

BAT PORTFOLIO

BEST AVAILABLE TECHNOLOGIES FOR THE MARITIME SECTOR



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INTRODUCTION



1.1. STAMAR PROJECT

The STAMAR (Showcase Technology Applicable to Maritime Small and medium Sized Enterprises (SMEs) in the Atlantic Area) project aims to improve the competitiveness and innovation capacity of SMEs in the Atlantic Area maritime sector by facilitating technology transfer processes through the creation of a transnational demonstration centre of capacities and technologies which are applicable to the maritime industry, paying special attention to those technologies which favour an environmental sustainable development. The project focuses on six main activities as outlined in Table 1, in addition to implementation of a communication and business awareness campaign and overall management, coordination and evaluation of tasks through the project.

STAMAR is funded through the INTERREG IVB Atlantic Area Programme and involves nine organisations from the five countries of the Atlantic Area Programme eligible area. It responds to priority 1 of the Atlantic Area Transnational Cooperation Programme 2007-2013 - Innovation Networks.

- Develop knowledge transfers between companies and research centres.
- Enhance competitiveness and innovation capacities in maritime economy niches of excellence.



- Stimulate economic conversion and diversification by promoting regional indigenous potential.

STAMAR is contributing to the area of innovation and entrepreneurship, focussing on activities related to promoting the cohesive development of the knowledge economy, creating networks for sharing and transferring knowledge, valuing indigenous resources through innovation, improving industrial competitiveness and business cooperation, stimulating processes to cluster economic activities, and developing new products and production processes.

Description of Activity 2

The aim of Activity 2 of STAMAR was to prepare a portfolio of ICT-intensive “best available technologies” that have the potential to result in business development opportunities within the marine sector. Through the project, mechanisms are being developed to demonstrate an effective transfer of suitable technologies to maritime SMEs. These technologies will support sustainable development while also protecting the environment. There were two key actions required for Activity 2:

- Regional selection of ICT-intensive best available technologies applicable to maritime ICT industries. The pre-selection was carried out at regional level by each member of the transnational working group.



- Preparation of the transnational BAT (“Best Available Technologies”) portfolio. Each region will share the technologies that have been previously selected and, in a later phase, they will be further selected in a face-to-face workshop which will take place in Brest and where all group members will take part.

1.2. DESCRIPTION OF REGIONS INVOLVED

Ireland

Ireland is situated on the western European continental shelf, with the deep ocean waters of the Atlantic Ocean to the west and shallower waters of the Irish and Celtic Seas to the east and the south. This unique location results in a dynamic and varied marine environment. As an island State, the sovereignty, security and economy are inextricably linked to the sea. Its geo-strategic location in the North-East Atlantic means that Ireland places huge importance in an Integrated Maritime Policy for the region and in Europe. Ireland’s marine economy is based on shipping and transport, seafood production, communications, maritime safety, security and defence, surveillance, offshore industry, hydrocarbon, mineral and resource exploitation and offshore renewables.

Taking our seabed area into account, Ireland has sovereign or exclusive rights over one of the largest sea to land ratios (10:1) of any EU

State. The State of Ireland consists of 90,000 km² of a land resource and 900,000 km² of a marine resource. Our coastline is 7,500km in length.

Ireland’s maritime area:

- contains some of the largest and most valuable sea fisheries resources in Europe;
- possesses significant potential for oil and gas reserves;
- is the western gateway for shipping to Europe’s busiest sea ports;
- is among one of the richest and most accessible ocean renewable energy (wave, tidal and wind) resources in the world;
- possesses spectacular natural tourism opportunities;
- offers the prospect of new enterprise activity arising from the development of a diverse genetic species resource for medical and industrial purposes; and
- Possesses a range of technology test-bed opportunities which can facilitate the development of innovative technologies, decision support and management tools for global marine markets.

Ireland has a strong ICT industry base and we continue to attract the best in scientific and technology investments. To date, €8 billion has been invested in science, technology and innovation in Ireland and we are home to 8 of the top 10 global ICT companies and 3 of the 5 top games companies.

There are currently over 50 indigenous and multinational companies based in Ireland engaged in the development and provision of High Tech Marine products and services to the Global Marine Sector. These include the provision of advanced sensing and communications systems, data management and visualisation tools,

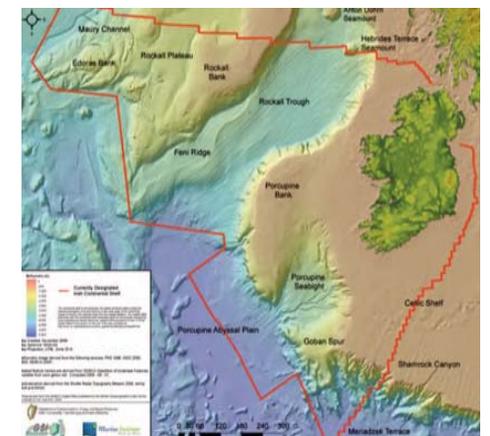


Chart of Ireland showing the extent of the Irish Continental Shelf

Main Activities of STAMAR

Project Activity	Description
Activity 1	Sectorial technological surveillance in the project participating regions
Activity 2	Preparation of a transnational portfolio of Best Available Technologies (BAT) for the maritime sector
Activity 3	Creation of the Transnational Demonstration Centre of Technologies
Activity 4	Design and implementation of a joint strategy to approach technology to the market
Activity 5	Organisation of co-creation sessions between Research Centres and SMEs
Activity 6	Implementation of technology transfer pilot projects with SMEs of the maritime sector

modelling, simulation, forecasting, decision support tools based on advanced data informatics and modelling and engineering design supporting operational management. A number of companies have also developed products and services based on patented research from National Centres of Research Excellence.

The Marine Institute's National Marine Technology Programme facilitates a range of research and development activities in the area of sensor development and communications, data management and information systems and data informatics. This programme aims to broker national and international relationships between technology developers in industry and academic centres of excellence for application driven technology development in marine ICT.

With innovative solutions, the indigenous ICT expertise can be applied within the marine sector. SmartOcean is an Irish initiative which, aims to establish Ireland as a leader in the development of high value products and services for global marine markets by creating a critical mass of research and development activities in Marine ICT. Our aim is to use our unique ocean resource as a catalyst for innovation, building on our existing internationally recognised capability in ICT to address major emerging market opportunities.

The aims of the STAMAR Project complement those of SmartOcean and the National Marine Technology Programme. The project will improve the competitiveness and innovation capacity of SMEs in the Atlantic Area maritime sector by facilitating technology transfer processes through the creation of a transnational demonstration centre of capacities and technologies which are applicable to the maritime industry, paying special attention to those technologies which favour an environmental sustainable development.

Scotland

In March 2013, SMEs in Scotland were accounting for 99.3% of all private sector enterprises, 54.7% of private sector employment and 36.7% of private sector turnover. Energy & Low-Carbon Technologies incorporate oil and gas, thermal generation, renewables and environmental activities. This sector encompasses over 2,520 businesses in 2012, ranging from multinationals, large Scottish global companies and a highly regarded SME base.

According to the Technology Strategy Board of UK (TSB-UK), the Scottish Government sets out the broad economic and innovation policy framework and direction for Scotland. The organisations with primary responsibility for delivering this framework are Scotland's two development agencies: Highlands and Islands Enterprise (HIE) and Scottish Enterprise (SE).

SE is the enterprise, innovation and investment agency for the southern and central belt of Scotland. In partnership with industry, academia and the public sector, SE aims to increase productivity in Scotland by helping businesses to start and grow, encouraging innovation and creating the right conditions for companies to access property, markets and finance. SE and TSB-UK have co-developed and co-funded joint projects in areas including Health and Life Sciences, Energy, Digital and Creative Industries and Enabling Technologies. SE offers a wide range of advice and support for businesses including:

- Securing funding and grants to develop new business ideas and products,
- Finding investors, business partners and collaborators,
- Getting advice from business professionals on how to achieve business growth,
- Refining existing products and services to make them more efficient and cost-effective,
- Information and advice on new working methods or production techniques, and
- Support to enable and equip businesses to break into new markets.



Highlands and Islands Enterprise (HIE) is the economic and community development agency for a diverse region which covers a territory of over 1500 square miles - containing some 443,000 people and over 21,000 businesses. To improve the region's performance and its contribution to the economic growth of Scotland, HIE delivers an integrated strategic approach to development, under three headings:

- Supporting high growth businesses and sectors, so raising growth rates across the area,
- Creating the infrastructure and conditions to improve regional competitiveness, and
- Strengthening communities, especially in the economically fragile parts of the area.

European Marine Energy Centre: a world-class marine energy research facility, supporting the marine renewable sector and generating significant economic benefits for Scotland.

Digital Economy, ICT and Rural Broadband: ensuring the Highlands and Islands have appropriate connectivity for now and the future and the capacity to adopt new and emerging technologies to boost economic growth and positively impact on remote and rural society.

KTN-P (Knowledge-Transfer Network & Partnership) activities: establishing better mechanisms to reach and engage regional businesses with funding, knowledge, graduate recruitment and other opportunities.

SBRI (Small Business Research Initiative): promoting SBRI opportunities to businesses across the region.

HIE also offers a wide range of services and programmes to businesses to support knowledge transfer, technology and research and development. These include:

- Business and innovation information and advice,
- Funding options and opportunities,
- Interface – linking businesses with academic research,
- Research and Development funding scheme,
- Business Innovation Grants – supporting links between businesses and academic institutions, and
- Framework Programme (FP7) – grants to encourage and support pan-European business collaborations

North Portugal

Portugal North Region has the following active sectors (notice that the information reports to 2011) connected with the maritime area:

• Shipping

The main shipping hubs in the North region are secured by Leixões Port, located in the city of Matosinhos and Viana do Castelo, further north. The Leixões harbour, the second busiest commercial port in Portugal receives annually 20% of all cargo ships arriving and departing Portugal. It is a multifunctional port, well connected to a dense infrastructural network, where the role of the general cargo (and in particular container) is growing. Leixões Port is also in a privileged market position, close to major retail and beverages industry as SONAE and UNICER and in the core of the regional fish catchment and sales area (DocaPesca).

• Shipbuilding

Shipbuilding and repair are significant activities in the North Region. The Viana do Castelo shipyards (Estaleiros Navais de Viana do Castelo – ENVC) are the most relevant actors in this field. With annual revenue around 100 million Euros, the ENVC involve a significant set of companies at national level, being the majority located in the Norte region.

• Marine equipment

Oceanographic research requires specific underwater vehicles and ICT support technologies. Under the robotics field a high expertise level has been reached through successful ROV (remotely operated vehicles) and AOV (autonomous operated vehicles) development by research centres like LSTS (Systems and underwater technologies laboratory) integrated in the Engineering Faculty of University of Porto.

• Seaports

The Norte region seaports are located at Leixões (Matosinhos) and Viana do Castelo. The first is one of the most important seaports in Portugal, and presents a workload (concerning handled cargo) 16 times bigger than the latter one. Concerning ships traffic, this ratio is around 10/1 (calculated based on annual average values between 1998 and 2005). Leixões seaport is internationally oriented, and the main traffic with the EU is



with countries like United Kingdom, Netherlands, Spain and France. Outside de EU, ships traffic is with Egypt, Algiers, Libya and Russia.

The Viana do Castelo Seaport, although smaller, is nowadays expanding, mainly due to the development of the wind energy sector. The main player in this sector and in the region is Enercon manufacturer, exporting a large part of its production.

• Maritime services

Several outreach centres focused on marine and environment scientific knowledge research, public environmental awareness rising and environment monitoring activities exist in the North region. Some of them are run as a partnership between municipalities and research centres.

• Offshore Services

The Atlantic sea at the North region offers immense potential concerning renewable energies production (waves and off-shore wind) through the application of new technologies. Some relevant private initiatives have been taken, such as the Enernova and DST Energias example.

• Fishing

Fisheries, considered as a sector that includes Maritime and inland fishing, fish processing and aquaculture, is a sector that employs 7900 people (source: Policy Research Corporation, 2008). This regional figure represents 24% of the national employment in the sector. The North region accounts for 19% of all the fish unloaded on the national fish market. According to INE (2007) enterprises consolidated statistics from 2004 to 2006, there were around 40 companies (including aquaculture and fish processing industrial sectors), employing around 1700 people. This represented around 30% of the human resources in these sectors. Sea fishing activities represented a transitioned source value of 254,8 M€ in 2009.

Aquaculture is an activity sector that presents high growth potential in order to overcome the restrictions imposed in order to guarantee sustainable fishing. Taking into consideration the opening of a very large aquaculture facility installed recently in the Centro region (Mira location), as well as the proximity of a significant world player region in the fish markets – Galiza – an opportunity gap exists: aquaculture support services and products. It is possible to value knowledge in this field of expertise in order to offer high value specialized services and products.

According to the statistical data available, the North region presented in 2007 a production of 923 tons. Although this value re-

presents around 2,2 million euros, only 32 tons (valued 269 thousand euros) were produced in marine and estuary environment. This production represented 12% of the national total.

• Food:

This activity sector, with long tradition in Portugal, has lived a concentration and modernisation process oriented towards quality and product certification, thus strengthening its international competitiveness over the years. This sector is mainly an exporting one, focusing on canned tuna (national sales focus) and sardine niches (mostly exportation oriented).

• Coastal tourism:

Portugal and the North region present a well distributed set of infrastructures, although many of the marinas require new support facilities in order increase its attractiveness at international level. The North region has 4 ocean marinas and a significant number of nautical sports clubs. According to statistics available, with 10.504 registered boat units, it represents 16,6% at national level. Recreational boating can benefit from the existence of fiber and steel yachts construction and repair industry, located at Viana do Castelo, as well as some small shipyards dedicated to wooden boats.

South Portugal

The Algarve is assumed, historically and currently, as a territory with a strong maritime tradition and where development has been strongly coupled to the direct use of coastal and marine resources. Tourist activities, fishing, aquaculture and marine-recreational are the main driver of the current economic development in the Algarve. Its continuity, as well as looking for new ways of economic development within a high standard of environmental respect, are fundamental to achieve sustained growth. The areas of potential development incorporate biotechnological exploration, exploration of energy resources (mainly renewable sources), increased marine tourism activity, increase on the supply of tourism with nature, diver-



sity in the types of coastal tourism, with greater maritime connections, sustainable exploitation of fishery resources and the valuation of the offer in aquaculture. The University of Algarve considers as fundamental the transfer of the academic generated knowledge to the community through direct collaboration and training articulated with and for the market, with concrete results in the creation and support of micro, small and medium enterprises, allowing the improvement of economic development of maritime economic activities at national and international level.

