Multifunctional Web Enabled Ocean Sensor Systems for the Monitoring of a Changing Ocean

Objectives

A growing concern about the health of the world oceans resulting from multiple stressors such as effects of climate change and increasing offshore activities leads to the need for better observational tools.

The objective of the NeXOS project is to serve those needs by developing **new cost-effective, innovative and compact integrated multifunctional sensor systems** which can be deployed from mobile and fixed ocean observing platforms, as well as to develop downstream services for the Global Ocean Observing System, Good Environmental Status of European marine waters and the Common Fisheries Policy.

PROJECT ACRONYM: **NEXOS**
PROJECT TITLE: Next generation Low-Cost Multifunctional Web Enabled Ocean Sensor Systems Empowering Marine, Maritime and Fisheries Management
FUNDING: European Commission, 7th Framework Programme, the Ocean of Tomorrow 2013
EU Financial contribution: 5.9 million Euros
START DATE: October 1, 2013
DURATION: 48 months
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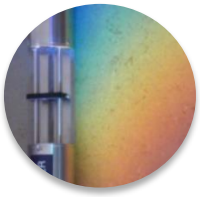
Developments and Outcomes



◆Compact and cost-efficient multifunctional sensor system for **optical measurement** of marine contaminants such as hydrocarbons and other components of the carbon cycle.

◆Cost-efficient compact and integrated sensor system for **passive acoustic measurements**. Development will focus on the pre and post-processing of acoustic information and improved transducer integration, reducing size and cost while increasing functionality in one integrated acoustics sensor system.

◆Low-cost sensor system for an **Ecosystem Approach to Fisheries** management, monitoring stock-relevant parameters, such as oxygen and chlorophyll-a, as well as physical parameters (T, S, Depth). The integration of the system to European fishing vessels will be done.

◆Miniaturised **smart sensor interface** common to all new NeXOS sensor systems. This standard interoperable interface will be reconfigurable to respond to sensor specificities, monitoring strategies and connection with the majority of ocean observing platforms.

◆ **Sensor antifouling technologies** to address the main limiting factor of sensor reliability, and to develop and test improvements based on cost-efficiency, power-efficiency and economic viability.

◆ Common toolset for **web-enabled and reconfigurable downstream services**, for European marine databases and data facilitators.

◆ Assess and optimise the life cycle economic **feasibility and viability** of the new sensor developments from the manufacturing phase through operations.

◆ **Demonstrate** new developments in **real operational scenarios**

PARTNERS: 21 partners from 6 countries

Loc.	PARTNER
A	PLOCAN (ES)
B	CTN (ES)
C	UPM (ES)
D	AMU (FR)
	ACSA (FR)
F	SMID (IT)
G	CNR (IT)
H	IFREMER (FR)
	NKE (FR)
I	ECORYS (NL)
J	UNOL (DE)
	TRIOS (DE)
	UNIHB (DE)
	52N (DE)
	TRIOS (DE)
K	HZG (DE)
	FRANATECH (DE)
L	UNIRESEARCH (NO)
	CMR (NO)
M	NIVA (NO)
O	RÜNDE (NO)

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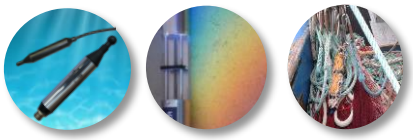
NeXOS innovations in a nutshell



Optics

Light is a fundamental driver of, as well as a means to sense, physical, chemical and biological processes in the ocean. Optical tools have a long and successful record in measuring major biogeochemical parameters in the marine environment. Techniques utilizing inherent optical properties like fluorescence and absorption are potentially applicable in long-term monitoring approaches. These properties are independent from ambient light conditions and can provide information about many components of the marine environment; including contaminants and dissolved and particulate constituents of the biological carbon cycle. NeXOS will innovate with the development of cost-efficient compact low-power multifunctional optical sensors, through fluorescence, absorption and spectrophotometric techniques.

Passive Acoustics

As sound can travel long distances underwater, humans and marine animals have used it as a means to accomplish all sorts of tasks, from scanning the environment to communication at short and long ranges, from centimetres to hundreds of kilometres. Through the development of passive acoustics technologies, sound can also be used to observe the ocean, from marine life, to seismic and human activities. NeXOS will develop new passive acoustics sensors (smart hydrophones) for the measurement of several human and biological sources, and underwater noise in general. These sensors will enable on-platform measurements and will be available for platforms with limited autonomy and/or communication capability, and platforms with unlimited autonomy and/or communication capability such as cabled observatories.

Ecosystem Approach to Fisheries

The RECOPESCA project has contributed to the so-called Ecosystem Approach to Fisheries by implementing a participative approach with low-cost ocean sensors installed on-board fishing vessels. These can monitor fish-catch and fishing effort, as well as oceanographic variables. NeXOS wish to extend this approach to Europe and add new features to the existing concept. The need for measurements of oxygen and chlorophyll for coastal oceanographic research was identified. This would enable the study of eutrophication in near-coast areas where data is sparse. The new sensors for chlorophyll and oxygen will be developed and demonstrated. These sensors will be very low-cost, high autonomy, small and sturdy. They will complement the measurement of fish catch, fishing activity tracking, temperature and salinity.

Sensor anti-fouling

The protection of the sensing area of the sensor is a major concern, especially for long-term deployments. Methods exist but are not always efficient or optimal in terms of cost, impact or applicability. NeXOS will apply an innovative monitoring technology that will detect the earliest stages of biological growth on sensor surfaces so that biofouling can be effectively prevented. This will reduce maintenance costs, increase the quality of data collected (reduction of biofouling-related interferences), and avoid unnecessary introduction of potentially harmful chemicals in the environment.

Sensor interoperability

To achieve a maximum level of interoperability, methods need to be implemented at several levels of the ocean observing systems. At the sensor interface, this will reduce the complexity of integrating the new sensors on existing and future platforms. From the user-end, sensors should be searchable through the web, and data easily accessible and fully exploitable through the implementation of proper data and metadata standards. Among other solutions, the standardized suite of Sensor Web Enablement specifications was identified as an integrated response to these needs. Development of the required profiles will further allow seamless integration with existing international initiatives such as GEOSS and Copernicus.

Multiplatform integration

NeXOS will introduce the multi-platform concept changing the traditional single-sensor use on a dedicated platform to the use of multifunctional sensors on several types of platforms. A variety of platform types have been selected for their operational capabilities and deployment. The platforms include both traditional types with long record of operation, such as stand-alone moorings, and new platforms such as Voluntary Observing Ships, drifters/profilers and Gliders. This multi-platform approach is expected to further reduce the cost of sensors and observations.