ* measurements will be carried out with both sensor versions of MatrixFlu fully demonstrating end-to-end data communication from data collecting towards deployment into database and visualisation via 52N online client.

Outcomes:

The expected results of this demonstration mission: Scientific data of *in situ* deployment and knowledge, ability to use combination of sensor and platform, increased awareness and interest among potential users/stakeholders.

Schedules and Milestones

mid of May 17	Deployment of buoy
end of May 17	Installation of sensors MatrixFlu-UV/VIS
31.05.2017	Sensor integration finish
01.06.2017	Start of Validation
14.06.2017	End of Validation
15.06.2017	Start of Demonstration
18.-20.07.17	Online data deployment Demonstration during mission NOR4 (estim. Dates!)
15.08.2017	End of Demonstration (no recovery of buoy/sensors needed)

Issues & Risks:

Services of buoy include its recovery and re-deployment, hence are time consuming. Currently finished service took approximately 3 months due to new power supply installation and further changes in setup. Although electronics for new communication interfaces etc. have been carefully arranged prior the re-deployment, entire functionality cannot be guaranteed, additional delays are possible.

5.3. Central Atlantic missions

5.3.1. MISSION CAN1: CANARY ISLANDS A1.4

User Scenario:	Characterizing the underwater soundscape with emphasis on areas where human activities are taking place (User scenarios can be found in chapter 4.3).
Location:	PLOCAN Test Site (NE of Gran Canaria)
Platform:	WaveGlider SV2 (WG-SV3 optional)
Sensor	A1
Data users/customer	- Marine-technology sector developers in order to evaluate the generated noise. - Public institutions related to marine mammal monitoring and studies for Marine Spatial Planning.
Mission start date:	Pre-demo: 17 May 2017 Demo1: 9 June 2017 Demo2: 11 Sept 2017
Mission end date:	Pre-demo: 24 May 2017 Demo1: 22 June 2017 Demo2: 14 Sept 2017
Partners involved:	PLOCAN, SMID, UPC, 52N (WP9 partners)
Manager partner:	PLOCAN
Contact Person:	Carlos Barrera carlos.barrera@plocan.eu
Dissemination activity:	May 22-24: Video and photos of *in situ* environment made by PLOCAN unless WaveGlider accessible in the field for video. Video of data on screen and analyses done by IEEE. Local news. Twitter.

Mission description:
The CAN1-A1 mission will be performed in two stages in May and September 2017; the first one being a pre-mission for testing the system in real operational scenario and to consider some constraints. The underlying goal of the mission is to test and demonstrate capabilities of the A1 sensor as it is integrated on mobile platforms, such as the WaveGlider (WG) SV2 (Liquid Robotics, USA) owned by PLOCAN. The WG has a payload configuration suited by meteo station (Airmar), dissolved oxygen (Optode), GP-CTD (Seabird) mounted in the float body and a PAM module (Saint Andrews Instrumentation) attached to the sub-module as tow-body. The A1 integration is initially considered in the tow-body, close to the PAM system, in order to have a reference to compare results. Some mechanical and electronic issues remain to be solved and are still pending, for example, the connection from sensor to float body. The main area considered for the pre and demo activities is the PLOCAN test-site and surrounding areas, such as the other options at ESTOC and South of Gran Canaria. These sites are located in the North-East of Gran Canaria near Taliarte, the harbour base for deployment and recovery manoeuvres. Taliarte is considered a very suitable location due to the proximity to the PLOCAN land-based facility: PLOCAN has dedicated glider labs, boats and rest of the expected necessary logistics such as easy access, meeting rooms, mechanical and electronic tools, Wi-Fi, etc. The main boat to be used for deployment and recovery manoeuvres is a 5.2 m. rubber boat (PLOCAN-2) owned by PLOCAN. Additional logistics for both manoeuvres in the harbour is a truck suited with a crane. Initial and final approach to and from open water consist of a simple towing-manoeuvre with the rubber boat; there will be three skilled people in addition to the skipper for the recommended maximum capacity on board for a safe and successful manoeuvre. The expected area of operation for pre and demo has some maritime traffic to be considered. It allows the performance of a wide range of missions from few hours to days or more as needed; including overnight periods. However, in all cases piloting needs a permanent survey by a pilot team on duty.
Outcomes:
Test and demonstrate the wide range of capabilities of the A1 sensor in real operational scenarios, including quality data, etc. Stakeholder engagement.
Schedules and Milestones
Integration – 1 June 2016 to 24 April 2017 Lab test – 10 May 2017 to 15 May 2017 Pre-demo – 17 May to 24 May 2017

Demo1 – 09 June to 22 June Demo2 – 11 September to 14 September Reporting – 22 September to 30 September
Issues & Risks:
Shipping delay/Customs paperwork (ATA carnet). Mechanical, electronic and software integration. Piloting. At sea operation (including loss) and harbour manoeuvres. Mechanical and electronic failure.

