



Implementation Plan

**Presented to the
Board of Trustees**

April, 7, 2010

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1. Executive Summary

New monitoring technologies are being progressively implemented in coastal ocean observatories. These new observing systems, such as IMOS, OOI, IOOS, VENUS, POSEIDON, COSYNA among others, are delivering new insight into coastal ocean variability, that will trigger new theoretical and technological developments, increasing our understanding of open ocean, coastal and nearshore processes and contributing to a more science based and sustainable management of the oceans and coastal areas.

SOCIB is one of such systems, a **C**oastal **O**bserving and **F**orecasting **S**ystem located in the **B**alearic **I**slands, a new facility of facilities open to international access. SOCIB is a multi-platform distributed and integrated system that will provide streams of oceanographic data and modelling services to support operational oceanography in a European and international framework, therefore also contributing to the needs of marine and coastal research in a global change context. In line with EuroGOOS, operational oceanography is here understood in a wide sense, including both the systematic long-term measurements of the seas and their interpretation and dissemination, and also the sustained supply of multidisciplinary data to cover the needs of a wide range of scientific research and societal priorities. This will allow a quantitative increase in our understanding of key questions on oceans and climate change, coastal ocean processes, ecosystem variability, sea level rise, etc. and will also drive us towards a more science based coastal and ocean management. It is important to note that in its present format and financial status, SOCIB will not be carrying out direct research activities (except in specific areas directly related to SOCIB objectives) but will be providing support for them. The research activities will be carried out by IMEDEA, COB/IEO and UIB, among other organisations, in close coordination to SOCIB.

SOCIB is composed by three major subsystems: (1) an observing sub-system (Observing Facilities), (2) a forecasting and modelling sub-system (Forecasting and Modelling Facility) and (3) a data management sub-system (Data Centre Facility). Combined these three components form the Systems Operation and Support Division (SOS Division). The Engineering and Technology Development Division (ETD Division) provides the engineering and technical backbone to develop and operate the facilities of the SOS Division and is also responsible for the application, development and testing of new technologies for future observing systems and for

developing new analytical tools for the effective management of new, high volumes, of observational data and modelling output. The third Division, the Strategic Issues and Applications for Society (SIAS Division), develops applications and operational tools for science-based management of the coastal and marine environment, within the general frame of sustainability science, thus supporting the development and transfer of strategic knowledge to meet the needs of society in the context of global change. It is important to consider that the sound management of the coastal zone is of utmost importance in the Balearic Islands and elsewhere to guarantee both the quality of life of residents and the competitiveness and sustainability of the economic activity in the Balearic Islands.

This document presents the implementation plan for SOCIB for the period 2010-2014 but SOCIB lifetime is presently estimated to last at least until 2021. The 2014 plans represent the presently more reasonable and likely well based projections for the period 2015-2021, which will need to be adjusted annually. The document structure follows the Australian Integrated Marine Observing System (IMOS) Implementation Plan, one of the most successful and reliable examples of multi-facility system presently in operation. As a result, the document is organized as follows: first, a general overview chapter is presented, describing the context, mission, vision and objectives, the international framework, the ideal and strategic location of the Balearic Islands in the Western Mediterranean, the basic initial principles and the SOCIB initial participating organizations. Second, we describe the structure of SOCIB, represented by Divisions, Services and the Office of the Director. SOCIB is composed of three Divisions, which respond to the SOCIB drivers, three horizontal Services that provide central support to the Divisions in achieving their objectives and the Office of the Director, responsible for SOCIB strategic direction, budget planning and the communication with the consortium's governing bodies. Next, the partners, access policy, product and services and the governance structure are presented. The detailed implementation and financial projections for each subsystem are described in section 8, with details for each facility and services provided in Annexes (in particular Annex 1, 2, and 3). Finally, a list of supporting documents directly associated with SOCIB is included, among others, the original SOCIB proposal (named in Spanish *-Memoria Científico Tecnológica de la ICTS SOCIB*) submitted in 2006, evaluated by the Spanish Large Scale Infrastructures Committee (MICINN) and adopted by the Conference of Presidents from 2007.

SOCIB implementation plan is submitted to the Board of Trustees and has to be seen as a road map for the development of the system, road map that will be iterated with inputs from the Executive Commission, the Board of Trustees and the Scientific Steering Committee during 2010 and complemented by specific reports for each one of the subsystems developed.

SOCIB statutes (BOE April 5, 2008) define three major phases: design, construction and equipment and operation or exploitation. More specifically, the design phase will end by April 2010 when the construction and equipment phase will be starting until December 2011. The major investments (reaching 11.5 million Euros) are therefore foreseen in these two years. Some pilot operations are planned during 2010 but operational capability will be reached by the end of 2011. Specialised personnel, mostly engineers and technicians, will be hired by SOCIB associated with the design, construction and operation phases. More specifically, 11 new contracts will be starting during 2010 (23 persons contracted in total), 4 are planned for 2011, reaching, in 2012, a total of 25 persons formally contracted by SOCIB. These figures do not take into consideration the in kind personnel provided by leading research organisations in the Balearic Islands, such as UIB, CSIC and IEO with part time or full time agreements. Approximately a similar number of 25-30 in kind positions are expected to be provided by institutions to SOCIB.

The international financial situation from 2009 and 2010 has defined a new financial frame and this implementation plan, responds to the presently existing funding and shows that under the present scenario, SOCIB can be constructed and operated, hoping that a better financial situation will allow in the near future the establishment of a new Center of Excellence at the Balearic Parc of Innovation Technologies (ParcBit), where SOCIB, in close partnership with UIB, IEO and CSIC, would play a key role.

The financial contributions for investments from the two institutional partners, the Spanish Ministry of Science and the Balearic Islands Government, are available and it is expected that they will be fully used between 2010 and 2011. The running costs have just started formally in 2009 and accordingly running expenses will be intensifying significantly in 2010 and especially from 2011 onwards, when the operations phase will be launched. A carefully balanced budget has been established for the period 2010-2014, establishing therefore a solid frame for SOCIB, a solid Spanish contribution to the understanding of oceans and coasts.

2. Overview

2.1 Context

Oceanographic information, combined with integrated predictive models, is increasingly needed to manage national coastal and ocean areas, to portray the state of the ocean today, next week and for the next decade, for example to increase the efficiency of shipping, to mitigate storm damage and flooding of coastal areas, to sustain fisheries, to protect important ecosystems from degradation, to develop science-based sustainable management of marine and coastal areas, and to improve climate forecasting in response to global change¹. However the ocean changes continuously and therefore must be observed continuously in order to deliver accurate and effective ocean services. This, combined with the understanding that we have a responsibility to maintain healthy, resilient and sustainable coasts and oceans, and together with the curiosity driven advancement of knowledge and technology is the foundation for new ocean observing networks.

The establishment of such ocean observing networks is being adopted as an important component of marine strategy by most countries that are advanced in marine science research and with economically significant coastal areas. These new facilities, for example IMOS in Australia, OOI and IOOS in the USA, and VENUS and NEPTUNE in Canada, are already delivering new insight into coastal and open ocean variability, increasing our understanding of ocean, coastal and nearshore processes and contributing to a more science-based and sustainable management of the coastal area.

Oceanographic processes operate on variety of spatial and time scales and ocean monitoring operations need to be consistently maintained over the long-term and integrate a variety of data, in order to answer key questions regarding climate change, coastal ocean processes, ecosystem variability, and to improve the estimates of current ocean states and constrain model predictions. However as indicated in the GOOS (Global Ocean Observing System) Program, the development of a totally integrated, multidisciplinary global observatory system is a challenge

¹ In line with concepts outlined in White House Memorandum - Press Release, Obama B., June 12, 2009.

that entails great difficulty for at least two reasons: (1) monitoring activities in many coastal areas globally is very primitive or non-existent and (2) the operational capacity to detect, evaluate and predict variations that affect human health or coastal ecosystems and their sustainability is poorly integrated with maritime operations, meteorology or climatology.

Addressing these issues successfully requires an increase in the resources for marine research and technology development and a new framework of interaction between researchers, technologists and final users. The development of the new Balearic Islands Coastal Observing System (SOCIB in Spanish) harnesses the current evolution in approach to the interdisciplinary study of the marine environment, integrating networks of observing systems with the implementation and development of numerical models which analyse the combination of physical processes, associated biogeochemical fluxes and ecosystem variability and in addition where the assimilation of the observed variables and the delivery services and applications to society is key. In this approach SOCIB is unique in developing a new generation, well integrated observing and forecasting system, which responds to science, technology and society needs.

ICTS SOCIB is a multi-platform distributed and integrated system that will provide streams of oceanographic data and modelling services to support operational oceanography in a European and international framework, therefore also contributing to the needs of marine and coastal research in a global change context. In line with EuroGOOS, operational oceanography is here understood in a wide sense, including both the systematic long-term measurements of the seas and their interpretation and dissemination, and also the sustained supply of multidisciplinary data to cover the needs of a wide range of scientific research and societal priorities. This will allow a quantitative increase in our understanding of key questions on oceans and climate change, coastal ocean processes, ecosystem variability, sea level rise, etc. and will also drive us towards a more science based coastal and ocean management in the Balearic Region.