The development of a European Union Pole of Excellence in the field of sea research an extraordinary impact on the socio-economic development of the region, allowing the creation of skilled jobs and improving the economic and educational levels. The international recognition of the University of Algarve in this area has led to the demand to install international teams that can bring greater potential for external funding and help to create knowledge and local employment. The level of research and technological development reached at the University of Algarve in sea area has been instrumental and will be it in the future to capture funding to modernize and replace essential equipment to improve the competitiveness of current teams and attract new partnerships.

The coastal area includes the greater economic value of the Algarve region - the beaches, where environmental quality has a leading role in its recovery. The knowledge of the marine biodiversity in areas of high biological value aimed at the enhancement of underwater biodiversity, such as marine hazardous areas, has implications not only for sustainability of resources but also for development environmental and underwater tourism. In biotechnology, the development of marine high-yield strains for biofuels and processing of biomass show a high potential for incorporation of knowledge produced for global applications, as well as for identifying active compounds and industrial gene applications.

Galicia

The Galician coast, bathed by the Atlantic Ocean and the Cantabrian Sea, consists of 1.720 km, representing around 19% of the national total. It is traditionally divided into “Rías Altas” and “Rías Baixas”. The sea has been a major source of economic resources in Galicia from the Mesolithic period, from which the beginning of fishing activity in Galicia dates. But fishing is not the only way to make use of the Galician coast; it is also exploited through its multiple ports, through shipbuilding and repair and through activities from the recreational boating industry.

The maritime and fishing sector

The fishing sector (fishing and aquaculture and the processing and preserving of fish, crustaceans and mollusks) generated an added



value of 1,136 million euros in 2012, representing 2.1% of the autonomous region's GDP. This sector employed 33,000 people in 2012, of which two thirds work in fishing and aquaculture activities, while the remaining third belongs to the processing industry. The weight of the sector in terms of employment accounts for 3.2% of Galicia's total.

Galician boats land nearly 70% of Spain's fresh catch and over 11% of Europe's total. The Gross Added Value of fisheries and aquaculture in Galicia is 25 times higher than that of the EU and 6 times higher than Spain's, according to 2008 data.

	Extractive fishing <ul style="list-style-type: none"> 1,000 boats in 2008 Accounts for 23% of the EU's extractive fishing value Operating fleet of 4,500 jobs Landing of 375,000 tons fish, with an economic value of 850 million euros
	Seafood gathering <ul style="list-style-type: none"> The earnings of 4,000 people (mostly women) in Galicia depend upon this activity In 2009 the value of fisheries in Galician markets represented 68 million euros, from 9,000 production tons harvested
	Aquaculture <ul style="list-style-type: none"> Now activity the growth trends since the late 90's It employed 5,000 people in 2012 Its added value in 2012 reached 135 million euros
	Canned fish & mollusks <ul style="list-style-type: none"> Spain's leader in this activity Main Spanish exporter (30% of total in both volume and value) Production of 80% of the national total 12,000 jobs (70% of the national total) Great range of marine products
	Frozen fish <ul style="list-style-type: none"> 133 factories 2,122 million € in 2008 3,189 workers (2008) 37% of Spanish exports In 2009 sales reached 140,000,000
	Recreational fishing <ul style="list-style-type: none"> Fishing for entertainment, sport or hobby Recreational activity 43,000 people participate in this activity in Galicia

The shipbuilding and repair sector in Galicia

Galicia is a quintessentially maritime community. This feature has taken it to become a leader in sectors such as fishing, aquaculture,

maritime defense, nautical sports, marine biotechnology and the shipbuilding and repair sector that configures itself as the common link between all of them.

The naval sector accounts for 5% of Galicia's GDP; its average annual turnover in the last decade has reached 2,500 million Euros, which makes Galicia the first Spanish community in shipbuilding and repair.

In Galicia there are 10 shipyards and about 200 companies that provide services or sell products to shipyards. The environment in Galicia is favorable for shipbuilding and repair due to the implementation of specialized supporting institutions such as university colleges, technology centers, training centers, support foundations and associations.

Ports and port servicing

The Autonomous Community has 128 ports. Of these, the Xunta de Galicia, through its public body PORTOS DE GALICIA (Galician Ports), ascribed to the Regional Ministry of Rural Environment and the Sea, directly manages 122. The other six, with a larger dimension and of general interest to the State, come under the Ministry of Public Works and Transport.

Ports managed by PORTOS DE GALICIA (Galician Ports):

In Galicia's port facilities, three types of activities are developed, related to fishing and seafood gathering, trade and nautical sports activities.

These ports have 122 facilities, with a total area of 3,024,000 m², 31 km of docks, 7,947 spaces for sport boats and 20,500 meters of berthing pontoons. 1.9 million tons of goods, 107,861 tons of fresh fish, around 1.4 million tickets and 413 ships entered Galician ports managed by Portos de Galicia in 2012.

Ports managed by the Ministry of Public Works and Transport:

	A Coruña <ul style="list-style-type: none"> Area of 178 Ha which will be expanded to 250 45,468 regular passenger traffic and 156,890 in cruises, 11,404,636 tons of
	Ferrol-San Cibrao <ul style="list-style-type: none"> 2,773 Ha Ferrol, 41 flotation Ha and 563,456 m² of land area in San Cibrao Total maritime traffic of 12,539,644T in 2013 between both ports
	Marín <ul style="list-style-type: none"> 1,806 m of commercial docks and 2,686 m of fishing docks Port traffic in 2013 of 1,871,553 T
	Vilagarcía <ul style="list-style-type: none"> 3,000 meters of berthing in commercial docks and 570,000 m² total area Port traffic in 2013 of 966,491 T
	Vigo <ul style="list-style-type: none"> 2,572,577 m² service area and Bouzas port area of 802,354 m² Passenger traffic of 885,931 people, 3,797,499 T of goods, 79,978,936 kg of

Recreational boating, marinas and harbours

The Galician coast has an increasingly strong appeal for sailors and nautical sports fans due to the improvement of land communications and the growing demand for such facilities, making it necessary to undertake actions in order to provide this fleet with much more complete services and promote the development of this important sector of nautical sports.

Application of ICT in the marine and fishing value chain

The ICT sector also contributes to the marine industry helping to increase its added value and make it more competitive. The most important applications of ICT for the maritime and fishing value chain include:

- The transmission from the fishing fleet at any time of the tide of all kinds of information about the product, through the addition of new weighing, labeling and handling systems, which would allow for example the introduction of online auctions
- The improvement of working conditions and health on board through the improvement of the communication system and the development of telehealth applications, distance learning, etc.
- The improvement of maritime safety as a result of advances in the development of new tools such as navigation simulators that analyze navigation, maneuvering and fishing situations, in increasingly complex environments.
- New systems for marine and oceanographic monitoring and control of application for the improvement of the quality of the marine environment and the management of fisheries and aquaculture resources, among others.
- Applications related to renewable energy generation in the marine environment through off-shore systems.

The Galician ICT sector is composed of 2,029 companies which employ 15,144 people; it is the 5th Spanish community with more businesses of this type. Its GVA accounts for 2% of the Galician GDP and its turnover in 2012 exceeded 2,240 million euros.

In addition to these companies, the innovation system of Galicia has a large group of entities that combine scientific and technological ICT skills for their application in the maritime and fishing sector. This is the case for instance of the "Campus del Mar" (Sea Campus) promoted by the University of Vigo, the AIMEN technology center or the CETMAR Foundation, to name just a few. The detail of Galicia's technological and scientific capacities in relation to the ICT-maritime and fishing sector mix is provided in the technological surveillance reports that complement this BAT.

Brittany

A RICH MARINE NATURAL HERITAGE

Brittany is definitely a maritime region with more than 2700 km of coastline, or one third of the French coastal region 40% of the Breton population resides in the coastal municipalities that represent 18% of the area of Brittany Each of the four departments has a maritime façade most of the settlements are located on the coastline, including a large number of cities-ports.

73 wild mammal species, 128 protected plant species, 7 national natural reserves, two regional natural parks on coastal areas, plus the first French marine park created in 2007: the marine park Iroise.



A DYNAMIC AND CREATIVE MARITIME ECONOMY

The region has thus naturally valorized its maritime assets by strengthening ocean related activities:

- Maritime transport maritime and port activities: In 2013, the sector employed 5791 persons. Brittany is the owner of the ports of Brest, Lorient and St Malo. In 2013, 8 M tons of goods were landed, near 920 000 passengers were transported through trans-Manche channel and 453 000 to the Channel Islands.
- Fisheries and marine aquaculture: Fisheries is an important activity in Brittany (5120 jobs, a fleet of 11251 vessels, a catch value of 301 M€ (103987 tons). The sector of aquaculture is also an important economic sector (1397 jobs, 9571 exploitation licences, 170 M€) plus 91 million euros for cultivation of shellfish.4th
- Naval industries: ship building and maintenance (including leisure) constitutes the 4th industrial sector in Brittany, after food, electronic / information technologies and automotive industries. The sector counts 13700 jobs 18 500 jobs in total.

2.1. OBJECTIVE _____

This report is a compilation of the best available technologies within the partnering regions that can contribute to a business development opportunity for the marine sector. The data for the BAT report was gathered through the contribution of the representative partners from the six participating regions.

2.2. METHOD OF INVESTIGATION _____

To comprehensively assess the sector, it was necessary to collate data on ICT-intensive technologies for all participating regions. For this reason it was designed a common methodology to carry out this task, in which the key factors were the following:

A) Transnational Working Group

A Transnational Working Group (TWG) formed by representatives from the different regions involved was established and its main roles were to:

- I. Provide data around ICT-intensive technologies of interest for the maritime SMEs in their region,
- II. Submit pre-selection reports for their region and
- III. Identify and agree a transnational portfolio of best available technologies for the maritime sector.

B) Survey Questionnaire

The working group prepared a web-based survey questionnaire (Appendix 1), which was used to collect content for the surveillance reports and to elaborate the BAT portfolio.

The questionnaire was designed to undertake a qualitative assessment of technologies and the data collected included:

- Contact details
- Current activities:
 - Description of main activity (products and Services);
 - Whether marine technology is central to the company's activities;
 - The sector(s) the company currently offer products/services;
 - Description of ICT intensive technologies that company/Institution offers
- Potential future development in the maritime sector:
 - Which marine sector is institution/ company already involved in, or whether the organisation could potentially target in the near future;

- Whether the company conducted R&D activities and the level of innovation that exist in the company;
- The focus of any ICT R&D activities and whether they could be of use to the Marine sector;
- Case studies.

Each region (Figure 1) represented on the TWG was responsible for completing the survey for the technologies. They collected and assessed the data for their own region (e.g. desk study, survey, existing databases) and produced technology surveillance reports.

C) Regional Selection criteria

A regional pre-selection exercise was undertaken within each of the six Atlantic Area regions (Figure 1) in the STAMAR project.

This shortlisted the best available technologies for each region, based on the data collected by the TWG. Each region identified 3-5 technologies that could be of use to marine SMEs. The different sources of information and the selection criteria used by each region and the shortlisting methodology used are the following:



Main Activities of STAMAR

Country	Source of Information	Source of Information
Ireland	<ul style="list-style-type: none"> • SmartBay Ireland, managers of the national marine test facility for development of innovative maritime products and services • SmartOcean Industry database 	<ul style="list-style-type: none"> • Potential application area • Maturity of the technology • Value to the marine sector
Scotland (UK)	<ul style="list-style-type: none"> • EuroVIP (EU funded project 2011 – May) • Maritime-Graphics Group, Fraunhofer-Institut für Graphische Datenverarbeitung 	<ul style="list-style-type: none"> • Maturity of ICT tools • Application to marine sector
North Portugal	<ul style="list-style-type: none"> • UPORTO technologies that are protected by Industrial Property Rights (patents) • Analyze the portfolio of ongoing and past maritime sector projects where INESC TEC was involved 	<ul style="list-style-type: none"> • Technologies that are property of UPORTO or INESC TEC or where IP can be negotiated • Maturity of technology (emerging technology) in maritime field of application • Availability for licensing in the marine sector
South Portugal	<ul style="list-style-type: none"> • Company and R&D centre websites • CEO interviews • R&D centre coordinator interviews • UAlg spin-off database 	<ul style="list-style-type: none"> • Technology maturity • Market readiness • Field of application in maritime industry • Strategic relevance of technology domain according to the research developed by UAlg
Galicia (Spain)	<ul style="list-style-type: none"> • Interviews and website searches of R&D institutions, technological centres and firms that develop ICT intensive technologies 	<ul style="list-style-type: none"> • Technology maturity • Application to marine sector
Brittany (France)	<ul style="list-style-type: none"> • Technopôle database (research organisations, groupings and companies) • SATT/Ouest Valorisation database • Pole Mer database 	<ul style="list-style-type: none"> • Technology maturity • Application to marine sector

2.3. RESULTS AND FINDINGS _____

In total, 28 best available technologies that can contribute to a business development opportunity for the marine sector were identified in Ireland, UK, North Portugal, South Portugal, Spain and France. Table 2 summarises the transnational portfolio of BAT in the Atlantic Area and provides detail on the BAT technologies put forward. Almost 60% of the BAT technologies selected are the results of R&D activities in Universities; the remaining technologies were commercially developed. 40% of the technologies represented in the BAT portfolio have little or no prior experience in the marine sector.

Number of best available technologies put forward by each region in their pre-selection reports.

Region	Number of BAT proposed
Ireland	4
Scotland (UK)	3
North Portugal	6
South Portugal	5
Spain (Galicia)	6
Brittany (France)	5
TOTAL	29

Number of best available technologies put forward by each region in their pre-selection reports.