5.3.2. MISSION CAN2: CANARY ISLANDS O1.4

User Scenario:	Glider application for hydrocarbons in water detection. User scenarios can be found in chapter 4.1.
Location:	PLOCAN Test Site (NE of Gran Canaria)
Platform:	WaveGlider SV2 (WG-SV3 optional)
Sensor	O1
Data users/customer	Public institutions related to oil-spill and CDOM monitoring.
Mission start date:	Pre-demo: 17 May 2017 Demo1: 9 June 2017 Demo2: 11 Sept 2017
Mission end date:	Pre-demo: 24 May 2017 Demo1: 22 June 2017 Demo2: 14 Sept 2017
Partners involved:	PLOCAN & TriOS, UPC, 52N (WP9 partners)

Manager partner:	PLOCAN
Contact Person:	Carlos Barrera, carlos.barrera@plocan.eu
Dissemination activity:	May 22-24: Video and photos of *in situ* environment made by PLOCAN unless Wave Glider accessible in the field for video. Video of data on screen and analyses done by IEEE. Local news. Twitter. Abstract publication.

Mission description:
The CAN2-O1 mission will be performed in two stages in May and September 2017; the first one being a pre-mission for testing the system in real operational scenario and to consider some constraints. The underlying goal of the mission is to test and demonstrate capabilities of the O1 sensor integrated on a mobile platforms as it is the WaveGlider (WG) SV2 (Liquid Robotics, USA) owned by PLOCAN. The WG has a payload configuration suited by meteo station (Airmar), dissolved oxygen (Optode), GP-CTD (Seabird) mounted in the float body and a PAM module (Saint Andrews Instrumentation) attached to the sub-module as tow-body. The O1 integration is initially considered in the float body, close to the AADI-Optode sensor, in order to have a reference to compare results. Some mechanical and electronic issues remain to be solved and are still pending. The main area considered for the pre and demo activities is the PLOCAN test-site and surrounding areas, such as the other options at ESTOC and South of Gran Canaria. These sites are located in the North-East of Gran Canaria near Taliarte, the harbour base for deployment and recovery manoeuvres. Taliarte is considered a very suitable location due to the proximity to the PLOCAN land-based facility: PLOCAN has dedicated glider labs, boats and rest of the expected necessary logistics such as easy access, meeting rooms, mechanical and electronic tools, Wi-Fi, etc. The main boat to be used for deployment and recovery manoeuvres is a 5.2 m. rubber boat (PLOCAN-2) owned by PLOCAN. Additional logistics for both manoeuvres in the harbour is a truck suited with a crane. Initial and final approach to and from open water consist of a simple towing-manoeuvre with the rubber boat; there will be three skilled people in addition to the skipper for the recommended maximum capacity on board for a safe and successful manoeuvre. The expected area of operation for pre and demo has some maritime traffic to be considered. It allows the performance of a wide range of missions from few hours to days or more as needed; including overnight periods. However, in all cases piloting needs a permanent survey by a pilot team on duty.

Outcomes:
Test and demonstrate the wide range of capabilities of the O1 sensor in real operational scenarios, including quality data, etc. Stakeholder engagement.
Schedules and Milestones
Shipping – 1 December 2016 Integration – 6 June 2016 to 24 April 2017 Lab test – 1 March 2016 to 14 May 2017 Pre-demo – 17 May to 24 May 2017 Demo1 – 09 June to 22 June Demo2 – 11 September to 14 September Reporting – 22 September to 30 September
Issues & Risks:
Shipping delay/Customs paperwork (ATA carnet). Mechanical, electronic and software integration. Piloting. At sea operation (including loss) and harbour manoeuvres. Mechanical and electronic failure.

5.3.3. MISSION CAN3: CANARY ISLANDS A1.3

User Scenario:	Characterizing the underwater soundscape with emphasis on areas where human activities are taking place. User scenarios can be found in chapter 4.3
Location:	Canary Islands (Gran Canaria)
Platform:	PROVOR
Sensor	A1

Data users/customer	-Public institutions related to marine mammal monitoring and studies for Marine Spatial Planning.
Mission start date:	Pre-demo: 15 May 2017 Demo: 22 May 2017
Mission end date:	Pre-demo: 26 May 2017 Demo: 24 May 2017
Partners involved:	PLOCAN, NKE, Ifremer, SMID
Manager partner:	PLOCAN
Contact Person:	Carlos Barrera, carlos.barrera@plocan.eu
Dissemination activity:	May 22-24: Video and photos of *in situ* environment made by PLOCAN unless float accessible in the field for video. Video of data on screen and analyses done by IEEE· Video and photos should be taken of installation if done at NKE. IEEE video support in Brest. Local news. Twitter.

Mission description:
The CAN3-A1 mission will be performed in two stages in May and June 2017; the first one being a pre-mission for testing the system in real operational scenario but will also be considering some constraints. The underlying goal of the mission is to test and demonstrate capabilities of the A1 sensor integrated on a mobile platform, as it is the PROVOR float owned by NKE. The A1 integration is initially considered to be placed directly over the PROVOR hull, upwards looking. No additional acoustic sensor for reference is considered in this case. Some mechanical and electronic issues remain to be solved and are still pending. The main area considered for the pre and demo activities is the PLOCAN test-site and surrounding areas, such as the other options at ESTOC and South of Gran Canaria. These sites are located in the Northeast of Gran Canaria near Taliarte, the harbour base for deployment and recovery manoeuvres. Taliarte is considered a very suitable location due to the proximity to the PLOCAN land-based facility: PLOCAN has dedicated glider labs, boats and rest of the expected necessary logistics such as easy access, meeting rooms, mechanical and electronic tools, Wi-Fi, etc.