2.2 Mission, Vision and Objectives

Mission

The mission of SOCIB is to develop a coastal ocean observing and forecasting system, a scientific and technological infrastructure which will provide free, open, quality controlled and timely streams of data to (1) Support research and technology development on key internationally established topics, such as the role of the oceans in the climate system at an inter-annual scale, the interaction between currents and eddies and associated vertical exchanges with influences on ecosystems variability, the variability in nearshore morpho-dynamics and sea level variability in response to climate change, (2) Support the strategic needs of society in the context of global change, by using the data to create operational tools for decision support and the transfer of knowledge for sustainable management, science based mitigation, adaptation strategies and marine policy development. (3) Consolidate operational oceanography and associated marine technology development in the Balearic Islands and in Spain, contributing to the establishment of a well structured centre of excellence within the international framework of ocean observing systems.

SOCIB's objectives are driven by international scientific priorities, state of the art technology and also by specific interests from the Spanish and Balearic Islands society. The general objectives are twofold: (1) to contribute to addressing and responding to international scientific, technological and strategic challenges for operational oceanography in the coastal ocean and (2) to enhance operational oceanography research and technology activities being carried out in the Balearic Islands, contributing to the consolidation of a well structured centre of excellence.

Vision

Over the longer term, our vision is to advance on the understanding of physical and multidisciplinary processes and their non linear interactions, to detect and quantify changes in coastal systems, to understand the mechanism that regulate them and to forecast their evolution and/or adaptation under, for example, different IPCC

scenarios. More specifically, SOCIB will address the preservation and restoration of the coastal zone and its biodiversity, through the analysis of its vulnerability under global change and through considering new approaches, such as connectivity studies and Marine Protected Areas optimal design, to advance and progressively establish a more science based sustainable management of the ocean and coastal areas.

Through this work the ICTS SOCIB, alone and in conjunction with research institution partners, aspires to become an internationally recognized coastal observing and forecasting system, a reference facility, contributing to scientific excellence, technology transfer and knowledge dissemination, whilst remaining capable of adapting and responding to society's needs.

Objectives

SOCIB specific objectives are initially identified as:

1. To support peer reviewed research along three internationally established research lines (see Annex 6 for details) that have particular relevance to the oceanography and societal needs of the Balearic region, namely understanding:
 - The role of the oceans in our climate system, climate impact and climate variability effects in the Mediterranean Sea
 - The interaction between major Mediterranean currents and the shelf environments and their influence on the ecosystem variability
 - The nearshore morpho-dynamics and sea level variability in response to climate change
2. To contribute to the development of operational oceanography technologies, specifically:
 - To develop new products, sensors, tools and systems to enhance the real-time capabilities of the observational facilities and numerical modelling.
 - To expand SOCIB operational oceanography activities through adding new, complementary platforms, techniques and processes, in response to identified science, technology or society needs.
 - To progressively improve the observed information, adding new variables, increased range of spatial-temporal scales, and developing additional products and services in response to stakeholders needs.

3. Support the strategic needs from society in the context of global change:
 - Through developing operational tools for decision support and the transfer of knowledge for sustainable management of the coastal ocean
 - Through the development of science based (ICOM) coastal and ocean management, in the general frame of sustainability science.
4. To support and encourage the broad use of SOCIB data and services through:
 - Open, well designed and easy to use data access systems
 - Partnership with external research organisations
 - Transfer of knowledge, through outreach, education, training and mobility activities
5. To develop and maintain an international perspective, in order to increase the international visibility of the ICTS, to attract the participation of the best researchers from around the world, and over the medium term to advance towards participation within the European ESFRI framework.
6. To support SOCIB publications made in collaboration with key Balearic research institution, such as IMEDEA (CSIC-UIB), COB-IEO and UIB, and other national and international, and progressively with other key national and international partners and collaborators.

2.3 SOCIB in the framework of Marine Science Infrastructures

SOCIB is part of the Spanish large scale research and technology infrastructures (known as ICTS in Spanish - *Infraestructuras Científicas y Tecnológicas Singulares*) and represents a new way to fund marine R&D activities in Spain and a significant change in Spanish marine and coastal observing strategy. It is a pilot system, a strategic regional approach with a view to establishing a coordinated and sustained marine and coastal observing system integrated at a national² and/or European level.

Marine and coastal research is one of the priority axes of environmental and global change research at the European level (7th Framework Program) and at a national

² <http://www.redictsmarinas.ieo.es/redICTS/principal.html>

Spanish level embedded within the new National Research Plan. In addition, excellence in research, technological development and innovation constitute the base of the new European maritime policy, with the objective of optimizing the social and economic benefits of the use and sustainable exploitation of the oceans³. Marine and coastal research also constitutes one of the three priority axes of the new Plan for Research, Technology and Innovation of the Balearic Islands⁴ (2009-2013).

2.4 Strategic Location in the Western Mediterranean

The strategic location of SOCIB, based in the Balearic Islands, enables the development of an ocean observing and forecasting system that can deliver the critical information required to inform on issues of international scientific interest. This is due to three key points; a critical mass of experience in marine science (researchers, technicians and laboratory space), the pressure of tourism/economics on natural resources alongside the existence of sensitive and pristine ecosystems, and the location of the islands themselves in the centre of the Western Mediterranean, a small scale 'ocean' of world-wide relevance.

The position of the Balearic Islands, at the Atlantic/Mediterranean transition (one of the 'hot spots' of world ocean research) and the semi-enclosed nature of this sea offers an ideal reduced scale ocean laboratory, where processes such as thermohaline circulation, deep convection, shelf/slope exchanges, mesoscale and submesoscale dynamics, and coastal interactions can be studied at smaller scales than in other oceanic regions⁵ which strongly benefits oceanographic research in this area. Physical mechanisms can be more easily monitored in this 'ocean basin', contributing to the advancement of knowledge of physical interactions and biogeochemical coupling at nearshore, local, sub-basin and global scales.

Balearic Islands research institutions constitute a broad base of knowledge and already demonstrated international leadership in operational oceanography. The

³ Towards a future Maritime Policy for the Union: An European Vision for the Oceans and Seas, communication from the Commission to the Council, the European Parliament, The European Economic and Social Committee and the Committee of the Regions, Brussels, 7 June 2006, COM (2006) 275 final, Volume I, pp 54.

⁴ <http://dgtic.caib.es/www/plaCiencia/plaCiencia.ca.htm>

⁵ internal Rossby Radius of order 12 km

vision for SOCIB has developed from over 15 years of internationally acknowledged research by the researchers and technicians based in the Department of Marine Technologies, Operational Oceanography and Sustainability at IMEDEA (CSIC-UIB) in collaboration with other internationally acknowledged Balearic research groups at COB-IEO and in different departments and services at UIB. Together, the people and resources of these groups constitute a critical mass of multi-disciplinary personnel and facilities, located in the Balearic Islands and working at the forefront of international oceanographic research (see Box 2 for a summary of peer reviewed topics published by Balearic researchers in more than 100 international journals)

The oceans and coastal areas of the Balearics provide jobs, food, resources, recreation and tourism opportunities, and play a critical role in transportation, economy, trade and security and so management of this resource is of strategic societal interest in this region⁶. The Balearics dependence on marine activities (maritime traffic, fishing, tourism) places Balearic society at the forefront of confronting issues related to sustainability management of the coastal zone and this a strategic location for the development and implementation of new ICOM based tools and applications. In addition the existence of the Cabrera National Park, areas of barely disturbed marine ecosystems such as Menorca and the small islands of the Pitiuses, and areas with sensitive habitats and special interest ecosystems, such the NE of Mallorca, N and S of Menorca, Menorca channel and S. Cabrera, or Natural Parks of Ibiza and Formentera, are of great interest for the analysis of natural variability in, and human interaction with, pristine and threatened systems.

A summary of current and emerging problems, detected both by the European Union as well as by IMEDEA (CSIC-UIB), UIB, and COB-IEO in the Balearic coastal area are detailed below (Box 1, below), these require scientific knowledge in multiple disciplines and give an idea of the range of issues that need to be addressed through scientific observation.

⁶ For example need balance coastal resources with tourism, shipping and coastal development, surge prediction and variability and sustainability of important marine ecosystems

- **Deterioration of water quality (eutrophication, HAB's, marine spills, etc.)**
- **Beach erosion, reduction of emerged beach surface, beach variability, currents**
- **Beach load capacity**
- **Safety in bathing areas, rip currents**
- **Ecosystems with high biological value and sensitive habitats, dunes, shelf, endangered and vulnerable species, bird nesting areas, endemics, invasive species, preservation of the marine ecosystem**
- **Civil construction: buildings, urban development, walks, recreational ports**
- **Fishing (commercial and recreational) and agriculture**
- **Habitat fragmentation and degradation**
- **Water salinisation due to over-exploitation of underground waters**
- **Effects of climate change, coastline, currents and ecosystem variability**
- **Natural hazards: extreme phenomena, tsunamis, surges**

Box 1: A few examples of problems of the coastal zone of the Balearic Islands⁷

2.5 Guiding Principles and Scope

The SOCIB Implementation Plan describes the design and initial phases of implementation of the ICTS SOCIB Coastal Ocean Observing System in the Balearic Islands. It is anticipated that a thorough testing of the ability of the system to satisfy the needs of the principal drivers; science, technology and society, will take place concurrently and that this will result in some revisions after the current 5-year Implementation Plan. Over the longer term SOCIB will continue to test and adapt its system to the changing needs through consultation with the community and stakeholders.