Country	Technology Category	Name of Technology	Description of Technology	% of Business in Marine sector	Applicability of Technology to Maritime SMEs
IRE	Software engineering / development	Enerit / SmartBay Safety Management System Software (Company)	Enerit Systematic Energy Management Software promotes best practice energy management and complete coverage of ISO 50001.	0	Software is being developed to establish it as a safety management system compliant with OHSAS 18001 marine safety management systems.
IRE	Communications - Data management - Sensors / instrumentation / electronics - Software engineering / development	SmartAcq - SmartBay Data Acquisition System (Company)	SmartAcq - Data telemetry system supporting multiple comms channels, variable bandwidth up to 30 mbps. Pre-process data before sending to shore and features a no data-loss scheme.	100	SmartAcq could be used by a variety of users for reliable data transfer e.g. in Aquaculture, Environmental monitoring, Marine renewable energy, Oil and gas, Transport, Shipping.
IRE	Sensors / instruments/ electronics - Materials/ fabrication / assembly	MariaBox - MARine environmental in situ Assessment and monitoring tool BOX (R&D Institution / University)	Mariabox - Marine pollution monitoring device with novel autonomous biosensors for analysis of marine pollutants and assess water quality.	100	Mariabox enables the housing and testing of a large number of marine pollution monitoring devices. Suitable for the Environmental Monitoring and Water Management sectors.
IRE	Communications, Data management - Sensors / instruments / electronics - Software engineering / development	WIMU - Wireless Inertial Measurement Unit (R&D Institution / University)	WIMU - Novel motion sensor that will provide remote, real time, high-frequency sea state data.	100	WIMU has a wide variety of applications, including wave resource assessment and condition monitoring of moorings and fish farms.
Scotland (UK)	Data management - Software engineering / development	Evi from Brookes Bell, Safety at Sea Ltd (Private Company)	EVI - Advanced evacuation simulation software tool.	100	Potential use in a variety of industries e.g. Marine renewable energy, Maritime Services, Oil and gas, Shipbuilding.
Scotland (UK)	Data management - Software engineering / development	ISYS from Brookes Bell, Safety at Sea Ltd (Private Company)	ISYS - Systems-Operability and Failure-Mode-Effect Analysis tool.	100	Potential use in a variety of industries e.g. Marine renewable energy, Maritime Services, Oil and gas, Shipbuilding.
Scotland (UK)	Advanced engineering (including robotics / control systems) - Communications - Data management - Sensors / instruments/ electronics - Software engineering / development	White Space Communications From UoS (R&D Institution / University)	'White spaces' are gaps in radio spectrum in frequency bands, which can be used to offer new wireless applications of benefit e.g. intelligent dynamic communications, signal/image processing. White space technology is one way of meeting the growing demand for data and higher broadband speeds globally in the future.	.	Provision of internet access for ships and boats in areas which this was previously difficult or very expensive. Video streaming of events and animal behaviour, 'machine-to-machine' networks for flood defence.
N Portugal	Advanced engineering (including robotics / control systems) - Communications - Data management - Sensors / instruments/ electronics - Software engineering / development	Self-Automated Parking Lots from University of Porto (R&D Institution / University)	Self-Automated Parking Lots for Autonomous Vehicles based on Vehicular Ad Hoc Networking that could be applied to maritime services.	.	New approach to park unmanned vehicles and (semi-) autonomous vehicles where vehicular communication and remote control technologies are used. Maximising space and minimising the time passengers require for parking.
N Portugal	Communications - Data management - Software engineering / development	Remote Debugging Service from University of Porto (R&D Institution / University)	Remote Debugging Service - method to localize software faults automatically and remotely, using an efficient technique without access to source code - can be used with multiple technologies and systems with distributed components. It may be used with any operating system and programming language.	.	Any software developer is a potential user of this technology e.g. Environmental monitoring - Marine renewable energy - Maritime services - Oil and gas - Security - Transport and shipping - Water management - Other markets.
N Portugal	Communications - Software engineering / development	Resource reservation strategies from University of Porto (R&D Institution / University)	Resource reservation strategies for both synchronous and asynchronous traffic in cooperative clustered OBS (optical burst switching) networks - Advanced periodic resource reservation strategies that fulfil the QoS requirements of heterogeneous traffic, improving the network efficiency and reducing network complexity. Reservation strategies are proposed for the Clustered Cooperative Optical Burst Switching (C2OBS) network architecture service.	.	Suitable for the following sectors: Environmental monitoring - Marine renewable energy - Maritime services - Oil and gas - Security - Transport and shipping - Water management - Other market areas.
N Portugal	Sensors / instrumentation / electronics	PROTEU from INESTEC (R&D Institution)	PROTEU - Advanced optical sensor for monitoring estuarine and coastal environments (specifically temperature but other parameters like salinity, chemical and biological parameters (dissolved CO2, cyanobacteria) are being developed).	100	Technology to monitor temperature and salinity in coastal environments using an innovative fully integrated monitoring infrastructure based on optical fibre. For use in Aquaculture, Environmental monitoring, Water management areas.
N Portugal	Advanced engineering (including robotics / control systems)	TriMares from INESTEC (R&D Institution)	TriMARES - Autonomous Underwater Vehicle (AUV) designed for autonomous inspection; bathymetry, mapping and data collection. Modular structure that allows different sensor package configurations.	100	Marine surveys, installation, operational and maintenance activities. Has been used by Brazilian hydroelectric power companies. Potential use in Marine renewable energy, Maritime services, Oil and gas.
N Portugal	Communications	JANUS-NC from INESTEC (R&D Institution)	JANUS-NC - Multi-technology mesh access point for near coast coverage. Network equipment capable of offering Wi-Fi coverage, while connecting to the Internet via multiple heterogeneous links such as 3G, WiMax and even other Wi-Fi connections.	100	Internet connectivity and services (e.g. VoIP) to passengers on boats near the coast or at the dock. Can also be used to provide a dedicated network for nodes of the same entity.

S Portugal	Communications - Data management - Sensors / instrumentation / electronics - Software engineering / development	Digital Hyd SR-1 developed by MarSensing (Private Company)	Self-Recording Digital Hydrophone - autonomous recording device designed for user-friendly operation in underwater acoustic signal acquisition activities. Its compact construction and functionalities allows for the implementation of efficient measurement strategies, thus, avoiding the requirement of large operational human and material resources for deployment and recovery.	100	Underwater Noise Monitoring, Bio-acoustics, Underwater Acoustic Research, Acoustic Field Calibration and more specifically wave energy device noise monitoring, dolphin monitoring in open waters and captivity, underwater acoustic research in seagrass oxygen production, underwater noise monitoring in coastal aquaculture industries and others.
S Portugal	Communications - Data management - Sensors / instrumentation / electronics - Software engineering / development	DigitalHyd TP-1 - Digital Ethernet hydrophone developed by MarSensing (Private Company)	The digitalHyd TP-1 is an acoustic acquisition device designed for real-time streaming of digital data for remote storage, processing, and/or visualisation. This device has internal processing capabilities allowing, alternatively, to stream results such as spectral analysis.	100	Digital hydrophone suitable for integration in existing platforms. Real-time applications: use in tethered or system integrated configurations. Configurable for real-time on-board data analysis. Ideal for long-term monitoring.
S Portugal	Communications - Data management - Sensors / instrumentation / electronics	Subsurface Telemetry Unit (STU) developed by CINTAL - Centro de Investigação Tecnológica do Algarve (R&D Institution / University)	STU is an underwater array of acoustic and non-acoustic sensors and a cable connected base station (BS). The core function of STU is to serve as an underwater network access point, which functions as an active network node with an established connection to the client sensor node.	100	Technology will facilitate sub-sea communications
S Portugal	Communications - Data management - Sensors / instrumentation / electronics	MIRONE developed by CIMA at the University of Algarve - Centre for Marine and Environmental Research (R&D Institution / University)	MATLAB-based framework tool for display and manipulation of a large number of grid/image formats through an interface with the GDAL library. MIRONE's main purpose is to provide users with an easy to use graphical interface to manipulate GMT grids. In addition it offers a wide range of tools dedicated to the earth science sector, including tools for multibeam mission planning, elastic deformation studies, tsunami propagation modelling, earth magnetic field computations, plate tectonic reconstructions, seismicity and focal mechanism plotting.	100	One very useful tool to the marine sector is as a multibeam planning tool. With this, it is possible to plan multibeam surveys and make the most of scheduled survey time. System requirements simply include a gmt grid (satellite bathymetry is enough) for the region that is being surveyed.
S Portugal	Communications - Data management - Sensors / instrumentation / electronics	Acoustic Oceanographic Buoy (AOB) developed by CINTAL - Centro de Investigaçao Tecnológica do Algarve (R&D Institution / University)	The AOB addresses the requirements for a drifting acoustic recording platform with surface expression. This surface expression allows for on line data transmission to shore	100	Technology will facilitate sub-sea communications
Galicia (Spain)	Software engineering / development	GOVOCTOS from Campus do Mar (R&D Institution / University)	The software Govocitos allows you to make count analysis, measurement and automatic classification of fish oocytes, from histological images of the gonads, also estimating fertility by stereological method and study the dynamics of oocyte development and recruitment. The software presents information in base of a centralized database for sharing and collaboratively reviewing the data.	100	Primary application would be in the aquaculture and fisheries industries to estimate the fecundity of fish eggs. Also adaptable to other sectors: health (cytology, neurology etc.), mineralogy (quantification of rock systems microfaunal system), agriculture (calculating occupied area by crops or forests from satellite imagery areas), and physical materials (estimated porosity of materials).
Galicia (Spain)	Advanced engineering (including robotics / control systems) - Communications - Data management - Materials / fabrication / assembly - Satellite Navigation - Sensors / instrumentation / electronics - Software engineering / development	MANATI by CETMAR (R&D Institution / University)	MANATI is an Autonomous Underwater Vehicle (AUV) equipped with several sensors that can be used to collect marine environmental data such oceanographic data, bathymetric data, submarine mapping data, underwater images, transport information, animal tracking, spillage monitoring, or dredging operations monitoring.	100	This AUV is suitable for use in huge variety of sectors such as the dredging, marine works, marine renewables and public administration sectors.
Galicia (Spain)	Sensors / instrumentation / electronics - Software engineering / development	SAFE SKIPPER by Mytech Ingenieria Aplicada, S.L. (R&D Institution / University)	SAFE SKIPPER is an intelligent ship stability management system that facilitates storage operations in fishing trawlers. SAFE SKIPPER prevents risky situations due to lack of stability of the ship, whether due to overload or incorrect storage, providing vital information in order to avoid endangering the ship or crew.	45	Excellent potential for the fishing and shipping sectors.
Galicia (Spain)	Advanced engineering (including robotics / control systems) - Communications - Data management - Materials / fabrication / assembly - Satellite Navigation - Sensors / instrumentation / electronics - Software engineering / development	XEO HD TV by HCTech - Hercules Control, S.L. (Company)	XEO HD TV is a powerful tool to allow underwater goferenced video recording up to 100 m. depth. This project comprises both hardware (HD camera and its housing) and software development (HD video visualization and map visualization of each recorded track).	90	The equipment is designed to be used by firms and institutions in seabed inspection, cartography definition, marine heritage, shipwrecks, and so on. Therefore potential SME users would include environmental consultants, engineering firms, fishing inspection, scientific and technological research.
Galicia (Spain)	Communications - Data management - Software engineering / development	DIRECTION WAVE SENSOR by HCTech - Hercules Control, S.L. (Company)	HCTech has developed this software which allows direction wave measurement (based on acceleration measurement) at a low cost allowing for reduced sensor prices. The software balances deviations and gives an accurate, multi-parameter and reliable result. This technology is embedded in marine buoys which are used by support authorities and marinas which use wave information for navigation aid in port access.	90	Meteorology institutions, oceanographic observatories, environmental consulting and engineering firms as well as research institutions can be users of this technology.

Galicia (Spain)	Communications - Data management - Software engineering / development	CALIPESCA (Company)	CALIPESCA is a R&D project based on the fisheries value chain, starting from the capture stage and finishing with sale of the catch on the market. The goal is to optimize communication and logistic processes in the value chain to provide more information to producers and producing organisations on the catch of fishing vessels thereby allowing more informed buying decisions to be made. This will reduce the labour carried out by producers and producing organisations.	30	Fishing industries, primarily in the first sales note management area as well as first sale traceability documentation, self-service automated buying systems.
France	Advanced engineering (including robotics / control systems) - Communications - Sensors / instrumentation / electronics - Software engineering / development	MAGSALIA by Tellus Environment (Company)	Instrument for research of oilfield and aquifer developed in a specialized oceanic studies laboratory. Recordings of both the natural Electro-Magnetic activities of rock (EM method) and the Marine Controlled Source Electro-Magnetic signals (MCSEM).	100	Oilfield Exploration, Aquifer Detection, Detection of metallic structures
France	Advanced engineering (including robotics / control systems) - Sensors / instrumentation / electronics	MOBESENS (MOBILE water quality SENsor System) by Ifremer (R&D Institution / University)	MOBESENS is an autonomous surface drone capable of measuring various water quality parameters and taking samples in the water column in coastal zones, estuaries and lagoons.	100	Environmental monitoring (surface and subsurface measurements), wave energy resource assessment, Regular water quality measurement and monitoring.
France	Advanced engineering (including robotics / control systems) - Communications - Sensors / instrumentation / electronics - Software engineering / development	MAPPEM (3D mapping base d on electromagnetic technology) MAGSALIA technology and prototype	A new marine sub-bottom profiler, based on electromagnetic techniques. This technology provides a new vision of the structures and the localization of buried objects in sediment, particularly in areas where acoustic techniques cannot provide enough information (gas, acoustic masks).	100	Geophysical Surveys, site investigation for buried objects, defence and security industries, oilfield exploration and aquifer detection.
France	Advanced engineering (including robotics / control systems) - Communications - Sensors / instrumentation / electronics	BOB (Bubble Observatory module) by Ifremer (R&D Institution / University)	BOB is an autonomous acoustic surveillance system based on a single beam echo sounder designed to observe targets in the water column, in particular fluids and gas flows escaping from the sea floor.	100	Surveillance of natural risks (e.g. tsunamis, earth quakes) of industrial sites, underwater emissions (e.g. methane).
France	Advanced engineering (including robotics / control systems) - Communications - Sensors / instrumentation / electronics	MeDON (Marine e-data Observatory Network) by Ifremer (R&D Institution / University)	Cabled submarine observatory that enables continuous surveillance of the underwater medium via video images (monitoring physicochemical parameters, current measurements and acoustic data acquisition).	100	Subsea sensors / equipment testing and development, environmental monitoring / data collection and research and development.

BAT TECHNOLOGIES IN DEPTH



ENERIT / SMARTBAY SAFETY MANAGEMENT SYSTEM SOFTWARE

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Website	www.enerit.com www.smartbay.ie



• Key words

Software engineering / development

• Description

Enerit Systematic Energy Management Software promotes best practice energy management that offers complete coverage of ISO 50001. This collaboration between Enerit and SmartBay proposes to modify the software to be used as a safety management system for vessels.

Enerit Ltd. – Enerit is the first and only company in the world to develop systematic energy management software which provides complete coverage of ISO 50001. Enerit has been extensively involved in the development of the ISO 50001 standard and since 2006; Enerit has helped leading organizations to prepare for the roll-out of ISO 50001, using the IS 393 energy management standard. Although primarily an energy management system, Enerit has a flexible software solution to meet a variety of requirements.

SmartBay Ireland Ltd. – SmartBay Ireland offers a complete range of marine services to all users of the national marine test and demonstration facility. As part of its services, SmartBay fosters commercialisation initiatives to develop ICT products and services for the global maritime sector. SmartBay provides technical business

support to local SMEs and MNCs to develop maritime related applications. SmartBay brokers partnerships which include both national and international researchers, SMEs and MNCs. The ultimate aim is to translate research into innovative products and services which will result in economic growth and job creation for Irish companies.