Main boat to be used for deployment and recovery manoeuvres is a 12 m. multipurpose speedboat (PLOCAN-1) owned by PLOCAN. No additional logistics for deployment and recovery manoeuvres are expected. The expected area of operation for pre and demo has some maritime traffic to be considered. It allows the performance of a wide range of missions from few hours to days or more as needed; including overnight periods. However, in all cases the float trajectory needs supervision by a pilot team on duty.
Outcomes:
Test and demonstrate the wide range of capabilities of the A1 sensor in real operational scenarios, including quality data, etc. Stakeholder engagement.
Schedules and Milestones
Shipping – 1 April 2017 to 30 April 2017 (From NKE facilities) Integration – 1 June 2016 to 30 March 2017 (NKE facilities) Lab test – 30 Dec 2016 to 30 January 2017 (NKE facilities) Pre-demo – 15 May to 26 May 2017 Demo – 22 May to 24 May Reporting – 22 September to 30 September
Issues & Risks:
Shipping delay/Customs paperwork (ATA carnet) Mechanical, electronic and software integration. Trajectory planning. At sea operation (including loss) and harbour manoeuvres. Mechanical and electronic failure.

5.3.4. MISSION CAN4: CANARY ISLANDS A1.1

User Scenario:	Characterizing the underwater soundscape with emphasis on areas where human activities are taking place. User scenarios can be found in chapter 4.3.

Location:	Canary Islands – PLOCAN Test-site facility
Platform:	ESTOC TB (Moored Buoy)
Sensor	A1
Data users/customer	- Marine-technology sector developers in order to evaluate the generated noise. - Public institutions related to marine mammal monitoring and studies for Marine Spatial Planning.
Mission start date:	17 July 2017
Mission end date:	14 Sept 2017
Partners involved:	PLOCAN, SMID, UPC, 52N
Manager partner:	PLOCAN
Contact Person:	Carlos Barrera, carlos.barrera@plocan.eu
Dissemination activity:	May 22-24: Video and photos of *in situ* environment made by PLOCAN. Stills and video of installation. Video of data on screen and analyses done by IEEE. Local news. Twitter. Abstract publication.

Mission description:
The CAN4-A1 mission will be performed in July to September 2017. The underlying goal of the mission is to test and demonstrate capabilities of the A1 sensor integrated on a fix platform as it is the moored oceanographic buoy (OB) owned by PLOCAN. All sensors are connected to a main board electronics that integrates a Campbell CR-1000 data logger, and an Iridium telemetry gateway. The OB has a power system based in solar panel module and 12V batteries. The A1 integration is initially considered directly over the OB mooring line, upwards-looking in a dedicated frame. No additional acoustic sensor for reference is considered in this case.

Some mechanical and electronic issues remain to be solved and are still pending. The main area considered for the pre and demo activities is the PLOCAN test-site and surrounding areas, in depths ranging 25 and 42 meters, located in the North-East of Gran Canaria. These sites are located near Taliarte, the harbour base for deployment and recovery manoeuvres. Taliarte is considered a very suitable location due to the proximity to the PLOCAN land-based facility: PLOCAN has dedicated glider labs, boats and rest of the expected necessary logistics such as easy access, meeting rooms, mechanical and electronic tools, Wi-Fi, etc. Main boat to be used for deployment and recovery manoeuvres is a working boat (rental) and a 12 m. multipurpose speed boat (PLOCAN-1) owned by PLOCAN. Additional logistics for deployment and recovery manoeuvres are expected, like a truck and crane in Taliarte harbour, a mooring line and weight. Good weather conditions are mandatory to perform in a safe and successful way, specifically, the towing manoeuvre from Taliarte harbour to mooring site four nautical miles away.
Outcomes:
Test and demonstrate the wide range of capabilities of the A1 sensor in real operational scenarios, including quality data, etc. Stakeholder engagement.
Schedules and Milestones
Integration – 1 June 2016 to 9 May 2017 Lab test – 10 May 2017 to 14 May 2017 Demo – 17 July to 14 September Reporting – 22 September to 30 September
Issues & Risks:
Shipping delay/Customs paperwork (ATA carnet) Mechanical, electronic and software integration. At sea operation (including loss) and harbour manoeuvres. Mechanical and electronic failure.

6. Concluding remarks

Due to delays in testing and integrating the sensors, the dates for the demonstration activities had to be revised and may still need to be updated in the following weeks, so they should be considered flexible. Nonetheless, we are confident we will be able to follow through with all of them (and possibly a few extra) in the allotted time.

For the same reason, mission details may still need to be firmed up for some missions as the

NeXOS sensor development partners have had their attention on more pressing matters in development Work Packages to be finalised. More attention is being paid to the demonstration phase now, and more detailed plans are now to be developed, both for the demonstration activities themselves, and for the related dissemination activities