⁷ As cited in the Memoria científica del proyecto ICTS-SOCIB (2006) and sources from "The EU bids for coastal area, Results from the Demonstration Program about ICZM", European Commission, Luxembourg 2001

Guiding Principles

In line with IMOS, a number of well defined principles have been established from the very beginning. These principles will guide the development, decision making and interaction with SOCIB partners, users and other collaborating institutions. They are:

- Science, technology and society driven objectives
- Scientific and technological excellence through peer review
- Support for RTD activities in the Balearic Islands
- Integrated, coordinated multiplatform, multidisciplinary and sustained monitoring,
- Partnership between institutions
- Free, open and quality controlled data streams, with data in adherence to scientific community standards

Operational Scope

The operational oceanography activities of SOCIB will be primarily, but not only, centred in the western Mediterranean with focus in the Balearic Islands and adjacent sub-basins (specifically Algerian and Alborán/Gibraltar sub-basins), and covering the nearshore, coastal ocean and blue open ocean waters and their associated processes. Activities will be well coordinated with any new regional, national and/or European observatory that will be developing in the western Mediterranean.

SOCIB is designed to support and prioritize a sustained approach to ocean monitoring that is responsive to science, technology and society. The initial focus in the development of SOCIB is on physical variables and some biogeochemical variables, reflecting both the present state of sensor technology and the importance of the impact of physical processes on driving biogeochemical and ecological responses (see Annex 6 SOCIB scientific themes as stated in the original SOCIB

Proposal⁸). New biogeochemical sensor technologies are advancing rapidly and will be incorporated into the SOCIB observing network which will enhance the long term sustained monitoring of chemical and biological properties.

SOCIB is unique among coastal ocean observatory systems in that our mission, vision and structure respond to three key priorities, international scientific research, state-of-the-art technology and the strategic interests of Spanish and Balearic Islands society.

In other words SOCIB is science, technology and society driven. As with other international ocean observing systems this will involve the setting up of three key infrastructure components:

(1) a distributed ocean observing system, with appropriate instruments and technologies selected for the long term monitoring of ocean and coastal oceanographic parameters in the northwest Mediterranean, see Fig. 1 and Fig. 2.

(2) a numerical prediction and data assimilation system and

(3) a data management and visualization system that combined with the two previous, will enable real time monitoring of the state of the coastal zone and prediction of its spatial and temporal evolution.

⁸ Memoria científica del proyecto ICTS-SOCIB (2006)

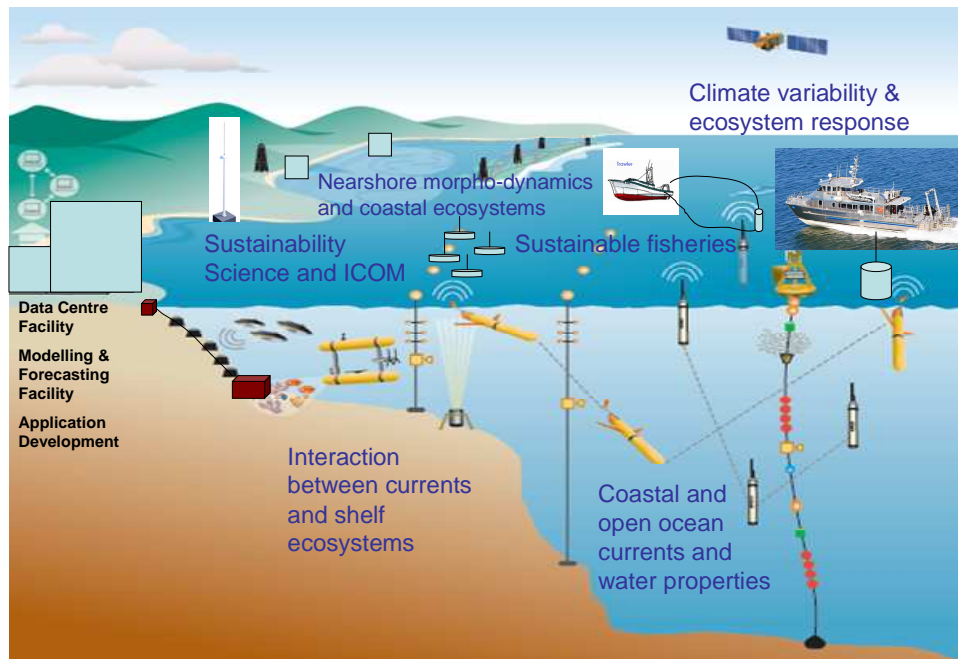


Figure 1: Overview of SOCIB observing and forecasting system, see Annex 2 for details on each element of the system (adapted from IMOS)



Figure 2: Distributed network of permanent and dynamic/re-locatable observing facilities in the northwest Mediterranean Sea

SOCIB will provide new observing and forecasting systems, new products and services and a new data centre infrastructure for the Balearic Islands research community which will dramatically increase the science and technology development in the islands.

The activities of SOCIB consortium will need to be well coordinated with the existing research institutions in the islands for mutual benefit and to promote the efficient use of public funds: this will imply the in kind-contribution of personnel, space and equipment to support SOCIB and the development of joint operations and programs in a new cooperative and collaborative framework that will make Balearic Islands marine science and technology more competitive.

As already indicated, active coordination with other national institutions is also anticipated, in particular CSIC and IEO, but also Puertos del Estado, Marina Mercante, etc. In addition at a European level coordination with programs and organizations such as MOOSE or MERCATOR in France, MOON in the Mediterranean at a regional European level, and other operational initiatives GMES EU funded such as MyOcean is anticipated.

2.6 The Importance and Benefit of Partnership

Partnership and participation was envisioned from the very earliest development of SOCIB (see original SOCIB proposal 2006⁹), the original idea for the development of a new Coastal Observing System in the Islas Baleares developed from the work of existing researchers in the Balearic region, within a national and international network of research collaborators. Thus SOCIB has been an early part of discussions with regionally represented research organizations, particularly CSIC, IEO and UIB.

This partnership and participation is not only vital to the initial development of SOCIB (Design, Construction and Equipment Phases) but also maximizes the operations forthcoming phases and in consequence the sound use of public funds. It is also crucial to enabling SOCIB to achieve good science and leading edge

⁹ Memoria científica del proyecto ICTS-SOCIB (2006)

operational oceanography. This partnership and participation from key national research organizations (CSIC, UIB and IEO) and the direct participation of local research institutes and departments (IMEDEA (CSIC-UIB), COB (IEO) and the Departments of Computing and IT, Physics and Engineering, etc (UIB)) in the oceanographic operations of SOCIB will give rise to mutual benefits, avoiding duplication.

For the partnering organisations the benefits of participation in SOCIB are numerous and vary depending on the nature of the partnership, local institutions will benefit strongly from close partnership with SOCIB through researcher access, influence in the decision making process regarding science outcomes, the investment in facilities and above all the fact that the new observing systems, new computing power and new data centre will provide a significant input to the marine science and technology development in the Balearic Islands research community. The Islands are characterised by more than 1.200 km of coastline, open to all directions. In consequence, a dedicated coastal ocean research ship is seen as a major need that will activate science progress and society services in the Islands. More specifically a new 24 m LOA advanced technology catamaran will become the major multidisciplinary facility that, together with the other observing facilities to be implemented (HF Radar, coastal buoys, gliders, ARGO and drifters, among others), will dramatically increase resources and capabilities to conduct scientific research. The specific benefits are further detailed under Section 4 – Partners.

2.7 SOCIB Participating Organisations

Formal agreement between the Spanish Government (Ministry of Science and Innovation MICINN) and the Balearic Islands Regional Government (Ministry of Economy, Finance and Innovation) was reached in 2008 to establish a new Coastal Ocean Observing and Forecasting System in the Balearic Islands (SOCIB). SOCIB was established as new consortium with legal entity funded jointly by MICINN (50%) and the Balearic Islands Regional Government (50%)

In 2010, CSIC (National Council for Scientific Research) will join formally the Consortium (approved in the Board of Trustees from December 2009, and formal agreement being at present-March 2010- being reviewed by legal departments) and funding distribution will be: MICINN (35%), CSIC (15%) and Balearic Islands

Regional Government (50%). The incorporation of UIB and IEO to SOCIB is also envisioned once the construction phase has started.

Total funding of up to 36.316.342 € until 2021, consists of 11.536.345 € for investment in scientific equipment and facilities and just over 2 million € per year to support operations from 2011 through to 2021¹⁰. The funding is provided annually and investment of this funding in equipment and operations is managed by SOCIB in line with legal Spanish requirements for public consortiums and governance procedures (see Section 7 – Governance for details).