Enerit Ltd has developed their software which enables companies and organisations to manage their energy use in an efficient manner. The main strengths of Enerit and their software are:

- Enerit is an established company and have input considerable resources into developing the software for the last 10 years.
- Intellectual property (IP) is in place protecting the software developed by Enerit Ltd.
- Enerit is ISO 5001 certified for Energy Management

• Applicability of Technology to Maritime SMES

SmartBay Ireland will assist Enerit Ltd by bringing the software already developed for energy management into the marine sector. SmartBay will licence the software from Enerit and develop it further, establishing it as OHSAS 18001 certified Occupational Health & Safety software with particular use in marine safety management systems to comply with health and safety procedures.

SmartBay will develop the route to a marine market, with the aim of using P&O Maritime as a demonstration case for the software. Although safety management systems exist, there are few specific systems in place to deal with Occupational Health & Safety in a marine work environment. This software solution will provide a document management system for Quality, Health and Safety, putting a hierarchy in place for editing and publishing documents, while allowing the most current version of the document to be available to a user at any time, in any location.

SMARTACQ – SMARTBAY DATA ACQUISITION SYSTEM

Institution/Company name	SmartAcq – SmartBay Data Acquisition System
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• Key words

Communications - Data management - Sensors / instruments / electronics - Software engineering / development

• Description

SmartAcq is a next generation communications solution providing resilient and reliable networked communication to and from buoys in all weather conditions. Adding on buoy services and replacing the current power hungry solution. SmartAcq Architecture comprises of 5 core services;

1. Buoy Client
2. Sensor Data Server
3. Database service
4. Catchup service
5. Off mooring tracker service

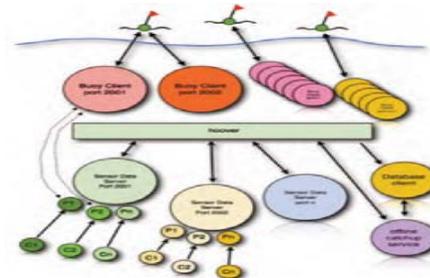
- Highly parallelised architecture

- Easily configured and scales automatically

The SmartBay SmartAcq Architecture incorporates features to maximise use of available communications bandwidth and secure delivery of data using compression and VPN connectivity. A key feature of SmartAcq is its resilient data communications module. This facilitates maintaining multiple data links in a harsh marine environment at sea where there are potential interruptions to data flow particularly in adverse weather conditions.

The Software on the SmartAcq base station receives the data from the remote Hoover platform controller and stores it internally. In addition to this, it can also write the data in a number of different formats as follows:

- To a file on the local disk
- To a file on a share on the local network
- To a SQL based server, such as MS SQL server, Oracle...
- Remotely to an FTP server



• Applicability of Technology to Maritime SMES

SmartAcq is a data telemetry system developed in-house by SmartBay. It supports multiple communications channels to shore, with variable bandwidth up to about 30mbps including Wi-Fi, 3G, UHF/VHF or satellite (on-demand). SmartAcq can receive data in analog or digital form from over 30 sensors simultaneously, pre-process this data and send it to shore in a secure way, featuring a no data-loss scheme to preserve data collection when the links to shore break. The system is configurable and monitorable over the air.

The software on the base station allows the rapid visualisation and management of the remote platforms, including remote access to vital systems on health information as well as details on power status. The user friendly interface allows simple administration of metadata related to the systems, as well as updating of calibration information for instruments and managing general data collection issues. The frequency and format of the data messages can be controlled by the end user depending on operational requirements.

SmartAcq could be used by a variety of users for reliable data transfer e.g. in Aquaculture, Environmental monitoring, Fisheries, Marine renewable energy, Oil and gas, Transport and shipping.

MARIABOX – MARINE ENVIRONMENTAL IN SITU ASSES-

Institution/Company name	MariaBox – MARIne environmental in situ Assessment and monitoring tool BOX
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SMART BAY MONITORING TOOL BOX

• Key words

Sensors / instruments/ electronics - Materials / fabrication / assembly

• Description

MariaBox is a four year project which is funded under the European Commission's Seventh Framework Programme. SmartBay Ireland and Dublin City University are part of the MariaBox European Research Consortium that will trial and validate a new sensor for detecting biohazards and man-made chemicals.

MariaBox will develop a wireless marine environment analysis device for monitoring chemical and biological pollutants while installed into a buoy, a maritime means of transport or a mooring. The device, based on novel biosensors, will be of high-sensitivity, portable and capable of repeating measurements over a long time, allowing permanent deployment at sea. The word "MARIA" is the plural of the Latin "mar" (sea) and expresses the wide applicability that this system offers in multiple locations where low-cost and real-time in situ analytical monitoring devices are required.

Due to growing concerns about the health of our oceans and their capacity to continue to provide resources as well as associated risk of declining water quality for the general population there is an increasing demand for real-time monitoring of the environmental status of marine water quality and the provision of early warning systems.

The ambitious project aims to deliver a Marine Pollution-Monitoring device based on new biosensors, implemented as a set of autonomous modules for the analysis of marine pollutants and the assessment of water quality. New biosensors for monitoring five man-made chemicals and four categories of microalgae toxins affecting the Aquaculture industry will be developed in parallel. SmartBay will lead the development of an innovative software platform and mobile applications, which will allow for data collection and distribution in near real-time. These data will be available and interfaced to Global Monitoring for Environment and Security (GMES) services. A pilot test will also be performed in Galway Bay.

• Applicability of Technology to Maritime SMES

MariaBox – A wireless, portable marine environment analysis device, based on novel biosensors of high sensitivity, capable of autonomously repeating measurements over a long period of time for marine chemical and biological pollutants and water quality assessment has potential for a wide variety of users in the Environmental Monitoring and Water Management sectors.

The MariaBox system is suitable for free floating devices, buoys, ships, or to be used as a portable instrument.

The novel biosensors will allow monitoring of man-made chemicals (pesticides, heavy metals) and 4 categories of microalgal toxins.

WIMU – WIRELESS INERTIAL MEASUREMENT UNIT

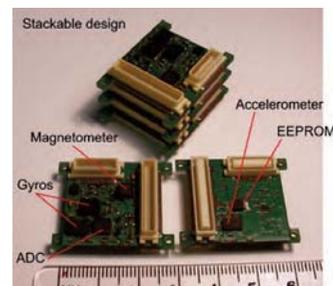
Institution/Company name	WIMU – Wireless Inertial Measurement Unit
Contact details	Tyndall National Institute, Dyke Parade, Cork Michael Walsh michael.walsh@tyndall.ie +353 21 490 4440
Website	www.tyndall.ie/content/inertial-sensing-systems

• Key words

Communications, Data management - Sensors / instruments / electronics - Software engineering / development

• Description

Wireless Inertial Measurement Unit (WIMU) – Recently developed, Tyndall's planar inertial measurement unit has been designed with the focus on various requirements. The planar WIMU coupled with the 2.4GHz transceiver, RF Nordic nRF2401, produces a very powerful customisable wireless node. Alternative implementations enable the Zigbee (IEEE 802.15.4) communications in the 25mm form factor if required. Thanks to high spec motion sensors used and variability of ranges the IMU can be used in a wide range of applications including sport player motion tracking or accuracy improvement for GPS based systems. Additional external data processing or Kalman filtering can be implemented on coupled PC or attaché microcontroller/DSP board.



25mm Wireless Inertial Measurement Unit (WIMU) – The Tyndall 25mm WIMU is a 6 DOF IMU module, which is made up of an array of inertial sensors coupled with a high resolution analog to digital converter (ADC). The 25mm WIMU module utilises the wireless communication capabilities of the 25mm wireless node to realise a fully autonomous WIMU module.

Accelerometer: 2xADXL202, analog
Magnetometer: 2xHMC1052L, analog
Gyroscope: 3xADXRS150, analog
12 bit ADC

The inertial sensor array consists of three single axis gyroscopes, ADXRS150 from Analog Devices, two dual axis accelerometers, ADXL202 from Analog Devices, and two dual axis magnetometers, HMC1052L from Honeywell. The sensor array was designed with a novel 3D structure, which produces the 6 required degrees of freedom (DOF) necessary to determine position. The module also has a 12-bit ADC chip, AD7490 from Analog Devices, handling the data conversion. This chip has a Serial Peripheral Interface (SPI), which allows easy interfacing to the ATMEL microcontroller.

IMU & GPS Data Merging – The IMU data can be used to improve accuracy and resolution of traditional GPS systems or provide short time localization data when the GPS signal is not available. Tyndall 25mm GPS mote can be linked to the 25mm WIMU or planar WIMU to provide a combined system where long term accuracy is given by GPS while short term improved resolution can be increased by using IMU sensor data. Both inputs can be processed using Kalman filtering technique to provide localization and orientation data with improved accuracy. The whole system can be also equipped with RF transceiver for wireless data transmission.

• Applicability of Technology to Maritime SMES

WIMU is a low power, low cost solution to the more tried and tested (accurate but expensive) wave buoys. Tyndall's WIMU motion sensor is in development and further testing is scheduled for 2015. Previously it has been tested and validated in SmartBay's data buoys. WIMU provides:

- Real time, high-frequency sea state data
- Wave Measurement
- Ocean surface random wave heights, periods and directions

The device is suitable for deployment on a variety of platforms and for a number of different purposes;

- Data Buoys for wave resource assessment purposes
- Fish Farms for condition monitoring
- Novel Mooring Systems for testing and condition monitoring

EVI – EVACUABILITY INDEX

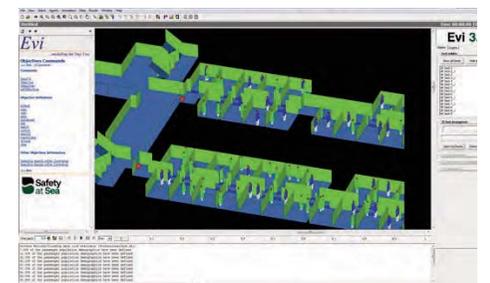
Institution/Company name	Brookes Bell, Safety at Sea
Contact details	2nd Floor, 280 St Vincent street, Glasgow, G2 5RL Liverpool office: Martins Building, Water Street Liverpool, L2 3SX Luis Guarin l.guarin@safety-at-sea.co.uk +44 (0)7852 934422
Website	www.brookesbell.com/

• Key words

Data management - Software engineering / development

• Description

The software environment Evi (the acronym stemming from: Evacuability index), exploits a virtual environment for enhanced effectiveness of evacuation performance evaluation. It represents the state-of-the-art computer simulation-based capability for the prediction of passenger mustering and evacuation involving a number of escape and rescue scenarios (abandon ship, transfer to refuge centres or a combination of these) in a range of incidents (fire, collision, progressive flooding, cargo shift, foundering) whilst accounting for ship motions in a sea environment. Unlike earlier models, Evi has been developed from the outset for application to passenger ships in a sea environment, including the largest cruise liners and Ropax. Valuable input and feedback from the owners/operators helped refine and render the model into a practical tool which, coupled to modelling of uncertainty in all the parameters that may affect evacuation times and the ability to play back a given scenario as video, provide for wide-ranging capability in modelling realistically the most complex of evacuation scenarios thus allowing for routine application of passenger evacuation analysis. The latter entails a wide range of evacuation capabilities including evaluation of evacuation time, potential bottlenecks, assess-



sment of accommodation module layout and sensitivity analyses to assist design for ease of evacuation, passenger familiarisation with a ship's environment, "what if" scenarios for training, devising effective evacuation planning procedures/strategies and decision support to manage a crisis. Evi is available in the form of a computer program that can be readily customised to any vessel environment with an efficiently tailored user interface and Run Time Simulator (RTS). Typically, simulation of 5,000 passengers mustering on a 17-deck vessel can be achieved at real time.

EVI is a software tool developed by SaS (Safety at Sea Ltd) used to simulate pedestrian movement in any environment. It has been used extensively to model circulation and evacuation of persons from ships, offshore structures and buildings.

Applications

- Evacuation analysis (MSCCirc.1238)
- Cruise ships layout development
- Passenger terminals turnaround time assessment
- Escape Evacuation and Rescue Assessments (EERA) for offshore installations.

Key features

- 3-D interactive simulation environment,
- Real-time user-interaction
- State-of-the-art agent-based modelling
- Semi-continuous space modelling
- Statutory or user-defined agent demographics
- Probabilistic analysis and Monte-Carlo simulations
- Impact assessment of casualty scenarios (fire and flooding)

• Applicability of Technology to Maritime SMES

Potential use in a variety of industries e.g. Marine renewable energy, Maritime Services, Oil and gas, Shipbuilding.

ISYS

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Website	www.brookesbell.com/

• Key words

Data management - Software engineering / development

• Description

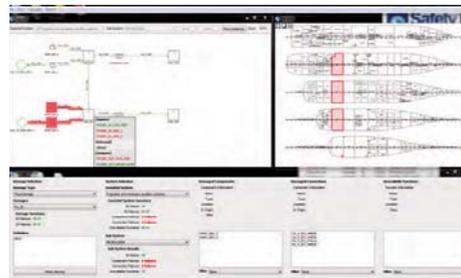
ISYS is a Systems operability analysis tool developed to verify compliance with "Safe Return to Port" requirements, SOLAS II-2. Entering into force on July 2010, this new regulation, applied to large Passenger Vessels and highly occupied Special Purpose Ships, recognises adage that "A ship is its own best lifeboat".

The Safe-Return-to-Port regulations provide performance requirements for 'essential systems' that must be demonstrated to remain operational following fire and flooding damages that do not exceed a certain pre-defined "casualty threshold". ISYS can support the customer to apply the Safe Return to Port criterion correctly and efficiently by performing the overall and detailed systems analysis. ISYS enables the components and connections involved in complex and interrelated ship systems to be easily modelled. This is done within the geometric subdivision of the vessel by the use of logical expressions defining dependency. ISYS allows all of the IMO required essential systems to be modelled in a unique analysis frame, including the connections between systems. The damage scenarios required by the regulations are then input into the ISYS model and the availability of each of the essential systems is determined for each damage case. The system automatically generates reports for submission for approval and can also be used to create ship documentation for crew operating procedures.

ISYS is a software tool developed by SaS (Safety at Sea Ltd) to assess ship systems operability and vulnerability. The tool is aimed at concept/basic design of vessels where vital operating systems and safety-critical systems are typically assessed for reliability and vulnerability. At present, this type of analysis is required by SOLAS mainly for large passenger ships and is routinely undertaken for offshore vessels as part of the Formal Safety Assessment process.

Key features

- Interactive GUI: Working environment integrates (1) watertight subdivision, (2) arrangement of fire compartmentation



and (3) systems topological diagrams.

