Sensors for the Oceans of Tomorrow

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"The Ocean of Tomorrow 2013"

a cross-thematic program focused on fostering research and innovation in marine technologies.
Understanding the “Blue Planet”
Ocean Observation Challenges

- Pervasive in Space and Time
- Affordable
- Quantifiable
- Interoperable
- Fit for purpose

Oceans surface is $3.6 \times 10^8 \text{ km}^2$
4 year FP7 Project, 21 partners

Optics and acoustics sensors for several application domains

8 web-enabled “plug’n play” sensor systems being developed and demonstrated
NeXOS Objectives

• Lower capital and operating expenses for sensor systems
• Multifunctional sensor packages
• Standard web interfaces for multiple platforms
• Extend the deployment duration of sensors
# NeXOS in a nutshell

<table>
<thead>
<tr>
<th>Sensor Technology</th>
<th>Sensor type</th>
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<tbody>
<tr>
<td>Optical</td>
<td>O1 Matrix-fluorescence</td>
</tr>
<tr>
<td></td>
<td>O2 Hyperspectral</td>
</tr>
<tr>
<td></td>
<td>O3 Carbon</td>
</tr>
<tr>
<td>Passive Acoustics</td>
<td>A1 Preprocessed</td>
</tr>
<tr>
<td></td>
<td>A2 Real-time</td>
</tr>
<tr>
<td>RECOPECA/EAF</td>
<td>EAF/ Chlorophyll</td>
</tr>
<tr>
<td></td>
<td>EAF/Oxygen</td>
</tr>
</tbody>
</table>

## Cross-cutting Technologies

- Smart Sensor Interface – OGC PUCK + SWE  
  Bio-fouling prevention

## Target Platforms

<table>
<thead>
<tr>
<th>Gliders</th>
<th>Drifters/profilers</th>
<th>Cable Observatories</th>
<th>Ferries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trawlers</td>
<td>Nets &amp; Lines</td>
<td>Other leisure</td>
<td>Stand alone</td>
</tr>
</tbody>
</table>
Smart Sensor Interfaces

- Smart Sensor Interface and Web Components
  Hardware and software interface with miniaturized low power modular design
- Implementation of OGC PUCK protocol for instrument discovery and identification
- Precision Time Protocol (IEEE Std. 1588) for time synchronization
- Open Source software development tools
- Open Data access based on Sensor Web Enablement framework.
Biofouling protection by electrochlorination on optical windows

Electrochlorination by SURFACE thin film working electrode on window

Copper

Conductive SnO2 coating (working electrode)

In situ test: SURFACE thin film electrode on window provides 6 months of protection with test still running

Image and information courtesy of Laurent Delauney, IFREMER
NeXOS Test and Demo Scenarios

Scenario 1: Hydrocarbon observations with gliders; detection and quantification of leakage

Scenario 2: Carbon cycle and carbon sequestration monitoring with ferry-boxes including pH, inorganic carbon, carbonate ions, partial pressure CO2.

Scenario 3: Passive acoustic monitoring and characterization of underwater sounds from floats and gliders

Scenario 4: Observations for sustainable fisheries observing ocean variables

Scenario 5: Detection and characterization of phytoplankton blooms and groups
Collaboration Among Projects

• Modularity of the developed sensor systems
• Standard web interfaces for multiple platforms
• Extend the deployment duration of sensors
<table>
<thead>
<tr>
<th>Project</th>
<th>Common Sense</th>
<th>NeXOS</th>
<th>SCHeMA</th>
<th>Sense Ocean</th>
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</thead>
<tbody>
<tr>
<td>Temp, Pressure</td>
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<td>CDOM</td>
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<td>Nutrients/carbonates</td>
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<td>Phytoplankton</td>
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<tr>
<td>microplastics</td>
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<tr>
<td>Heavy/trace metals</td>
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Interoperability – Supporting GEO

- **Sensor-Platform Interface** – OGC PUCK protocol for instrument discovery and identification

- **Sensor to Repository** - Standardized web services (SWE) for accessing sensor information and sensor observations

- **Addressing also** –
  - metadata standards
  - best practices in four areas: calibration; robustness and reliability; usability; and platform interface.