More specifically, the investment approved is as follows:

	2007	2008	2009	2010	2011	2012
MICINN	2.000.000	1.750.000	1.500.000	1.500.000	489.839,683	499.636,476
CAIB	54.000	1.924.715	1.424.715	1.424.715	1.112.215	1.130.964
CSIC	-	-	-	-	1.921.855	321.980,469
Total	2.054.000,000	3.674.715,000	2.924.715,000	2.924.715,000	3.523.909,683	1.952.580,945

	2013	2014	2015	2016	2017	2018
MICINN	509.629,206	519.821,790	530.218,226	540.822,590	551.639,042	562.671,823
CAIB.	1.150.089	1.169.597	1.189.494	1.209.790	1.230.491	1.251.607
CSIC	328.420,078	334.988,480	341.688,249	348.522,014	355.492,455	362.602,304
Total	1.988.138,284	2.024.407,270	2.061.400,475	2.099.134,605	2.137.622,497	2.176.881,127

	2019	2020	2021	Total
MICINN	573.925,259	585.403,765	597.111,840	12.710.719,7
CAIB	1.273.145	1.295.113	1.317.521	18.158.171
CSIC	369.854,350	377.251,437	384.796,465	5.447.451,3
Total	2.216.924,609	2.257.768,201	2.299.429,305	36.316.342

In addition, and as indicated in the previous section, in-kind contributions from local and national research institutes are expected and will be confirmed during the initial part of the construction phase. More specifically, in kind contributions are foreseen from:

- CSIC at IMEDEA (CSIC-UIB) Esporles and Calanova location (space, scientific equipment and personnel, in particular in lines related to SOCIB mission and objectives and in line with IMEDEA 2010-2013 Strategic Plan, approved by IMEDEA governing boards and well evaluated by the independent review panel) and at other directly interested CSIC institutes such as ICMAN, ICM, UTM, CEAB, among others.

¹⁰ Funding for operations reaches approximately 2 million € in 2011 and thereafter rises at approx. 2% per annum to counter inflation

- UIB (space-potentially CTI-, equipment and personnel, from different departments and services, in lines related to SOCIB mission and objectives)
- IEO (equipment and personnel, from different groups in lines related to SOCIB mission and objectives, and also services –crew in particular-)

The relationships and in-kind contributions are and will be managed by SOCIB through partnership agreements that are either already in place or that will be prepared and signed during the design and construction phases; see Section 4 - Partners for details.

Over the last two decades coastal ocean research and technology development in the Balearic Islands has contributed to the study and understanding of different oceanographic problems of worldwide interest and is the basis for the scientific contributions underlying SOCIB. Peer reviewed research can be found in topics related to mesoscale and sub-mesoscale dynamics, fronts, eddies and filaments induced vertical motions and biological effects, shelf/slope exchanges through canyons, interactions between basin and sub-basin scale circulation, mesoscale eddies blocking effects, satellite altimetry studies of interactions with large basin scale flows, inter-annual oceanic variability, influence on mesoscale circulation and relation with ocean climate variability at decadal scale including biogeochemical effects, internal-near inertial waves energy propagation in the coastal ocean, new forecasting systems such as genetic algorithms successfully applied to different oceanic areas, coastal morpho-dynamics, wave current interactions, beach erosion and sediment transport, seiche oscillations in harbours and relation to atmospherically generated long trapped edge waves, and also technology implementation and development (including gliders, new coastal AUV's, ROV's, coastal altimetry algorithms, multi-sensor approach experiments and drifting buoys) or new Integrated Coastal Zone Management initiatives in the frame of international based sustainability science. Theses contributions have been carried out by a team of more than 25 researchers, technicians and support staff mostly from the Division of Marine Technologies, Operational Oceanography and Sustainability at IMEDEA (CSIC-UIB), in the frame of competitive projects funded by EU FP's, Spanish National R&D Plan and also Balearic Islands R&D&I Plan, and published in more than 200 international articles.

Box 2: Summary of Marine Science research in the Balearic Islands

3. SOCIB Structure

3.1 Overview

In order to achieve its objectives, SOCIB is composed of three Divisions, which respond to the SOCIB mission and drivers and correspond to the structure outlined in the establishment of ICTS SOCIB (BOE. 83). Three horizontal Services will provide central support to the Divisions in achieving their objectives (see Fig. 3 below). In this section we briefly present the general structure.

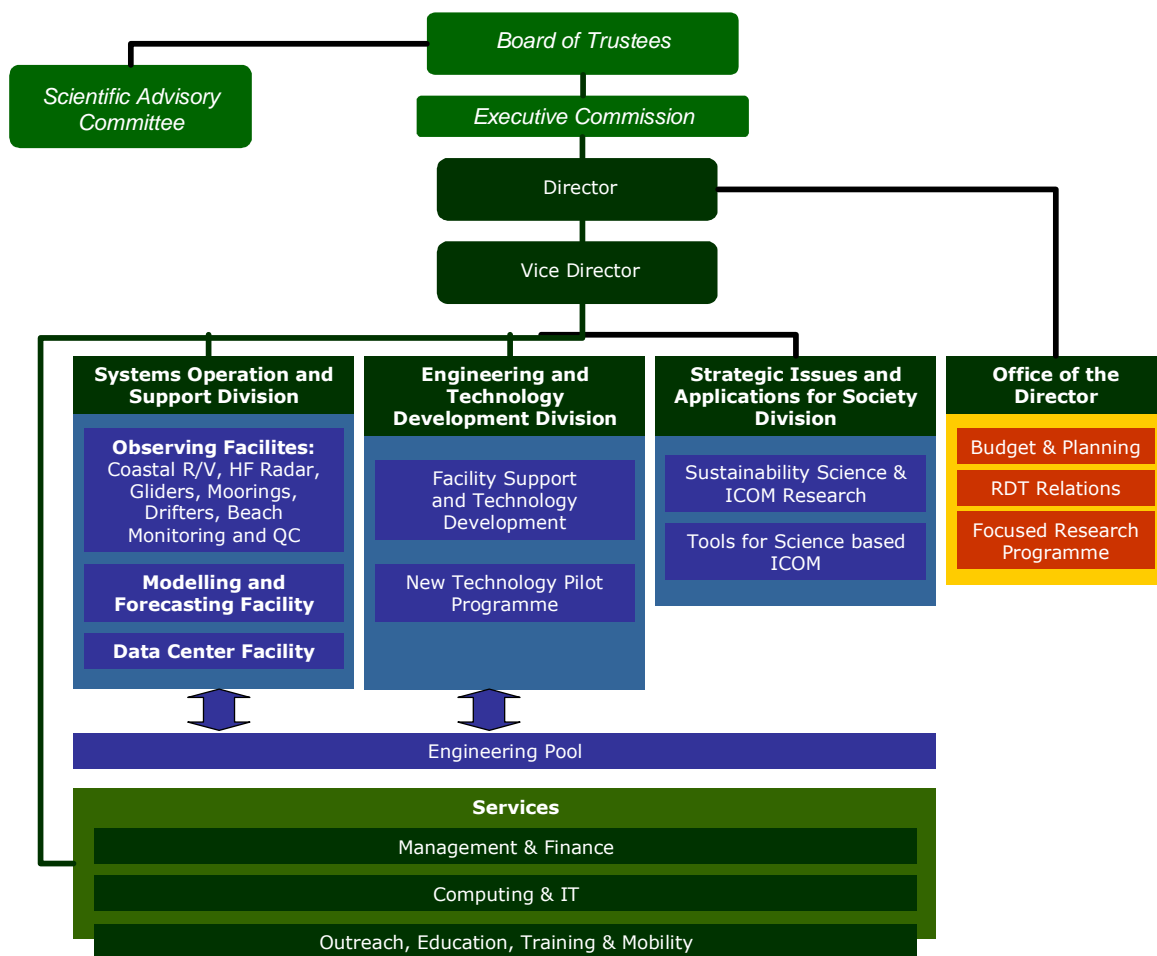


Figure 3: SOCIB Structure

In line with similar international initiatives, SOCIB will be composed of three major subsystems: (1) an observing sub-system (Observing Facilities), (2) a forecasting and modelling sub-system (Forecasting and Modelling Facility) and (3) a data

management sub-system (Data Centre Facility). Combined these three components form the Systems Operation and Support Division (SOS Division).

The second Division, the Engineering and Technology Development Division (or ETD Division), provides the engineering and technical backbone to develop and operate the facilities of the Systems Operation and Support Division and is also responsible for the application, development and testing of new technologies for future observing systems and for developing new analytical tools for the effective management of new, high volumes, of observational data and modelling output.

The sound management of the coastal zone is of utmost importance to guarantee the quality of life of residents and the competitiveness and sustainability of the economic activity in the Balearic Islands. The third Division, the Strategic Issues and Applications for Society (SIAS Division), is therefore designed to develop applications and operational tools for science-based management of the coastal and marine environment, within the general frame of sustainability science, thus supporting the development and transfer of strategic knowledge to meet the needs of society in the context of global change.

The three 'horizontal' SOCIB Services support the Divisions, Management & Finance, Computing & IT, and Outreach, Education, Training & Mobility (or OETM), these are all essential elements of SOCIB activities. It is important to mention that the structure proposed represents a step forward from the present management of research in Spain, which requires a major revision to guarantee competitive management structures that will allow the building and consolidation of a state of the art internationally competitive observing and forecasting system.

The final component of the SOCIB structure is the Office of the Director. This Office is responsible for SOCIB strategic direction, budget planning and the communication with the consortium's governing bodies.

The responsibilities and main functions of the Divisions, Services and Office of the Director are outlined briefly below with details provided in Annex 2.

3.2 Systems Operation and Support Division

This Division will launch the ocean observing and forecasting network, extending from the emerged beach out to the outer limit of the continental slope, and combining the latest technological advances in sensors, systems for continuous parameter acquisition, data archiving, pre-processing and near real-time data analysis. It will be responsible for the operation of the different systems and also for developing products and services to support science, technology and society needs.