- Efficient data management: The program runs on a SQL database which allows multiple users working on the same project and allows detailed tracking of changes and updates.
- Assessment of both physical damage and impact on system functionality / operability.
- Automatic report generation and documentation: customised for (i) design iterations, (ii) FMEA verification or (iii) statutory approval.

• Applicability of Technology to Maritime SMES

Potential use in a variety of industries e.g. Marine renewable energy, Maritime Services, Oil and gas, Shipbuilding.

WHITE SPACES COMMUNICATIONS

Institution/Company name	University of Strathclyde
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• Key words

Advanced engineering (including robotics / control systems) - Communications - Data management - Sensors / instruments/ electronics - Software engineering / development

• Description

'White spaces' are gaps in the radio spectrum in frequency bands, which can be used to offer new wireless applications to benefit consumers and businesses.

Industry is already testing a range of uses for this technology, such as internet access for ships and boats in the Orkney Islands, wireless video streaming of animals at ZSL London Zoo, new 'machine-to-machine' networks for flood defence in Oxfordshire and Wi-Fi-like services at the University of Strathclyde.

On 12th February 2015 the Office of Communications (Ofcom), independent regulator and competition authority for the UK commu-



nications industries, gave the green light for industry to harness the benefits of an innovative new wireless technology, following a series of successful industry trials.

White space spectrum in the TV frequency band is appealing for industry because it can travel longer distances and more easily through walls than the bands mainly used by other wireless technologies, such as Bluetooth and Wi-Fi.

Ofcom is now putting in place the foundations for industry to use TV white spaces. A key part of this work has been to allow these airwaves to be shared, while managing the risk of interference for current users. To avoid interference, databases will communicate with these devices to give them technical constraints they must operate within. These databases identify locations, frequencies and times where white space devices will not affect existing users and will apply rules, set by Ofcom, which put limits on the power levels they can operate at.

These frequencies are currently used for digital terrestrial TV, and on a sharing basis with wireless microphones used for programme making and special events (PMSE), among other services.

Based on the trials and stakeholder feedback, there is considerable interest from industry in developing this technology. Ofcom believes commercial applications for this white space technology could emerge by the end of the year.

Ofcom is exploring how the white space in other spectrum bands could be used for similar innovation in the future.

Ofcom is also supporting other forms of wireless innovation and has already released spectrum which can be used for machine-to-machine networks.

The UK is among the first countries in Europe to provide spectrum specifically for this technology, which will form a major part of what is becoming known as the 'Internet of Things', networks of devices communicating with each other online.

There has been considerable interest in the technology with multiple trials running across the UK. Both public and private organisations are taking part, testing a variety of innovative applications, using spectrum temporarily licensed by Ofcom:

- Live video streaming: Google and ZSL London Zoo, along with equipment providers MediaTek and 6Harmonics, have launched a trial this week to use a TV white space network to stream live video of the Zoo's meerkats, Asian otters and giant Galapagos tortoises to YouTube. The trial will use Google's spectrum database and will help ZSL London Zoo test the technology for use in additional efforts to monitor and protect endangered animals in the wild.
- Flood defence: using TV white space technology, Love Hz and Nominet are working with the Oxford Flood Network, a citizen-built wireless sensor network, which provides early flood warnings for the community. Water levels are monitored in real-time and sent over white space using Adaptrum devices.
- Next generation Wi-Fi and city sensing: The University of Strathclyde's Centre for White Space Communications has been working with Microsoft, 6Harmonics, MediaTek, Spectrum Bridge, and Sky - with backing from the Scottish Government. The pilot explores how the latest technology, including triple-band Wi-Fi, can enhance internet coverage in indoor and outdoor urban locations and enable 'smart city' functionality, including linking webcams and other sensors.
- Internet on ships and boats: CloudNet IT Solutions, Fairspectrum and Carlson Wireless Technologies are using white spaces to provide internet connectivity and communications to ferries travelling in the Orkney Islands and Pentland Firth, which have no wireless broadband availability. CloudNet are also looking to extend this trial to other transport operators in the area. Separately, Microsoft, Neul and 6Harmonics have been working with Click 4 Internet on the Isle of Wight to test how the technology could work with boats at sea.
- Broadband coverage enhancement: King's College London, the Joint Research Centre of the European Commission, and Eurecom, are leading an EU effort to investigate various scenarios for providing backhaul over TV white space to achieve broadband access in challenging situations. This includes studying long-distance roof-top white space links and long-distance in-building and between-building white space links. As well as coverage enhancement, these services could provide broadband for security, emergency and disaster relief situations. An important capability being investigated is the aggregation (merging) of TV white space links and channels to maximise capacity and address challenging and innovative communication applications.

White space technology is one way of meeting the growing demand for data in the UK. Ofcom is separately planning to free up more

spectrum later this year, or early 2016, potentially for high speed mobile broadband. This follows the successful completion of the 4G mobile spectrum auction in 2013.

White Space Trial on the Isle of Bute, Scotland

On 27th March 2012, a collection of journalists and reporters visited the Isle of Bute to hear about the White Space rural broadband trial that is taking place on the southern part of the island. They were given an overview of BT's plans to increase broadband coverage in rural areas by BT Scotland Director, Brendan Dick, and this was followed by an overview of the White Space trial on Bute, given by Chris Gibbs, Director of Insight, Innovation, and Futures at BT Openreach.

A number of local residents participating in the trial gave accounts of how the arrival of broadband has transformed their lives. Many of them run their own local businesses and the ever-increasing drive to do all manner of things on-line (e.g. tax returns, ordering of supplies, checking livestock pedigree) makes decent broadband connectivity more of a necessity than a luxury nowadays.

The BBC's technology correspondent, Rory Cellan-Jones, was able to make a video call on his iPad from a remote location some 5-6km from the local telephone exchange, something that would have been completely unthinkable 12 months ago.

The trial on Bute is supported by the UK's Technology Strategy Board, and involves six collaborating partners - BT, BBC, Netprogate, Berg Design, Steepest Ascent, and the University of Strathclyde.

• Applicability of Technology to Maritime SMES

Provision of internet access for ships and boats in areas which this was previously difficult or very expensive. Video streaming of events and animal behaviour, 'machine-to-machine' networks for flood defence.

SELF-AUTOMATED PARKING LOTS

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• Key words

Advanced engineering (including robotics / control systems) - Communications - Data management - Sensors / instruments/ electronics - Software engineering / development

• Description

Self-Automated Parking Lots for Autonomous Vehicles based on Vehicular Ad Hoc Networking discloses a new approach to park unmanned vehicles whereas vehicular communication (V2V, V2I), (semi-) autonomous vehicles and remote control technologies are used. The automated parking lots maximize space and minimize the time passengers require for parking.

Background

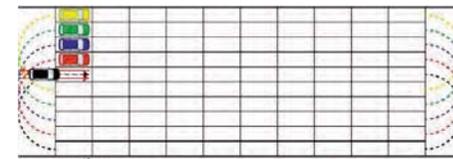
Urbanization along with an increased number of vehicles leads to major implications on the urban landscape. While traffic congestions are one major impact, it is the phenomenon of "cruising for parking" that causes a surprisingly high amount of traffic. Besides, space within the urban area is getting scarce and thus more expensive.

In order to counteract this trend several solutions to effectively use parking space have been proposed.

Automated parking systems have been developed to cut space requirements by as much as 50%. However, those systems, which mechanically move the vehicles, are very expensive as well as complex in their operation and maintenance.

Benefits

Henceforth, a new concept will be presented to park (semi-) autonomous vehicles, safe space and time and thus reduce the costs of car park owners.



The novelty of this invention is the use of vehicular communication (e.g. wireless, VANET, etc.), (semi-) autonomous vehicles and remote controller technologies to offer an optimized parking lot solution, which is related to an efficient parking and retrieval configuration. This invention can be considered a better alternative when compared to the automated parking lots with electric elevators, rolling and rotating platforms due to the self-mobility of the

(semi) autonomous vehicles which eliminates the use of mechanical devices.

The results of computer based simulations indicate that by applying the new concept, space and time can be reduced. Besides, a vehicles total distance travelled compared to conventional parking lots can be reduced by as much as 30%.

• Applicability of Technology to Maritime SMES

The present invention may be incorporated in electrical vehicles with ad hoc networking. Intended users and beneficiaries of this invention are parking lot owners/operators, (semi-) autonomous vehicles' owners/drivers as well as car park owners and car manufacturers.

REMOTE DEBUGGING SERVICE

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• Key words

Communications - Data management - Software engineering / development

• Description

The present invention discloses a method to localize software faults automatically and remotely, using an efficient technique without access to source code. This debugging technology allows the use of remote network service on software under test, which can be composed by multiple different systems and used distributed architectures.

Background

Software is built upon source code written in a given programming language. Being a (mostly) manual task, software may have several faults, mainly on large projects. When a fault is activated at execution time, the behaviour may not be the expected one, leading to (catastrophic) failures. One of the most cumbersome and expensive tasks during software development is the localization of the root cause of failures (known to cost the US economy alone 60B dollars). Several approaches were developed to provide automatic debugging

features. However, they are not easily applicable to current software systems. Some of these techniques require a complete rewrite of the source code. Moreover, almost all of these techniques require full access to the source code that may lead to privacy issues when dealing with debugging tasks performed in third party entities. Furthermore, these techniques are not ready to be used in technological heterogeneous and/or large distributed systems.

Benefits

With this technology it is possible to fill the main gaps of the currently available automatic debugging techniques. It allows the creation of a remote debugging service that may be used with multiple technologies and systems with distributed components.

It may be used with any operating system and programming language. Due to its nature, it also guarantees the source code confidentiality because it never accesses it (it only access to data collected during the software runtime). This technology enables the offer of remote debugging services to the software industry, increasing efficiency and reducing costs and development time. It may be accessible from any part of the world and can be used with several different application paradigms (local applications, web applications, mobile applications, embedded devices, and several others). According to academic and industrial studies, this technology reduces the debugging task effort in up to 75%. The users who participated in these studies found the output produced by this technology fundamental to find the software faults. This technology has a very high accuracy that may lead the software developer directly to the faulty line of code. The Remote Debugging Service is also very fast, not only because it may be used in already implemented systems without much effort, but also because it is based on fast algorithms, and because the more demanding processing is done off-site. This allows the use of this service in devices presenting low computational resources.

Applicability

The remote debugging service can be used by the entire software industry, namely on critical systems but also in all the entities who need to debug their software, namely: software houses, independent software developers, consultancy agencies, specialists from academia, etc. Any software developer is a potential user of this technology. Software developers are present in every organization that develop software to use internally or to market (software houses). Furthermore, it may also be used by teams of software testers, software debuggers, and the ITC consulting professionals (in particular, from software quality and reliability fields). Due to the architecture of this technology, it also enables the creation of a new concept: debugging as a service. The users may subscribe the service and be only charged according to the used resources. It also allows the exploration of a "Freemium" model, to boost the dissemination of this technology.

• Applicability of Technology to Maritime SMES

Any software developer is a potential user of this technology e.g. Environmental monitoring - Marine renewable energy - Maritime services - Oil and gas - Security - Transport and shipping - Water management - Other markets.

RESOURCE RESERVATION STRATEGIES

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• Key words

Communications - Software engineering / development

• Description

RESOURCE RESERVATION STRATEGIES FOR BOTH SYNCHRONOUS AND ASYNCHRONOUS TRAFFIC IN COOPERATIVE CLUSTERED OBS NETWORKS discloses advanced periodic resource reservation strategies that fulfil the QoS requirements of heterogeneous traffic, improving the network efficiency and reducing network complexity. The reservation strategies are proposed for the Clustered Cooperative Optical Burst Switching (C2OBS) network architecture offering a circuit like service without two way end-to-end reservation, while still benefiting from a high level of statistical multiplexing by employing only OBS nodes.

Background

Optical backbone networks carry both synchronous and asynchronous traffic. The synchronous traffic is mostly from telecomm operators utilizing legacy SONET/SDH over WDM, while the asynchronous traffic comes from IP networks which is also transported over WDM networks over long distances, and is either streamed long flows such as video on demand, video streaming, video conferencing, VoIP and e-science applications, or on-demand bursts.

In the WDM layer, optical circuit switching (OCS) has been widely deployed so far, but it can be potentially bandwidth inefficient especially for highly bursty self-similar traffic such as IP traffic from several different sources.

For this reason, optical burst switching (OBS) has been proposed as an alternative to OCS that increases statistical multiplexing at a sub-wavelength granularity. Unfortunately, classical OBS still cannot fulfil the QoS requirements of time constrained, loss intolerant, synchronous and streamed long flow traffic.

The present invention presents two advanced periodic resource reservation strategies for efficiently transporting both synchronous and asynchronous streamed long flows over the C2OBS network architecture, respectively called C2OBS Synchronous Resource Reservation Scheme (C2OBS-SRR) and C2OBS Asynchronous Flow Resource Reservation scheme (C2OBS-aFRR).

Benefits

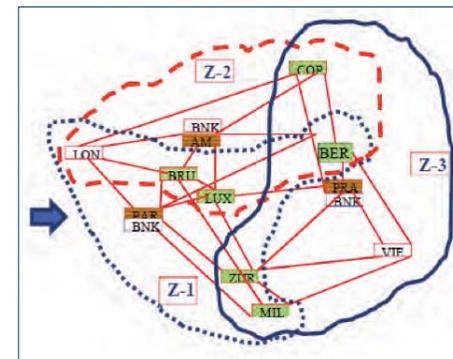
The proposed reservation strategies emulate a circuit like service for QoS constrained traffic over an optical burst switching node architecture, without two way end-to-end reservation, while reducing burst drop probability, delay, and jitter.

Moreover, these periodic resource reservation strategies deliver the above said advantages while still operating over a OBS like network architecture which uses relatively simple nodes when compared to other proposed alternatives. [1-13]

Applicability

Optical burst switching is envisioned as one of the promising technologies for future optical backbone networks. However, classical JET OBS is not suitable for synchronous and streamed long flow traffic due to both its relatively high burst loss probability and end-to-end delay. Furthermore, burst header packet (BHP) generation, transmission, processing and switch fabric reconfigurations for each burst results in an enormous overhead when transmitting synchronous traffic.

The proposed reservation strategies will be applied in future optical burst switching backbone networks for supporting heterogeneous



traffic, synchronous traffic from telecomm operators, and asynchronous streamed long flow traffic from IP networks. The proposed strategies reserve resources in advance for both types of traffic, resulting in a reduced burst loss probability and end-to-end delay. Moreover, both types of traffic are supported by employing only OBS switches resulting in lower capital cost and OAM expenditure, unlike hybrid switches which require two or more types of switches.

• Applicability of Technology to Maritime SMES

Suitable for the following sectors: Environmental monitoring - Marine renewable energy - Maritime services - Oil and gas - Security - Transport and shipping - Water management - Other market areas.

PROTEU - ADVANCED OPTICAL SENSOR FOR MONITORING ESTUARINE AND COASTAL ENVIRONMENTS

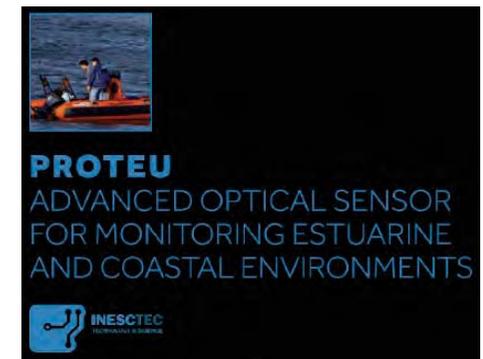
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• Key words

Sensors / instrumentation / electronics

• Description

Technology to monitor temperature and salinity in coastal environments using an innovative fully integrated monitoring infrastructure based on optical fibre. As part of the research project PROTEU, an 11 km optical fibre cable, with Bragg sensors placed every 500



eters, was installed that runs from the mouth of the Ria de Aveiro and follows the Espinheiro channel bed to the Vouga river. This made it possible to measure the water temperature at each sensor location in real-time. The results of this project are currently being used in several studies concerning the Ria de Aveiro and the surrounding area and are crucial for continuous environmental assessment and management.

This technology is now being explored further and will be able to measure salinity and other chemical and biological parameters (dissolved CO₂, cyanobacteria) making it an advanced analytical tool for the monitoring and study of marine conditions in estuarine environments.

MAIN FEATURES

- Electromagnetic immunity
- Based on standard telecom optoelectronics
- Multipoint detection
- High sensitivity
- Real-time remote operation
- Quasi distributed sensing
- Adaptable for the detection of other environmental parameters

SPECIFICATIONS

11 km Optical fibre cable (TON GERE from CABE LTE S.A.) with three SMF 28^o optical fibres with 19 Fibre Bragg grating temperature sensors distributed every 500 m. Cable anchored to the river bed with concrete structures placed every 500 m in the vicinity of the sensors.

• Applicability of Technology to Maritime SMES

Technology to monitor temperature and salinity in coastal environments using an innovative fully integrated monitoring infrastructure based on optical fiber. For use in Aquaculture, Environmental monitoring, Water management areas.

TRIMARES – AUTONOMOUS UNDERWATER VEHICLE

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• Key words

Advanced engineering (including robotics / control systems)

• Description

TriMARES is an underwater vehicle designed for autonomous inspection, bathymetry; mapping and data collection. TriMARES' modular structure allows different sensor package configurations. Its increased capacity to transport sensors allows it to carry an on-board high resolution video camera, as well as different types of sonar equipment. It can move smoothly in the water, increasing the quality and georeferencing of the collected data.

TriMARES was developed in 6 months by INESCTEC and commissioned by a consortium of Brazilian hydroelectric power companies (CEB Lajeado, EDP). The first unit was exported to Brazil in 2011.

MAIN FEATURES

- Modular construction with reconfigurable sections
- Spare ports to accommodate additional payload sensors
- Robust and safe with fully shrouded moving parts
- Operates in confined spaces- able to ascend/descend on the vertical
- Hovering in the water column -station keeping and close inspection
- 5 degrees off freedom (surge, sway, heave, yaw, pitch)
- Autonomous operation with simple mission definition
- Rechargeable Li-Ion batteries
- Low maintenance
- Optional fiber-optic umbilical for real-time video/data transmission
- (ROY mode)

SPECIFICATIONS

- Length: 1.3 m II Total width: 80 em II Overall height: 50 em II Weight: 75 kg
- Maximum depth: 100m
- Horizontal speed: 0-2 m/s. variable //Vertical speed: 0-0.3 m/s, variable



- Autonomy/Range: 10 hrs/40 km
- Typical sensors: video camera, high sensitivity still camera, multi beam sonar;
- sidescan sonar, CTD, turbidity, fluorescence

• Applicability of Technology to Maritime SMES

Marine surveys, installation, operational and maintenance activities. Has been used by Brazilian hydroelectric power companies. Potential use in Marine renewable energy, Maritime services, Oil and gas.

JANUS-NC - MULTI-TECHNOLOGY MESH ACCESS POINT FOR NEAR-COAST COVERAGE

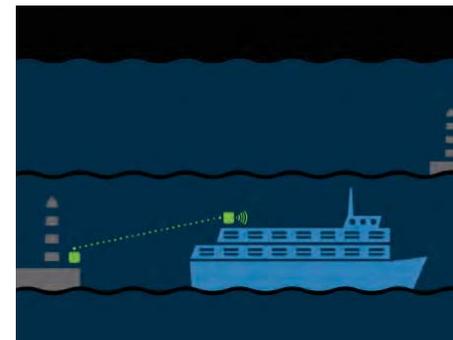
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• Key words

Communications

• Description

Network equipment capable of offering Wi-Fi coverage, while connecting to the Internet via multiple heterogeneous links such as 3G, WiMax and even other Wi-Fi connections. The devices connect to JANUS via a single stable Wi-Fi connection and the box transparently selects the best connection to the infrastructure depending on temporal conditions.



JANUS can form a transparent mesh network that is used to extend a network infrastructure or Internet link to remote locations, via multi-hop wireless links. JANUS can offer Internet connectivity and services (e.g. VoIP) to passengers on boats near the coast or at the dock. Improved Internet connectivity can be achieved using fibre or ADSL as backhaul instead of 3G/WiMax. It can also be used to provide a dedicated network for nodes of the same entity.

FUNCTIONALITIES

- Near coast Internet extension
- Self-configured network
- Support for prioritized traffic and QoS
- Support for data storage
- Remote management
- JANUS GPS location- estimated position of network clients

MAIN FEATURES

- Support for multi-hop and mobile mesh network mode (Wi-Fi)
- Scales to large mesh networks (up to 7000 JANUS boxes)
- Multiple link layer technologies: 3G, Wi-Fi, WiMax, etc.
- Stable Wi-Fi connection regardless of the Internet link used
- Unnecessary network planning: dynamic auto-configuration
- TECHNICAL SPECIFICATIONS
- Dimensions: 26cm length, 23cm width, 8.8 cm height
- Power: DC jack or passive POE. 7-20 V, 5-6 W
- Supports renewable energy sources (e.g., solar panels)
- Internal Batteries: 12 V, 7.2 Ah
- Autonomy: -10 hours
- WRAP-BOX is rated NEMA-67 I IP67

• Applicability of Technology to Maritime SMES

Internet connectivity and services (e.g. VoIP) to passengers on boats near the coast or at the dock. Can also be used to provide a dedicated network for nodes of the same entity.

DIGITALHYD SR-1 - A SELF-RECORDING DIGITAL HYDROPHONE

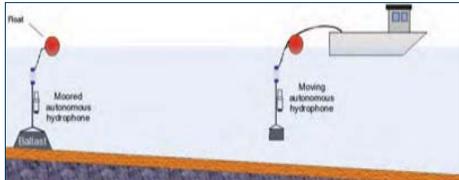
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• **Key words**

Communications - Data management - Sensors / instrumentation / electronics - Software engineering / development

• **Description**

The digitalHyd SR-1 is an autonomous recording device designed for user-friendly operation in underwater acoustic signal acquisition activities. Its compact construction and functionality allows for the implementation of efficient measurement strategies, thus, minimising the requirement for human and material resources for



deployment and recovery. The digitalHyd SR-1 records signals in the frequency band from 1Hz to 24.9kHz or 1Hz to 49.8kHz, depending on selected sampling frequency. These signals are stored on a removable memory card with up-to 128GB of capacity, using 16-bit or 24-bit of resolution, and can be opened by conventional media players and signal processing applications. All acquisition information including date, time and gain are available in the header of the files for later analysis. The acquisition can start as soon as the device is powered up or at predefined scheduled dates and times. Programmable parameters include file duration, PGA gain and start-up times, among others. The configuration of all parameters is performed through a USB interface with access compatibility from various types of operating systems. The digitalHyd SR-1 is powered by a rechargeable lithium-ion battery and is able to remain on for up to 10 hours of continuous acquisition, or various days in stand-by. Battery and memory card are field replaceable, to allow for quick redeployments of the Hydrophone. Optional battery extension packs are available on demand, ex: the 4PACK option expanding the SR-1 to up-to 5x the autonomy. Applications: The digitalHyd SR-1 has been used in various applications including wave energy device noise monitoring, dolphin monitoring in open waters and captivity, underwater acoustic research in seagrass oxygen production, underwater noise monitoring in coastal aquaculture industries and others; Underwater Noise Monitoring; Bio-acoustics; Underwater Acoustic Research; Acoustic Field Calibration.

Specifications

- Sample Frequency: 52.734 kHz / 105.469 kHz (selectable)
- Sample Resolution: 16 or 24 bits

- Usable Acoustic Band: 1 Hz to 25.8 kHz / 1 Hz to 51.6 kHz
- Receive sensitivity: -162.2 to -126.1 dB re 1 V/uPa
- Programmable Gain Amplifier: 1x, 2x, 4x, 8x, 16x, 32x, 64x
- Input Sound Pressure Level Range: 46.3 dB re 1 uPa to 172.5 dB re 1 uPa
- Memory Card Capacity: up to 128GB (field replaceable)
- Battery: 3.7VDC, 3400mAh, Lithium-Ion 18650
- Battery Life: up to 12h in continuous acquisition; up to 500h in stand-by; expandable with larger battery packs.
- Operation depth: Up to 100 m.
- Case dimension: 50 x 323 mm (diameter x length)
- Case Material: Delrin
- Weight: 0.18 kg (in water), 0.77 kg (in air)
- Real Time Clock: Precision of ± 64 seconds per year
- Operation Temperature Range: 0 °C to 40 °C

• **Applicability of Technology to Maritime SMES**

Underwater Noise Monitoring, Bio-acoustics, Underwater Acoustic Research, Acoustic Field Calibration and more specifically wave energy device noise monitoring, dolphin monitoring in open waters and captivity, underwater acoustic research in seagrass oxygen production, underwater noise monitoring in coastal aquaculture industries and others.



DIGITALHYD TP-1 - DIGITAL ETHERNET HYDROPHONE

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• **Key words**

Communications - Data management - Sensors / instrumentation / electronics - Software engineering / development

• **Description**

Digital hydrophone suitable for integration in existing platforms. Real-time applications: use in tethered or system integrated configurations. Configurable for real-time onboard data analysis. Ideal for long-term monitoring.

The digitalHyd TP-1 is an acoustic acquisition device designed for real-time streaming of digital data for remote storage, processing, and/or visualisation. This device has internal processing capabilities allowing streaming of results such as spectral analysis. The TP-1 hydrophone is ideal for integration into monitoring buoys or readily existing systems, or it can be connected directly to a computer.

This digital hydrophone features a pre-amplifier combined with a programmable gain amplifier (PGA) with 7 different gains, for convenient adjustment of the overall sensitivity according to expected incoming signals' amplitudes. The device is equipped with an analog-to-digital converter with a wide range of selectable sampling rates up to 312500 samples per second at 24 bits.



The TP-1 is a telemetry based hydrophone which features a 10/100 MBit/s ethernet interface, which allows direct connection to a computer, or to a wired or wireless network for real-time data streaming to a client that can handle the acoustic data for storage, processing, and/or visualisation. A power/ethernet cable for power supply and two-ways communications can be supplied.

The TP-1 digital hydrophone has internal processing capabilities, where FFT based data analysis can be carried out and results can be made through a low-speed serial link. It features various configurations, including selectable sampling frequencies, programmable sensitivity, and acoustic data processing modes.

Specifications:

- Sample Frequency: 36.3, 67.8, 78.1, 119.8, 180.2, 156.3, 312.5 ksps (selectable)
- Sample Resolution: 24 bits
- Usable Acoustic Band: 1 Hz to 150 kHz
- Receive sensitivity: -165 to -129 dB re 1 V/uPa at 80 kHz (1x gain)
- Programmable Gain Amplifier: 1x, 2x, 4x, 8x, 16x, 32x, 64x
- Input Sound Pressure Level Range: Up to 200 dB re 1 uPa
- Power Supply: 12 to 24 VDC
- Operation depth: Up to 100 m
- Case dimension: 60 x 310 mm (diameter x length)
- Case Material: Delrin
- Weight: 0.5 kg (in water), 1 kg (in air)
- Operation Temperature Range: 0 °C to 40 °C

• **Applicability of Technology to Maritime SMES**

Digital hydrophone suitable for integration in existing platforms. Real-time applications: use in tethered or system integrated configurations. Configurable for real-time on-board data analysis. Ideal for long-term monitoring.

SUBSURFACE TELEMETRY UNIT (STU)

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• Key words

Communications - Data management - Sensors / instrumentation / electronics

• Description

As opposed to the AOB, the STU is a bottom moored acoustic recording unit. It was originally designed to serve as an underwater communication gateway node between an underwater network and a terrestrial network to which it is connected via a fibre optic bottom cable for real time data link and power supply. It can be equipped with a transmit modem for full underwater network integration. This configuration was used in two sea trials one in Italy and another in Norway in 2010 and 2011, respectively. It can also be used suspended from a surface platform (like a ship) serving as relay for data exchange and supply. In those configurations the system can be operated for long periods of time. Alternatively the STU could be used as a standalone self-recording system in which case it should have surface expression for data link and battery exchange. In that regard the STU is one of the most versatile systems for ocean exploration and networking.



Technical specifications

Model	STU
Type	Acoustic VLA
Aperture (m)	30/60
No. sections	1/2
No. channels	8/16
Hydrophone depths (m)	2/4 spacing
Frequency band (kHz)	0.1-30
Sampling frequency (kHz)	60 (GPS synchro)
AD conversion (bits)	24, Sigma-Delta
Time synchro	NTP and 1 PPS
No. thermistors	8/16, @hyd depths, Fs=1 Hz
Autonomy (h)	infinite
Communications to shore	100Mbps Ethernet via optic cable with power driver
Underwater network	RS2323 and power to acoustic modem

• Applicability of Technology to Maritime SMES

Technology will facilitate sub-sea communications

MIRONE – MATLAB-BASED FRAMEWORK TOOL FOR DISPLAY AND MANIPULATION OF A LARGE NUMBER OF GRID/IMAGES FORMATS

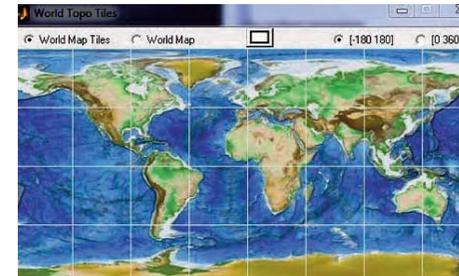
Institution/Company name	CIMA- Centro de Investigação Mariana e Ambiental
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• Key words

Communications - Data management - Sensors / instrumentation / electronics

• Description

MIRONE is a MATLAB-based framework tool that allows the display and manipulation of a large number of grid/images formats through its interface with the GDAL library. Its main purpose is to provide users with an easy-to-use graphical interface to manipulate GMT grids. In addition it offers a wide range of tools dedicated to topics in the earth sciences, including tools for multibeam mission planning, elastic deformation studies, tsunami propagation modelling, earth magnetic field computations and magnetic Parker inversions, Euler rotations and poles computations, plate tectonic reconstructions, and seismicity and focal mechanism plotting. The high quality mapping and cartographic capabilities for which GMT is renowned is guaranteed through Mirone's ability to automatically generate GMT cshell scripts and dos batch files.