The SOS Division will be composed of three major subsystems: (1) an observing sub-system, (2) a forecasting sub-system and (3) a data management sub-system. From this perspective, SOCIB will be therefore constituted by a sustained, spatially distributed, heterogeneous, potentially re-locatable and dynamically adaptive observing network that will be integrated through data management and numerical methodologies to exploit the synergies between both the observational network, *per se*, and between the observational network and the numerical models, with the aim of providing a complete and integrated description of the physical and biogeochemical properties of the marine environment.

3.2.1 Observing Facilities

Six major observing facilities are identified for initial implementation: a new advanced technology coastal catamaran research vessel (24 m LOA), HF Radar for coastal monitoring of strategic areas such as the Ibiza channel, gliders and autonomous underwater vehicles, coastal moorings, drifting systems (Argo profilers and surface drifters), and a nearshore beach monitoring system. The output from each observing facility will make an individual contribution in terms of data (observed parameters) and will also, in combination with the other facilities, contribute to the development of new tools to integrate and optimize the different types of monitoring platforms (research vessel, buoys, gliders, satellites etc.).

SOCIB will operate the observing facilities on two different modes: permanent and re-locatable/dynamic.

Permanent facilities will be initiated during 2010-2011, undertake sustained monitoring activities and are implemented as part of the long term 'core' SOCIB

monitoring activities in the Balearic Sea. Permanent facilities will include the research vessel, HF radar, coastal moorings, regular glider transects, Argo profilers, and beach monitoring systems. The data will be open and free to international access and their initial operation will allow us to extend facility access to offer dynamic/re-locatable facilities for external scientific and/or technological users.

From 2012 onwards dynamic/re-locatable facilities will be implemented, these will be facilities (such as gliders and the R/V coastal catamaran, but potentially in the near future also involving coastal AUV and other systems), available to local, national and international research organizations, following an open call and an external scientific peer review process (see Section 5 – Access Policy for more details), so as to respond to additional scientific research questions that fall in line with the mission and priorities of SOCIB. This represents a real challenge as to our knowledge SOCIB will be one of the first systems internationally to offer access to dynamic facilities such as for gliders and AUV's. Specific requests and expressions of interest have been already received from researchers from CSIC, IEO, AZTI and other universities.

Combined the static and dynamic Observing Facilities will constitute a sustained, spatially distributed, heterogeneous, fixed and re-locatable observing network, capable of dynamically adapting to well-qualified needs from science, technology and society.

Summary of initial facilities:

1. Advanced technology research catamaran
2. Fixed coastal buoys
3. Coastal HF radar
4. Gliders
5. Drifters (Argo profilers and surface drifting buoys)
6. Marine and terrestrial beach monitoring system

3.2.2 Modelling and Forecasting Facility

This Facility is responsible for the numerical and forecasting operations at SOCIB that will be combined with the observing facilities through data assimilation and validation. The Modelling and Forecasting Facility will also include assimilation of satellite data.

Coastal ocean state of the art numerical models (such as ROMS) will be implemented in the Balearic Sea, coupled to the MFS/MOON system. The ocean currents system, forced by WRF atmospheric model, will be implemented with resolution of the order of 2-3 km and by this the system will be able to adequately reproduce mesoscale and submesoscale features at different temporal and spatial scales. Physical-biological coupling with a 'simple' Fennel type biological model will be also considered to address key process studies questions associated with the physically triggered ecosystem variability. Finally, wave modelling in the Balearic Sea will be also considered, using WAM initially and at a later stage SWAN at local scale (in coordination with Puertos del Estado).

The activities from the Modelling and Forecasting Facility commenced mid 2009 and the ROMS Balearic Sea model is already implemented and running. New computing capabilities available during 2010 will allow the development of specific products and services of interest for society (in particular DG Emergencies, DG Environment and DG Fisheries, Balearic Government and also the Balearic Harbours Authority, Puertos del Estado and DG Marine Merchant). See Section 6 – Products and Services for more details.

3.2.3 Data Centre Facility

As the provision of marine data and information is one of the key outcomes of SOCIB, the role of the Data Centre is a core element in the project's success and is one of the systems that started definition and design in 2009 and that is currently under development. The SOCIB Data Centre will host, manage and archive the data (raw and processed, model and observational) from all the SOCIB facilities, it will provide the standards, protocols and systems to integrate the data and related information into a number of frameworks and the tools to allow appropriate end users to access and utilise data.

As it is essential that data is discoverable and accessible to both the scientific researcher and wider community, in an open and timely way and through a single integrated framework for data and information management, the initial strategy will focus on developing end-to-end protocols, standards and systems to manage the datasets from each facility, coherently integrating the datasets and enabling search, discovery and visualization of relevant datasets.

The data management system for free and open access to glider data developed at IMEDEA (CSIC-UIB) by engineers that are currently developing the SOCIB Data centre can be considered an example of the type of service that will be progressively extended to other SOCIB Observing Facilities. To offer new informatics capabilities for real time definition of mission planning, including adaptive sampling and real time monitoring using a Web tool that allows quick visualization and download. We have implemented a new tool RAMADDA (Unidata), a suite of comprehensive data management, archiving and repository services that automatically read NetCDF files, discovery, search and download the data and complementary data (such as figures, instructions, etc), establishing the relation between them. The CF NetCDF files can be visualized with existing technologies such as OGC Services (Godiva, Reading e-Science Centre) or JAVA tools as IDV. IDV allows combination of data (gliders or other) with models, drifters, etc. and also the direct exploration of THREDDS and RAMADDA. This is an example of SOCIB data life-cycle for a platform with the combination of different existing tools, standards, and own developments.

The SOCIB Data Centre will be one of the key elements providing major benefits to marine researchers in the Balearic Islands.

3.3 Engineering and Technology Development Division

This division has two key responsibilities: first it provides engineering and technical support to the Observing Facilities, and second it is responsible for technology development, for example using new technologies to develop additional observational facilities particularly targeted at the coastal ocean monitoring but also developing new applications to enhance the performance of existing operations or implementing new systems to ease the transfer of knowledge, products and services to the market, with particular attention to coordination with Balearic marine technological SME's in the frame of the Cluster/Polo Náutico association¹¹.

ETD Division will constitute a well trained pool of specialized engineers and technicians (mostly mechanical and electronic) that will be working under the ETD Manager, in close coordination with the SOS Division Manager, to provide support for the Observing Facilities and develop new technology. The activities of the ETD

¹¹ Association of local companies and research organisations focused on the marine environment

are summarized into these two areas: Facility Support and Operations and New Technology Development (through specific Programmes).

The activities of the ETD Division will be carried by in coordination with SOCIB partners, specifically CSIC, UIB and IEO among others. In addition a significant part of the ETD activities will be initially carried out at CSIC operated laboratories (2010-2011) at IMEDEA (CSIC-UIB) and warehouses, as the initial SOCIB offices at ParcBit are only suitable for office work. This is a good example of coordination between public institutions, avoiding duplication of technical space, equipment, personnel, etc during the initial development of the SOCIB infrastructure.

The management of personnel and space resources will be one of the key tasks for the ETD Manager.

3.3.1 Facility Support and Operations Unit

The maintenance, calibration, testing, preparation and operation of all instruments, planning of routine maintenance, support for scientific surveys and operation of equipment at sea, new data analysis tools and visualisation elements (e.g. for problematic and/or volumetric datasets and modelling outputs) are the major activities of this unit.

3.3.2 New Technology Pilot Programmes

This encompasses the development to operational level of new observing technologies and infrastructures and will initiate with two programs:

1. Near Shore Station Programme
2. Ships of Opportunity/Fishing Fleet Monitoring Programme

These two areas have strong potential in the Balearic Islands and significant interest exists from UIB, CSIC and IEO engineers and scientists. The Nearshore Station Programme will be in principle established in the Ibiza-Formentera Natural Park area while the Fishing Fleet monitoring programme will be starting in 2010 with a pilot project and, depending on evaluation of results, will continue in 2011 in the Balearic Seas area.

3.4 Strategic Issues and Applications for Society Division

The objective of this Division is to develop applications related to Coastal Operational Oceanography and Integrated Coastal and Ocean Management, within the general framework of sustainability science.

The Division combines research at the forefront of sustainable coastal zone management, with data from the observing platforms and with local Balearic concerns and pressure points, which strongly reflect global issues, to develop tools for the practical application of best practice to help local, national, European coastal and marine environmental managers.

The output from this division will ultimately provide key science-based decision support tools and sustainable policy insight for Balearic, Spanish and International ICOM managers in the marine and coastal environment. This area of activity is again a good example of cooperation and development between local institutions (Economic and Social Council) as work in this area was initiated in 2005 at IMEDEA (CSIC-UIB) and is continued at SOCIB as requested by the Board of Trustees in 2008.

3.5 Services

Three 'horizontal' SOCIB Services have been established to support the operation of the three Divisions.

3.5.1 Management & Finance

Responsible for providing human resources, administrative, financial accounting and budget support services to SOCIB Managers, as well as supporting the general functioning of the SOCIB office. The Management & Finance Service is also responsible for ensuring the SOCIB complies with Health and Safety at Work legislation, developing the SOCIB Human Resources Policy and the Environment and Sustainability Policy. During 2010 focus of this Service will be on office systems and management of the SOCIB investment in equipment and instrumentation as well as in establishing the management infrastructure. As SOCIB develops the

management of the tender/purchasing process and human resources will increase in importance.