MIRONE is written in Matlab but a stand-alone version to run under Windows is also provided. This version now loads windows faster than the native Matlab code and provides a solution for users that don't have Matlab.

Besides the grid/image processing capacities, MIRONE provides tools to measure length, area, azimuths; register images, digitize, drawing lines, circles, squares; plotting symbols, text, etc... All this graphical elements may be edited, moved interactively and saved to disk as x,y ascii files.

For teaching, demonstration or just getting info Mirone provides a small database with plate boundaries, volcanic and seismic activity, ODP/DSDP sites, hot-spots locations (according to some opinions), magnetic isochrons and tools to calculate and draw plate Euler velocities using the available models.

• Applicability of Technology to Maritime SMES

One very useful tool to marine sector is the multi-beam planning

tool. With this, you can plan your next multi-beam survey and take most advantage to the time scheduled to your mission. All you need is a gmt grid (satellite bathymetry is enough) for the region you want to survey.

ACOUSTIC OCEANOGRAPHIC BUOY (AOB)

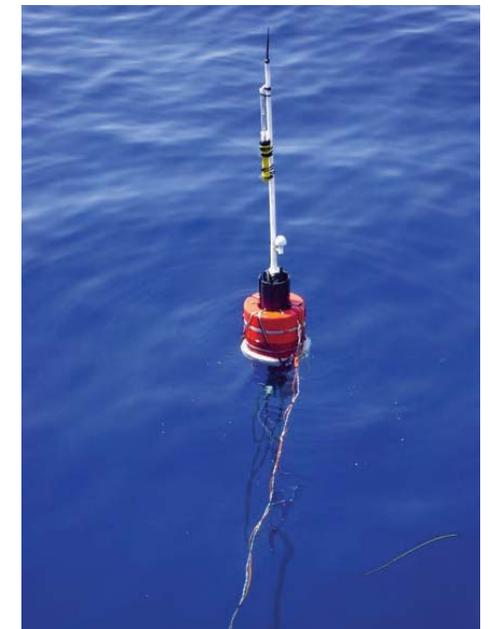
Institution/Company name	CINTAL
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• Key words

Communications - Data management - Sensors / instrumentation / electronics

• Description

The AOB addresses the requirements for a drifting acoustic recording platform with surface expression. This surface expression allows for on line data transmission to shore. The acoustic and non-acoustic sensors are vertically positioned in the water column which



is a preferred set up for sea bottom (geophysical surveying) and water column (oceanography) observation. This observation may be active using purpose operated sound sources (fixed or mobile) or using ocean noise (surface noise or shipping). This AOB was developed in 2004 and first operated in a 1 month long cruise in Hawaii (USA) in September 2005. Since then it has been used over 10 sea trials, in Portugal, Italy, Norway and Greece, for applications ranging from ocean tomography, bottom estimation, underwater communications, marine mammals monitoring and others.

Technical specifications

Model	AOB (version 2)
Type	Acoustic VLA
Aperture	66 m
No. sections	2
No. channels	16
Hydrophone depths (m)	hyd 1 at 6, spacing 4
Frequency band (kHz)	0-16
Sampling frequency (kHz)	50 (GPS synchro)
AD conversion (bits)	16
Bit rate (Mbit/s)	15.36
No. thermistors	16, @hyd depths, Fs=1 Hz
Battery	48 Ah/15 V
Autonomy (h)	11 to 13
Data storage (GB)	120
Communications	802.11b, 1W, antenna 7 dBi
Weight (air/water Kg)	41 / 10
Height w/mast (m)	3
Width (m)	0.4
Ballast (Kg)	10

GOVICITOS

Institution/Company name	SEA CAMPUS (CAMPUS DO MAR; CM)
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• Key words
Software engineering / development

• Description
The analytical evaluation of the quality and status of fish stocks is used to establish appropriate measures of fisheries management, to ensure the sustainability of resources. Traditionally, the determination of reproductive strategy and the estimation of fertility in fish have been tedious tasks that require a high degree of technical training and time-consuming work. The software Govocitos allows making count analysis, measurement and automatic classification of fish oocytes, from histological images of the gonads, estimating fertility by stereological method and study the dynamics of oocyte development and recruitment. The software presents information in base of a centralized database for sharing and collaboratively reviewing the data. Services based on these software and skills involved:

- Analysis and processing of micro and macroscopic images of all kinds of particles.
- Study of structural and morphological biological samples and other materials using common optical microscopy.
- Adaptation and training of specific software for each specific need.
- Advice on obtaining, enhancement and image analysis.
- Ecology fisheries: estimating the fecundity of fish and other species.
- Management of marine resources.



• Applicability of Technology to Maritime SMES
Primary application would be in the aquaculture and fisheries industries to estimate the fecundity of fish eggs. Also adaptable to other sectors: health (cytology, neurology etc.), mineralogy (quantification of rock systems microfissural system), agriculture (calculating occupied area by crops or forests from satellite imagery areas), physical materials (estimated porosity of materials).

MANATI - AUTONOMOUS UNDERWATER VEHICLE

Institution/Company name	SEA TECHNOLOGICAL CENTER (CETMAR)
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• Key words
Advanced engineering (including robotics / control systems) - Communications - Data management - Materials / fabrication / assembly - Satellite Navigation - Sensors / instrumentation / electronics - Software engineering / development

• Description
MANATI is an Autonomous Underwater Vehicle (AUV) to be applied in the management in multiple missions: acquisition oceanographic data, bathymetry, submarine mapping, underwater images, underwater security, transport information, animal tracking, spillage monitoring, or dredging operations monitoring. This AUV is equipped with several sensors which measure the impact of those operations in the marine environment.

The MANATI AUV is lightweight and easy to use, with a highly configurable modular structure, whose batteries and internal components can be easily replaced on mission without putting on risk the sealing conditions. It has a fiberglass shell composed of assem-



blable parts. The shell's interior gets flooded when the vehicle submerges, hence, floatability is not affected. The external profile has been conceived for hydrodynamic and structural strength and protection of the rotors from direct exposure to objects. The profile has proven its reliability by computational tests of fluid dynamics (CFD).

Internal components are located in watertight boxes of PVC for ease production and maintenance operations. The propulsion system (magnetic coupling thruster system and hydraulic buoyance system) has been developed entirely seeking optimum performance at a cost effective.

Several versions for the AUV bow have been tested, which permits to configure it for several different functions: sampling, monitoring of hydrographic parameters, video recording, side scan sonar or simply navigation. A multiparametric (SBE37 probe, eureka manta2) could be integrated in the bow, and accompanied by a sampling tube. Another configuration has an illumination system and a webcam to get underwater images. The webcam is protected in a sealed Perspex window. Finally, to be able to use the side scan sonar, the original profile of the navigation bow is kept and the side scan sonar is housed in the bottom of the AUV body.

Concerning the electronic and software design, the electronic of the AUV has a high capacity process component and a sensors and actuators access component. Both components can be changed and extended without modifying the control software. The first "high capacity process" block has been expanding ARM cortex A8 a 700 to a 1.2 GHz AMD T40 (with Debian GNU / Linux operating system) and in the other component has been changed from a ATMEL Cortex Mega2560 to a Cortex A4. The connections of the peripheral devices and the vehicle control are centralized in the sensor board. Eight packs of high-energy capacity and low-weight lithium polymer batteries supply two independent power lines at 24V and 12 V, which are distributed through a powerboard. Communications include an Ethernet cable connection and several different-range radiofrequency systems: Wifi, XBee, GPRS, Iridium. These systems enable the synchronization with a database on a remote server when the vehicle emerges. The storage of bulky data such as video or sonograms can be done on a SD card of 8Gb (update to a SSD 128GB). The control system is programmed in Python. This programming language is easy to use and presents a number of features which are particularly suitable for any mission, like multiprocessing easy programming or a large repository library covering a wide range of functionality. This system is going to be integrated in the Robot Operating System (ROS), a set of software libraries and tools, in order to improve the capacities of the AUV.

When the AUV is at surface, the AUV communications allows sending the vehicle status, battery level, and even some sensor data from the AUV to the mission control computer onshore or on a boat. Low-level decisions, such as “speed up” or “turn,” are order by the computer and software on the AUV, but operators can transmit higher-level decisions, like “stop” and “come home.” Operators can also change the survey area while the AUV is at surface. This software is based on Ardupilot software included in the new droneconce version. Besides, a “Mission planning” application is under development. It allows collecting and analysing external information, resources and requirements. It permits the interactive generation of the mission timeline, and the planning of the on-board tasks during the cruise.

• Applicability of Technology to Maritime SMES

This AUV is suitable for use in huge variety of sectors such as the dredging, marine works, marine renewables and public administration sectors.

SAFE SKIPPER

Institution/Company name	Mytech Ingeniería Aplicada, S.L.
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Website	

• Key words

Sensors / instrumentation / electronics - Software engineering / development

• Description

SAFE SKIPPER is an intelligent ship stability management system that facilitates storage operations in fishing trawlers. SAFE SKIPPER prevents risky situations due to lack of stability of the ship, whether due to overload or incorrect storage, providing vital information in order to avoid endangering the ship or crew.

Starting from the hull of the ship, its hydrostatic characteristics and its weight distributions, SAFE SKIPPER analyses the equilibrium conditions and the stability and risk levels of a given load condition and display them in a clear and intuitive manner through an interactive graphical interface. As the user introduces the different elements that make up the load situation, the system graphically displays the corresponding balance and trim as well as the maxi-

mum safe wave height for these load conditions. When the ship is not stable or the equilibrium situation surpasses the minimum freeboard, SAFE SKIPPER displays clear and unequivocal warning messages for the skipper to be able to correct the positioning of the load.

It presents a “pre-commercial” degree of development and it is registered in the Software Register of Spain (code: 03/2010/1348).



• Applicability of Technology to Maritime SMES

Excellent potential for the fishing and shipping sectors.

XEO HD TV

Institution/Company name	Hercules Control, S.L. (HCTech)
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Website	www.hctech.eu

• Key words

Advanced engineering (including robotics / control systems) - Communications - Data management - Materials / fabrication / assembly - Satellite Navigation - Sensors / instrumentation / electronics - Software engineering / development

• Description

XeoTV is a tool to allow HD underwater georeferenced video recording and analysis.

The device comprises both hardware - HD camera with water proof housing, cable, GPS and plugging interface, plus optionally an additional device for the camera for in-motion record - and software - for HD video visualization and mapping for each track. The hardware is plugged to an on board regular laptop - not included.



User of XeoTV will get a georeferenced record from a boat during navigation (up to 70 m depth) or stopped (up to 100 m depth). In a single screen the user will get a map of the track, an image window - where the recorded images are shown, plus a text window where the main parameters of the record - name of the file, date, place, company... - and for each frame - GPS coordinates, time... - are displayed.

Additionally, XeoTV GPS reference of each frame is protected in order to make record inviolable.

XeoTV has been designed to be used by companies and public institutions on seabed inspection, cartography definition, marine heritage research and inspection, shipwrecks and so on.

• Applicability of Technology to Maritime SMES

XeoTV has a wide range of applications for almost any underwater activity, based on two main benefits: it is easy to use - and results may be quickly understood even for non-specialist staff - and in its inviolable - each frame is linked to its GPS coordinates.

Potential customers of this technology are environmental consultancy and engineering companies, who can offer their customers an easy to use inviolable record as a third party proof of any underwater work or operation. Firefighters, security forces, fishing inspection and scientific and technological research agencies are also enlisted among potential customers of XeoTV.



DIRECTION WAVE SENSOR

Institution/Company name	Hercules Control, S.L. (HCTech)
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Website	www.hctech.eu

• Key words

Communications - Data management - Software engineering / development

• Description

HCTech has developed a software for directional wave monitoring, to be installed at Bares Wave Sensor, a hardware composed by a system including three accelerometers, gyroscope and compass, plus a control unit and external plugs for power supply and data communication.

Thanks to this innovative development HCTech's Bares Wave Sensor does sharply decrease the cost of this sort of technology comparing to other solutions at the market.

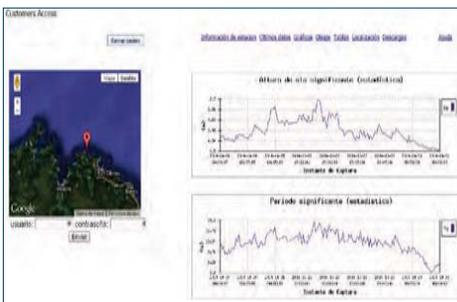
The software balances deviations and gives an accurate, multi-parameter and reliable result based on hardware data. Wave information is available for the customer in real time.



When embedding such technology within a Galicia specifically adapted buoy we get the best performance of the system, plus a turn-key solution called Bares Wave Buoy. Bares Wave Buoy includes float a float and a tower where Bares Wave Sensor is deployed jointly with a self-sufficient power supply system (with solar panels), communication system (via GPRS or optionally via satellite), adding marine signalling (mark, lantern and radar reflector). To complete the turn-key pack, customer may access data through Pagina Continuada Sensorum software pack, which includes graphics, tables and raw data without needing any installation at customer's computer systems.

• Applicability of Technology to Maritime SMES

Seaport authorities and marinas may use real-time directional wave information for navigation and port operations, increasing safety, speed and therefore cost-efficiency of the port or marina. Meteorological institutions, oceanographic observatories, environmental consulting and engineering firms as well as research institutions are the scope of this technology.



CALIPESCA

Institution/Company name	GALICIAN RESEARCH AND DEVELOPMENT CENTRE IN ADVANCED TELECOMMUNICATION (GRADIANT)
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Website	www.gradiant.org

• Key words

Communications - Data management - Software engineering / development

• Description

The main objective of CALIPESCA project is to investigate and propose solutions in different segments of the value chain of the fishing marketing industry. It aims to:

- Improve the commercial value of these products.
- Ensure appropriate conditions of transport and storage.
- Provide the necessary information systems intercommunicate of different actors in this sector functionalities.

Specifically, the goal is to employ information and communication technologies (ICT) to:

- Increase the value of fishery products at first sale
- Minimize the costs associated with the transport of the products, ensuring the traceability of lots traded
- Improve the image and promotion of products marketed nationally and internationally.

• Applicability of Technology to Maritime SMES

Fishing industries, primarily in the first sales note management area as well as first sale traceability documentation, self-service automated buying systems.



MAGSALIA - SUBMARINE OIL & AQUIFER FIELDS DETECTION

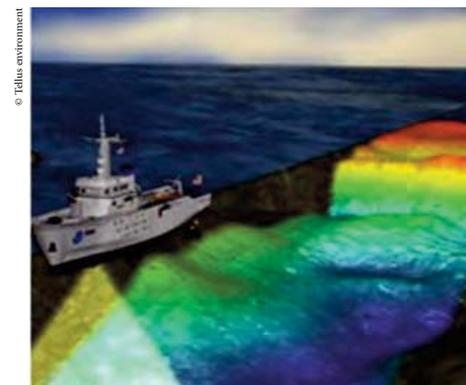
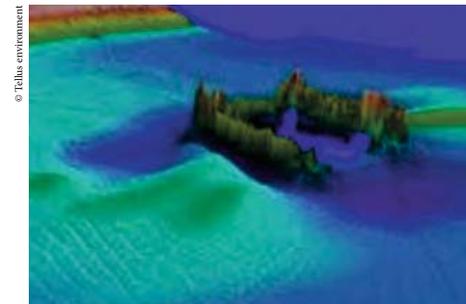
Institution/Company name	Tellus Environment
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Website	www.tellus-environment.com

• Key words

Advanced engineering (including robotics / control systems) - Communications - Sensors / instrumentation / electronics - Software engineering / development

• Description

A new submarine instrument for the research of oilfield and aquifer has been developed in a laboratory specialized in oceanic studies. The MAGSALIA technology enables measuring the electronic and magnetic fields of the sedimentary rocks.



The system instrument records both the natural Electro-Magnetic activities of the rock (EM method) and the Marine Controlled Source Electro-Magnetic signals (MCSEM method). It thus enables the study of rocks at different depths and is particularly interesting for deep sea research, generally limited with classical methods.

The internal architecture of the instrument is also innovative. The sensors are assembled and interconnected in an original manner. Moreover, this instrumentation is very light and manageable. It is possible to use several instruments of this kind at the same time to cover large submarine areas.

Applications

- Oilfield exploration,
- Aquifer detection
- Detection of metallic structures

Innovative features

- Combination of two techniques: EM and MCSEM
- High resolution 3D tomography thanks to magnetic signal acquisition
- Associated with multibeam sonar the process boosts the relief of the digital terrain (detection of seabed anomalies)
- Investigation in deep water
- Very light and manageable instrument

Examples

- Detection of buried objects ()
- Detection of seabed anomalies
- Oil and aquifer fields

• Applicability of Technology to Maritime SMES

Oilfield Exploration, Aquifer Detection, Detection of metallic structures

MOBESENS - A DRONE FOR COASTAL WATER QUALITY CONTROL

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Website	www.ifremer.fr/institut_carnot/Presentation www.captiven.fr

• Key words

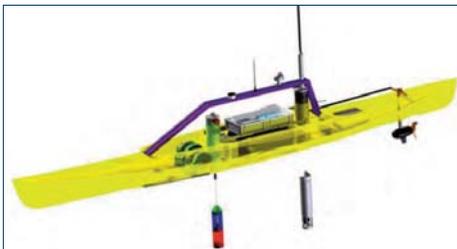
Advanced engineering (including robotics / control systems) - Sensors / instrumentation / electronics

• Description

MOBESENS is an autonomous surface drone capable of measuring various water quality parameters and taking samples in the water column in coastal zones, estuaries and lagoons. Collected data are transmitted in quasi-real time to the remote control centre on land. It is designed for providing a low cost operational solution for regular surveillance of water quality.

Applications

- Measurements of water quality parameters (salinity, temperature, toxics..)
- Test campaigns of new sensors
- Integration of new sensors (modularity of the system)



Innovative Features

- 24/48 hours autonomy: electric engine with batteries NiMn 2*2 kWh
- 4.20 m. length, 100 kg: designed for shallow waters, lakes or lagoons where survey vessels can't go
- Modularity: capability to integrate new sensors (e.g. to detect toxins)

- Near real time data acquisition and transfer
- Remote control and data transfer through GSM, GPRS, ...

Validation phase achieved

- Lakes (Leman, Tau)
- Coastal zones (bay of Brest)
- Rivers (Ebre)

• Applicability of Technology to Maritime SMES

Environmental monitoring (surface and subsurface measurements), wave energy resource assessment. Regular water quality measurement and monitoring.

MAPPEM GEOPHYSICS

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Website	www.mappem-geophysics.com

• Key words

Advanced engineering (including robotics / control systems) - Communications - Sensors / instrumentation / electronics - Software engineering / development

• Description

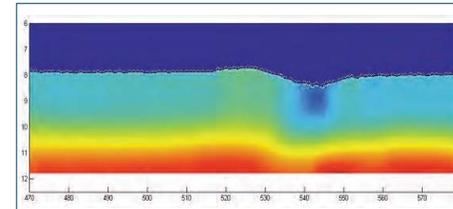
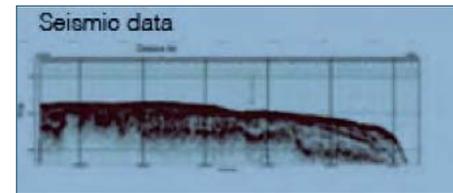
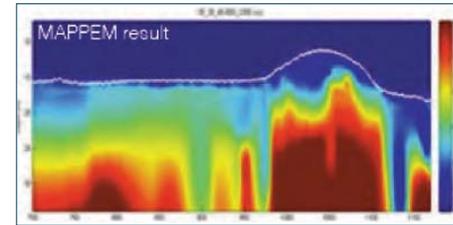
The MAPPEM instrument is a new marine sub-bottom profiler, based on electromagnetic techniques. This innovative technology provides a new vision of the structures and the localization of buried objects in the sediment, particularly in areas where acoustic techniques cannot provide enough information (gas, acoustic masks,...).

Applications

- Geophysical surveys,
- sub bottom structures, geology
- Gas detection and risk assessment
- Buried objects 3D localization (Pipe lines, UXOs, Cables,..)
- EM Impact assessment of marine power plants & cables



- 20 simultaneous electric sensors
- 0.5s acquisition rate
- 24 bits resolution data acquisition
- Navigation sensors (depth, altimeter, compass, tilts), GPS localisation



Innovative Features

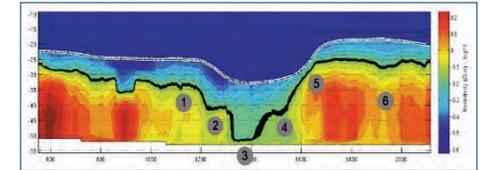
- Resistivity mapping with penetration to 10-50m below sea-floor (depending on targets)
- «Colored» acoustic profiles with new physical added value information
- Submeter 3D resolution
- Real time data visualization

Examples

- Seismic masks: When the sediments include biogenic gas, seismic techniques are blind. Electromagnetic technology enable visualising the gas distribution in the sediments. The resistivity values give access to sediment porosity and gas content.
- Burried objects: research of an old pipe. A local local survey with Mappem product show differences of resistivity. The pipe

here appears in blue, as more conductive than the surrounding materials as being metallic with an altered coating (old pipe)

- Sediment deposits: Mappem results show deeper structures (down to about 40m deep). The black line represents the sediment bedrock limit.



• Applicability of Technology to Maritime SMES

Geophysical Surveys, site investigation for buried objects, defence and security industries, oilfield exploration and aquifer detection.

BOB - A BUBBLE OBSERVATORY MODULE

Institution/Company name	Institut Carnot - Ifremer EDROME
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Website	www.mappem-geophysics.com

• Key words

Advanced engineering (including robotics / control systems) - Communications - Sensors / instrumentation / electronics

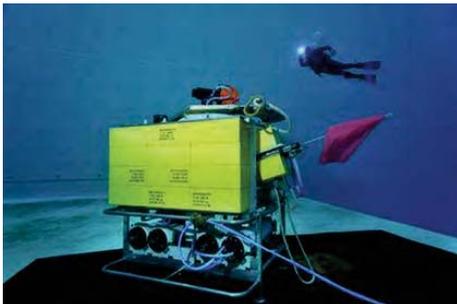
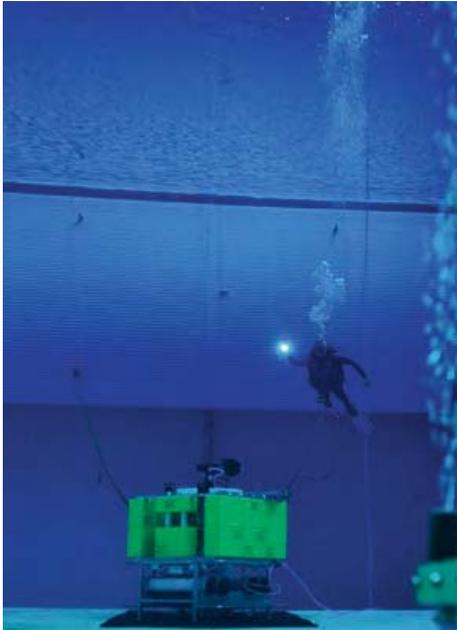
• Description

BOB is an autonomous acoustic surveillance system based on a single beam echo sounder designed to observe targets in the water column, in particular fluids and gas flows escaping from the sea floor. It is a gas bubble detector. It is deployed using a cable, dropped to a depth of 10 m from the sea floor and can be positioned with a ROV. Once positioned, it probes the underwater horizon at regular time slots.

Applications

- Acoustic monitoring of gas emission from the sea floor
- Surveillance of natural risks (gas emission from underwater faults): earth quakes, tsunamis
- Surveillance of industrial sites (water capture zones, exploration areas)

- Impact assessment of methane from sea floors on climate change
- Location of hydrogen sources



Innovative features

- Advanced acoustic technique in water column
- Deep sea capabilities: down to 1500 m
- Acquisition of acoustic and environmental data (T°, Pressure, position of the station)
- Autonomy: 25 days
- Compact system: Weight 634 kg (23 kg under water), dimension: 1,3 m x 1,3 m x 2,8 m (hight)

Validation phase achieved

- In the Marmara sea (European project ESONET, network of submarine observatories)
- In the test basin facility of Ifremer

• Applicability of Technology to Maritime SMES

Surveillance of natural risks (e.g. tsunamis, earth quakes) of industrial sites, underwater emissions (e.g. methane).

MEDON - CABLED SEA FLOOR OBSERVATORY

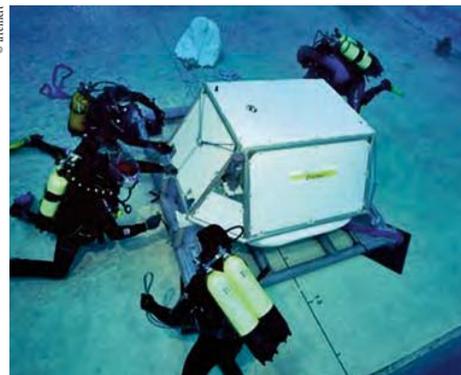
Institution/Company name	Institut Carnot - Ifremer EDROME
Contact details	Centre Ifremer de Bretagne C.S. 10070 - 29280 Plouzané Cedex, France nadine.landeri@ifremer.fr captiven@ifremer.fr
Website	www.ifremer.fr/institut_carnot/Prese- ntation www.captiven.fr

• Key words

Advanced engineering (including robotics / control systems) -
Communications - Sensors / instrumentation / electronics

• Description

Some coastal areas require continuous surveillance to follow their evolution along time. Multidisciplinary cabled observatories are well adapted to such continuous and long term monitoring. With MEDON Ifremer provides a new generation of cabled multidisciplinary underwater observatories for coastal areas, based on reliable industrial technologies.



Applications

- Continuous surveillance of marine environment
- Environmental studies
- Surveillance of seismic zones
- Multi-sensors: video images, physical & chemical parameters, currents and waves, acoustic data

Innovative Features

- Remote and virtual control of the instruments (sensors and software)
- Cable transmission capacity up to 1 Gbit/s:
- Typical distance from the coastal: 20 kms
- Water depth down to 4000 meters
- Possible data diffusion towards all users registered to an intermediate server



Validation phase achieved

- Pre-validation in basins
- Validation: a pilot observatory "MeDON" deployed in the Iroise Sea (North East of Molène island)

CONCLUSIONS



© dario xemar

The BAT document is an initial catalogue of the Best Available Technologies in each STAMAR participating region. These technologies were selected by each regional partner. Should other relevant technologies emerge throughout the project; they will continue to be added to the BAT portfolio. Although these technologies will not be reported on as part of the final report, they will be described and promoted through the surveillance reports.

The main objective of STAMAR is to improve the competitiveness and innovation capacity of maritime SMEs of the Atlantic Area through technology transfer, in particular those solutions which encourage a sustainable business development and protection of the marine environment. This will be achieved through the following activities:

- Promulgation of the BAT portfolio and subsequent surveillance reports;
- Organisation of knowledge transfer and co-creation sessions (involving SMEs, research institutions and other interested parties);
- Creation of a transnational demonstration centre to promote all the technologies identified and organise technology diffusion events;
- Development of a standard/common methodology for the transfer of technology solutions to SMEs;
- Implementation of technology transfer pilot projects in each Atlantic Area region (informed by the BAT portfolio).

This document is the final report on the Transnational Portfolio of Best Available Technologies (BAT) for the maritime sector in the Atlantic Area. It summarises the regional pre-selection reports on this topic and presents them over the entire Atlantic Area. It provides a consolidated source of information and identifies technologies that can be used for future pilot projects.



STAMAR

ICT & Maritime innovation



ATLANTIC AREA Transnational Programme
 ESPACIO ATLÁNTICO Programa Transnacional
 ESPACE ATLANTIQUE Programme Transnational
 ESPAÇO ATLÂNTICO Programa Transnacional

INVESTING IN OUR COMMON FUTURE



European Union
 European Regional
 Development Fund



amtegn
 Axencia para a
 Modernización Tecnolóxica



U. PORTO



Comhairle Contae Thiobraid Árann
 Tipperary County Council



UAlg
 UNIVERSIDADE DO ALGARVE



Marine Institute
 Fórsa na Mara



University of
Strathclyde
 Glasgow



INESCTEC
 TECNOLOGIA E CIÊNCIA
 LABORATÓRIO ASSOCIADO

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Innovación



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TECHNOPÔLE
 BREST-IRDISE