3.5.2 Computing & IT

The Computing & IT Service is responsible for providing the major computing infrastructure to support the Data Centre, Modelling and Forecasting Facilities, and general operations. Importantly the Computing & IT Service will also ensure that the SOCIB data archive, a key asset, is protected and that SOCIB complies fully with the requirements of Data Protection and Data Storage regulations. A specific agreement with UIB C&IT Service has been signed in 2009 and fibre optics communications at 2 GB have been achieved. Further coordination and intensive collaboration is foreseen between SOCIB and UIB C&IT.

3.5.3 Outreach, Education, Training & Mobility (OETM)

The role of this service is to create awareness, visibility and to enhance the understanding of SOCIB's mission, products and services, and through this process contributing to expanding the application and use of SOCIB products and services. Outreach and Education will be undertaken through the dissemination of information via multiple channels of communication, including traditional media, conferences, workshops and new media channels, such as web, facebook and twitter etc. Targeted end users include; the scientific community, coastal residents, educators and students, administrators involved in coastal zone management, recreational coastal zone users, marine workers and the public at a regional, national and international level. A specific agreement with the Computer Animation and New Technologies Group from UIB (<http://www.ladat.es>) is being prepared to guarantee high level 3D animations in the near future.

Training and Mobility will ensure adequate training and exchanges of SOCIB personnel with leading Ocean Observing Systems, to establish a visiting professor programme (that will be linked to an existing UIB framework) and feature "Joint Appointments" to guarantee fruitful mid to long term interactions with leading centres. A SOCIB Advanced Studies Program (which will include a UIB Masters and Postgraduate Marine Technologies, Coastal and Operational Oceanography

Programme, managed through a specific SOCIB-FUEIB agreement) is also foreseen from 2012 onwards with external funding to be obtained.

3.6 Office of the Director

The Office of the Director has overall responsibility for SOCIB strategy, communications with the external governing bodies, developing strategic partnerships with other institutions and the annual budget reporting and planning process. In addition the Office of the Director manages the SOCIB Focused Research Program, which initially will encompass one research programme, Atlantic Bluefin Tuna, developed with the active participation of both IEO (Mallorca) and IFREMER (France). A second program on Connectivity and MPA's Design in the Mediterranean is also under consideration and external funding being actively sought.

4. Partners

4.1 Overview

SOCIB was conceived in the Balearic Islands and thus partnership with local institutions for personnel, space (lab, warehouse and computing) and instruments has long been a part of SOCIB development vision/plan (see Box 3). This partnership is not only necessary for the efficient use of public funds, avoiding duplication and making best use of investment in existing infrastructure, but also is the key method by which research and science is integrated into the SOCIB structure and thus vital to the success of the ICTS on an ongoing basis. It is also the way similar types of initiatives such as IMOS in Australia or OOI in the USA are being built.

At a national and regional level the vision for partnership is driven by the same concerns as the local level, without strong partnership with scientific research institutions the SOCIB datasets will not be fully utilised, the instrumentation will not be state-of-the-art and transfer of knowledge and advancement in the field of operational oceanography will not be effectively achieved.

Partnership, cooperation and exchange is also anticipated at European (ESFRI target) and international level in order to gain from external ocean observing expertise and to participate fully as a part of the regional and global ocean observing infrastructure and also as a way to becoming an internationally recognized coastal observing and forecasting system, a reference facility, contributing to scientific excellence, technology transfer and knowledge dissemination.

4.2 Principles

Partnership with organizations, institutes, departments and companies will be governed by the following principles:

- Scientific research is integrated into SOCIB structure and operations through partnership

- Optimisation of public resources through partnership and collaboration rather than duplication
- SOCIB aims to enhance, consolidate and support oceanographic research operations in the region¹²
- SOCIB will participate as part of regional, national and international networks for global ocean monitoring
- Data and facilities provided under partnership are governed SOCIB Access and Pricing Policy

4.3 Major Benefits

The benefits from the establishment of a large scale infrastructure such as SOCIB will be shortly (in a time frame of around 5 years) apparent on the scientific, technological and also societal aspects. The triggering effect of large scale infrastructures is well known, and in the Balearic Islands, the “know how” and the critical mass of scientists indeed exists to guarantee sound benefits. Some of the major benefits (to scientists, research institutions and society) can be summarised as follows:

- The new 24 m LOA Coastal Catamaran R/V will enable new multidisciplinary oceanographic science and technology developments to be undertaken in the Balearic Seas.
- The Observing Facilities, and the data provided by the different observing platforms will allow the establishment of baseline data of crucial relevance in the present context of climate and global change.
- The Modelling Facilities, and the Balearic Sea forecasting systems will be of major relevance to optimize research projects and society driven responses.
- The Data Centre will also represent a new resource and a new tool to support the data lifecycle needs of any coastal and marine scientist in the Balearics and beyond (potential pilot national operational oceanography data centre).
- The Engineering and Technology Development activities, and the SOCIB investment in leading edge equipment, people and technology, will build know how and experience in the Balearic Islands that is of direct benefit to all researchers and institutions and also more generally to oceanographic and sustainable science in the region.

¹² The IMEDEA (CSIC-UIB) strategic plan for 2010-2013 gives early indications of the value of partnership with the Balearic Islands Coastal Observing System

- SOCIB investment in specific programmes and projects that follow the SOCIB core research lines and/or technology and society objectives, e.g. Argo international programme.
- The maximizing and sound use of public funds, sharing equipments, resources, laboratory spaces, etc.
- A substantial input of new, quality controlled, oceanographic datasets, concentrated on the Balearic region and delivered online direct from the observing facilities, from 2011 onwards, providing vast new research resources and opportunities for scientists in the region and beyond.
- A substantial increase in marine technologies monitoring systems and laboratory equipment.
- A significant increase in engineering and technical competences through the incorporation on new personnel to SOCIB.
- Raising the international profile of Spain in the developing area of Ocean Observing Systems and operational oceanography
- Access to the dynamical facilities, under access policy

4.4 Agreements

Partnership Agreements may encompass one or more of the following elements:

1. Partnership for resources, in terms of personnel, space or scientific equipment. Among the most important of such partnerships is the in-kind contribution of personnel nationally by CSIC and the local in-kind contribution of space (laboratory and warehouse) by IMEDEA (CSIC-UIB) and personnel by IEO. Additionally this covers scientific equipment potentially provided by partners but operated by SOCIB (given the raising of a new pool of engineers and technicians from ETD Division, inexistent at present) and as part of the 'permanent' monitoring programmes and the provision of SOCIB oceanographic instruments and technicians to meet well defined scientific objectives.
2. Partnership for data sharing and provision. This encompasses provision of data to SOCIB or provision of data by SOCIB to European/Global monitoring networks. The data supplied by partners to SOCIB is managed within the SOCIB Data Centre and is subject to the full data management process from quality control, to backup, archive and incorporation into visualisation system and forecasting systems. Those partners providing datasets to the SOCIB Data

Centre do so in agreement with the SOCIB terms of access and pricing and with recognition to the providers given within the metadata structure. SOCIB will be part of international networks and agreements for data exchange (such as MOON DEA, for example) either directly or through one of SOCIB partners (such as CSIC, late 2010).

3. Partnership for specific research projects, pilot projects and joint monitoring programmes of mutual interest.

Each partner relationship is managed under a separate SOCIB Partner Agreement.

- **ICTS will complement TMOOS and more generally IMEDEA**
- **ICTS will help to consolidate both TMOOS activities and related activities at IMEDEA**
- **ICTS might undertake routine monitoring that can be found of potential interest to IMDEA research activities**
- **ICTS will collaborate in establishing Spanish Ocean Monitoring initiative to address global change in the Western Mediterranean (e.g. collaboration with MOOSE – France)**
- **ICTS will establish a data management division that will help archiving, accessing, and download of operational oceanography products and that might also be of help to retrieve historical data.**

Box 3: From IMEDEA Strategic Plan 2010-2013

5. Access Policy

5.1 General Principles

The SOCIB Access Policy follows similar open access policies from IMOS (Australia), Neptune (Canada) and the OOI ocean observatory in the US.

One of the key values of the infrastructure investment in the SOCIB Coastal Observing and Forecasting System, as an integrated system, lies in the coordinated deployment of a wide range of monitoring technologies aimed at deriving critical data sets which in turn become the base for a wide range of research at a variety of scales. The process of identifying the SOCIB scientific, technological and societal objectives to be addressed by a 'coastal ocean observing and forecasting system' and the development of the SOCIB integrated scientific research lines has provided a large part of the strategic framework necessary for the initial deployment of infrastructure. This development involved extensive consultation with local, regional and international research institutions and government bodies resulting in a 'community' view of the priorities for the SOCIB observing infrastructure (see Annex 6 - ICTS SOCIB Research Themes, which have been essential in creating an integrated and sustainable marine observing system).

5.2 Observing Facility Access

The SOCIB Implementation Plan provides details of the initial deployment of the permanent and dynamic/re-locatable Observing Facility infrastructure, see Annex 2.

Permanent Infrastructure: The access regime has been designed to support and prioritize a sustained long term monitoring approach, generally only considering the use of equipment related to the identified long term objectives of integrated marine observing. However where appropriate, researchers will be able to use the permanent facilities infrastructure for the deployment of specialist instrumentation providing proposals have been subject to scientific peer review, do not create any significant risk to achieving the objectives of SOCIB, and meet logistical and operational requirements, and any additional costs.

Dynamic/re-locatable Infrastructure: In addition ICTS SOCIB will offer open calls for the use of specific dynamic/re-locatable facilities in research projects. Such calls

will be subject to a scientific peer review process to ensure equality in access and scientific merit in the use of publicly funded ICTS SOCIB resources. Unsolicited proposals can also be made for access to this infrastructure providing the proposal is consistent with the marine observing objectives of the ICTS SOCIB.

All proposals to use permanent or dynamic/re-locatable facilities will be reviewed by the a review committee that will be composed of 4 members from the external Scientific Advisory Committee and a final decision made by the SOCIB Director's Office, in all instances researchers will be encouraged to consult with the Office of the Director prior to any proposal development.

5.3 Data Access

The archive and dissemination of the observed marine data is at core of the SOCIB mission and timely, free and unrestricted access to all data, associated metadata and products generated under the auspices of ICTS SOCIB will be delivered through systems and processes for data and information management as developed by the Data Centre Facility.

SOCIB Data Access Policy, like that of NEPTUNE in Canada and IMOS in Australia places few formal restrictions on access to data, this emphasis on free and open use of data is also one of the guiding principals of the data policy being developed for the OOI ocean observatory network in the US. However full recognition of the use of data will be strongly encouraged, that is to say the use of SOCIB datasets requires that ICTS SOCIB and any specific research team involved must be acknowledged by the researcher or other third party making use of the data. Some monitoring datasets may be the result of research experiments designed by SOCIB Partners and implemented through SOCIB infrastructure e.g. dynamic/re-locatable facilities, these datasets are also part of the ICTS SOCIB Data Access Policy and SOCIB will strongly encourage the use of co-authorship in the use of this data by third parties in order that the input of the research experiment designers/SOCIB Partners is explicitly recognised. In addition and in exceptional circumstances SOCIB will allow the research experiment designers/SOCIB Partner to retain exclusive rights to the data for a period of 90 days following collection. Users downloading data from the Data Centre will be explicitly reminded of their ethical obligation to contact the research experiment prior to publication, where appropriate, and offer co-authorship.

The SOCIB Data Centre Facility aims to be at forefront of data provision, in terms of management of the data life cycle (from observation to archive) and in terms of developing technically innovative ways to handle the large quantities of interrelated datasets that will be available through the coastal ocean observing and forecasting system, with new tools for data search and visualization. The Data Centre will host, manage and archive the data (raw and processed, model and observational) from all the SOCIB facilities and provide the standards, protocols and systems to integrate the data and related information into a number of frameworks and tools to allow the end users to access and utilize the data in an open and timely way and through a single integrated framework for data and information management. Additional fast-tracked access to data and products may incur a processing cost

Based on the success of this approach other research institutions (e.g. TMOOS-IMEDEA (CSIC-UIB), Puertos del Estado), universities and agencies may join the existing infrastructure and offer their marine data through the same data management process. With the eventual aim of providing a blue print for marine data management in Spain, hosting additional datasets and ensuring interoperability with similar services internationally; however, additional resources will be needed to achieve these longer term objectives.

5.4 Charges

The data streams, data products and services from the nationally supported SOCIB infrastructure will be accessible to all users through the SOCIB Website. Ordinary, automated, electronic access will be provided free of charge, with special data requests serviced at the cost (if any) of the work associated with the specific request. Charges might have to be considered for specific requests involving data post processing or data preparation.

5.5 Intellectual Property¹³

Intellectual Property Rights (IPR) associated with SOCIB raw data lie with the SOCIB consortium. Any IPR associated with SOCIB value-added products produced under the auspices of SOCIB lie with SOCIB consortium. SOCIB will issue a non-

¹³ Following IMOS Intellectual Property Policy

exclusive licence to any user of the data or value added products. For value-added products not produced under the auspices of SOCIB, but which use SOCIB data, products or services, the IPR of the value-added product rests with the agency that produces the product, with no restriction other than that set out below.

Any IPR existing at the commencement date of SOCIB will be recognised and respected and will only be used as authorised by the owner of the IPR or as permitted under Law. To minimise conflicts over IPR arrangements, all data, products and services developed under the auspices of SOCIB will be free of encumbrances (i.e. users should be able to use and apply the data in whatever way they see fit without restriction other than that set out below).

Except where otherwise negotiated with the Office of the Director and agreed by the governing bodies, any users (including re-packaging) of SOCIB data, data products and services are required to clearly and prominently acknowledge the source of the material derived from SOCIB, together with (where relevant) a reference/link to the related metadata record. Re-packagers of SOCIB data should include a statement that information about data quality and lineage is available from the metadata record and a statement that data, products and services from SOCIB are provided “as is” without any warranty as to fitness for a particular purpose.

5.6 Education/Public Access

Access for educators, students (and the public) is made real through the work of the Outreach, Training, Education and Mobility Service, in particular through:

- SOCIB Website
- Seminars and workshops
- Public access days on the SOCIB research vessel
- New SOCIB technical classrooms
- SOCIB new Ocean Trailer (in line with CSIC MOVILAB)

6. Products and Services

6.1 Overview

The delivery of timely, accessible, appropriate and easy to use products and services to the end user is an important objective for ICTS SOCIB, see Annex 3 for details on the products and services for each Facility. Although the SOCIB value chain is not simply about delivering products and services (see Fig. 4 below), they represent a visible and concrete method of delivering value to science, technology development and society from the investment in the coastal ocean observing and forecasting system and form a key part of the value SOCIB objectives.

It is also important that the ITCS SOCIB gains input on the utility, robustness and value of the datasets provided and one mechanism for achieving this is to develop applications that use the SOCIB datasets to create higher level products, services or applications for end users and society. This follows similar ideas developed within the RCOOS System (USA) where a Forecast Analysis, Synthesis and Product Development (FASPD) centres¹⁴ are created to both use and provide a feedback mechanism on the available data streams, development of the tools and applications will be the responsibility of the SOS Division Manager.

The primary users targeted for the products and services are scientists, marine and coastal managers (government or private), the public, educators and students.

Below is an overview of the data products, tools, applications and services planned and under development:

1. Archived and real time data streams from the 6 observing facilities, including but not limited to the following oceanographic parameters, u, v (currents, surface and profile), T (fixed point, profile, SST), Hs, Hm, Tp, Dp (Waves), S (fixed point, profile), coastal morphology, coastline and bathymetry, sediment transport, fluorescence, oxygen and other biogeochemical indicators. These will be available through the SOCIB Website using the following 5 services; data

¹⁴ RCOOS have initiated a set of functional centres whose mission is to utilize the information flow from the information management system subsystem to develop higher level products

Catalogue, data directory and search, web visualisation, 3D visualisation¹⁵ and Wiki (sharing human knowledge).

2. Ocean currents and waves forecasting subsystem at a regional scale, Balearic Sea waters and a local scale, Balearic littoral waters.
3. Physical/ecosystem modelling subsystem: water quality, conservation state of special interest habitats, monitoring of exploited ecosystems and their living resources (sustainable fisheries, EU Directives, etc.)
4. Waves and beach rip current subsystems (safety in bathing areas)
5. Meteo-tsunamis, long waves and resonant seiches in the Balearic Sea, analysis and potential forecasting system
6. Real-time operational forecasting systems for environmental emergency response e.g. Decision support tools for spill trajectory forecasting and coastal ocean impact oil spills, jelly fish invasion trajectory estimations, etc
7. Tools for coastal ocean decision makers, managers and policy makers, based on sustainability science, developed from SIA Division ICOM and Sustainability Science applied research
8. Science based coastal zone ICOM policy recommendation
9. Beach carrying capacity (physical and social) indicators
10. Forecasting of vulnerable species spawning location and larval survival rates - initially Atlantic bluefin tuna (*Thunnus thynnus*)
11. Balearic/Mediterranean beach system response to climate change, erosion and variability monitoring

¹⁵ New methods of visualisation of observed parameters

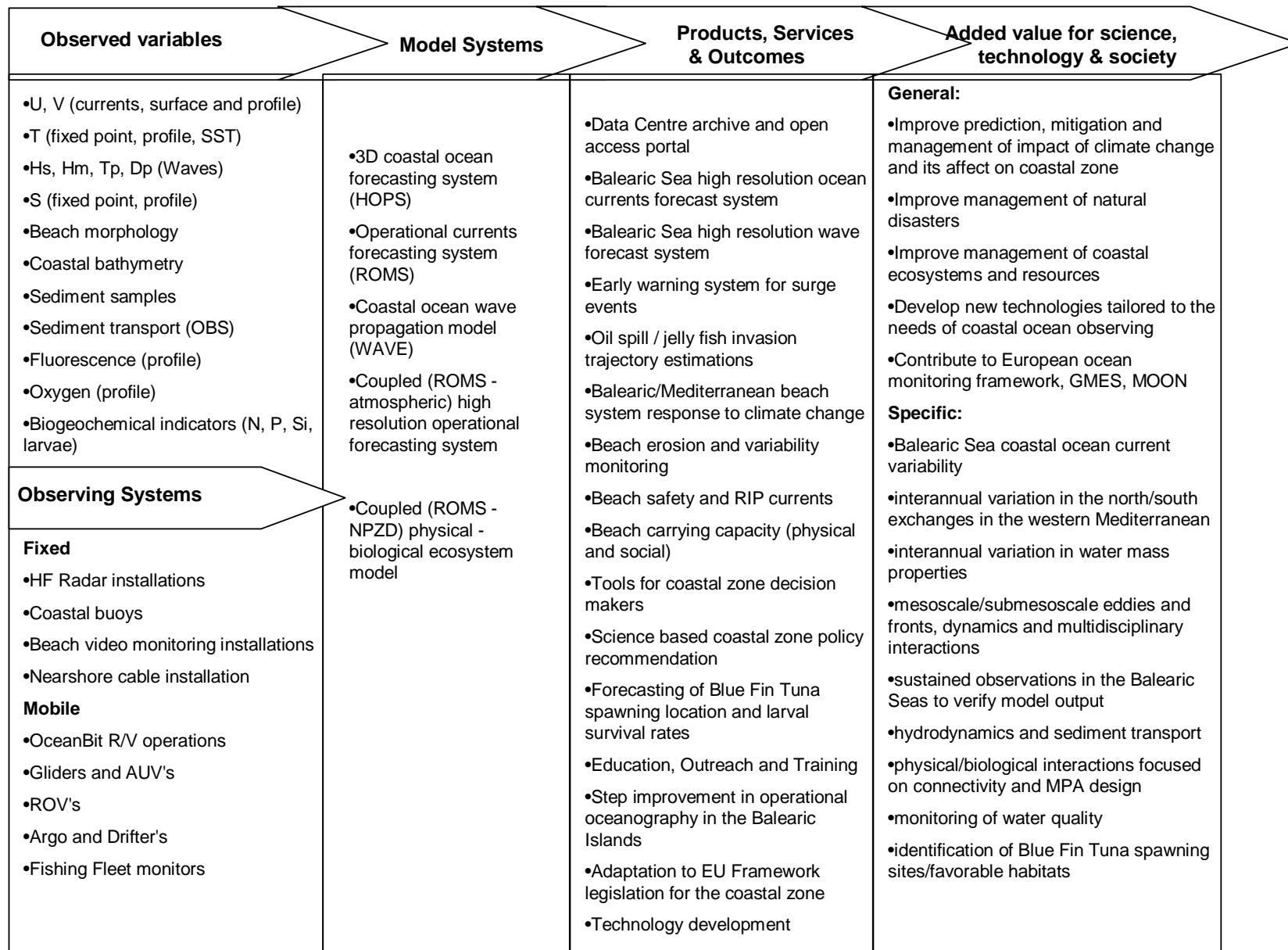


Figure 4: SOCIB Value Chain

7. Governance

7.1 Governance Structure

SOCIB is formally a consortium with its own legal entity created through a joint agreement between the Government of the Balearic Islands (CAIB) and the Spanish Ministry of Science and Innovation (MICINN). The governance of this consortium is managed through the following mechanisms:

1. Board of Trustees – formed equally by members from CAIB and MICINN (including CSIC from 2010 onwards), it establishes the rules, direction and general function of the SOCIB consortium; it also approves the management structure. The Board of Trustees meets twice a year in order to approve the annual accounts¹⁶ and the SOCIB Budget and Activities Plan for the forthcoming year, and to approve any changes to the SOCIB constitution.
2. Executive Commission – second to the Board of trustees and again formed equally by members from CAIB and MICINN, it meets once per quarter to discuss and approve the Activities Plan and approve the annual budgets to be put forward to the Board of Trustees. It also approves the proposed salary structure.
3. External Scientific Committee - composed of ten senior scientists of international standing in marine science, proposed by the SOCIB Director and approved by the Board of Trustees. The External Scientific Committee meets once a year to advise the SOCIB Director with regard to SOCIB strategic objectives with regard to operational oceanography, marine science and technology issues. The Scientific Committee (or a sub-section of it) also reviews proposals for access to SOCIB facilities, as a result of the open call process. Thus ensuring equal opportunity for the applicant groups based on scientific standards within an international framework. See Box 4 for the current committee membership (Dec 2009).

The SOCIB Director is appointed by the Board of Trustees and is responsible for the overall development and administration of SOCIB and the reporting to the Board of Trustees, Executive Commission and External Scientific Committee.

¹⁶ Memoria Annual de Actividades del ICTS SOCIB-SOCIB

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6. **Jaume Piera** UTM, CSIC. jaume.piera@cmima.csic.es
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10. **Miguel Angel Losada**, Univ. Granada. mlosada@ugr.es .

Box 4: The SOCIB Scientific Advisory Committee members (as proposed at SOCIB Board of Trustees, in December 2009)

8.0 Implementation Plan and Financial Projections

8.1 Summary of major milestones and SOCIB phases

• SOCIB Board of Trustees first meeting	18/12/2007
• SOCIB Statutes published, BOE No. 83	05/04/2008
• SOCIB Director appointed	02/12/2008
• SOCIB Management and Finance Manager appointed	06/07/2009
• New SOCIB Office opened in ParcBit	01/08/2009
• First draft of SOCIB Implementation Plan presented to the Executive Commission	06/12/2009
• SOCIB Implementation Plan (final) presented to the Executive Commission and Board of Trustees	07-08/04 /2010
• Design phase	11/2008 - 3/2010
• Construction and equipment phase	12/2009– 12/2011
• Operational (exploitation) phase	6/2012 – onwards

Table 1: Summary of major milestones and Phases
(Phases are as outlined in BOE No. 83)

8.2 Description of Phases

Design Phase (to March 2010): initial organization, set-up of the SOCIB Office at ParcBit (August 2009), planning and development of the major facilities and development of agreements with key partner institutions. A key element of this phase was the setting up of the SOCIB Offices in ParcBit, the creation of the Management & Finance and Computing & IT general services, and the development of the SOCIB Implementation Plan.

Construction and Equipment Phase (to December 2011): The construction of the main facilities and elements of the SOCIB observing and forecasting system, including the development and set up of the Data Centre and the Engineering and Technology Division, the initiation of key facilities and data streams, the development of forecasting tools and ICOM applications, and the staged release and use of SOCIB data products and services by the marine community as initial operational capability achieved. Also crucial is the establishment of partnership agreements.

Operational Phase (2012 and beyond): By 2012 many facilities will have reached final operational capability. At this phase there is an anticipated step up in the activities of the Outreach, Education, Training and Mobility Service to maximise use of the data, products and services by the identified SOCIB user groups.

8.3 Implementation Schedule

The implementation schedules for the major SOCIB elements are summarised below (Table 2) and detailed by facility and element in Annex 3.

	2009		2010				2011				2012		2013	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1/Q2	Q3/Q4	Q1/Q2	Q3/Q4
Systems, Operations and Support Division														
Observing Facilities:														
Coastal Research Vessel	CD	CD	PDP	LP	LP	C	C	C	C	C	IOC	OM	FOC	FOC
Coastal HF Radar	CD	CD	PDP	LP	LP	C	C	IOC	FOC	FOC	FOC	FOC	FOC	FOC
Gliders	CD	CD	PDP	LP	IOC	IOC	OM	OM	OM	OM	FOC	FOC	FOC	FOC
Drifters	CD	CD	PDP	PDP	PDP	PDP	LP	IOC	IOC	OM	FOC	FOC	FOC	FOC
Moorings	CD	CD	PDP	LP	C	IOC	OM	OM	FOC	FOC	FOC	FOC	FOC	FOC
Marine and Terrestrial Beach Monitoring	CD	CD	PDP	LP	C	C	C	C	C	C	IOC	FOC	FOC	FOC
Data Centre Facility	CD	CD	CD	PDP	PDP	IOC	IOC	OM	FOC	FOC	FOC	FOC	FOC	FOC
Modelling and Forecasting Facility	CD	CD	PDP	PDP	LP	C	C	IOC	IOC	OM	FOC	FOC	FOC	FOC
Engineering and Technology Development Division														
Facility Support and Technology Development	CD	CD	PDP	LP	IOC	IOC	OM	OM	FOC	FOC	FOC	FOC	FOC	FOC
Near Shore Station	CD	CD	CD	CD	PDP	LP	PDP	C	C	IOC	OM	FOC	FOC	FOC
Ships of Opportunity/Fishing Fleet Monitoring	CD	CD	LP	PDP	IOC	IOC	OM	OM	FOC	FOC	FOC	FOC	FOC	FOC
Strategic Issues and Application to Society Division	CD	PDP	IOC	IOC	OM	FOC	FOC	FOC	FOC	FOC	FOC	FOC	FOC	FOC
Services														
Management & Finance	PDP	IOC	OM	OM	FOC	FOC	FOC	FOC	FOC	FOC	FOC	FOC	FOC	FOC
Computing & IT	CD	C	OM	PDP	LP	C	IOC	OM	FOC	FOC	FOC	FOC	FOC	FOC
Outreach, Education, Training & Mobility	CD	CD	PDP	PDP	PDP	PDP	IOC	IOC	OM	FOC	FOC	FOC	FOC	FOC

Project Stages:

CD	Concept Development
PDP	Planning, Design and Pilots
LP	Legal Procedure/Purchase
C	Construction
IOC	Achieve Initial Operational Capability
OM	Operation and Maintenance
FOC	Final Operational Capability

Table 2: Implementation Schedule Summary for the major SOCIB elements, detailed schedules are available in Annex 3.

8.4 Financial Projections

The projected budgets have been developed under the assumption, already mentioned before in this implementation plan and in the original SOCIB proposal in 2006, that agreements with partner institutions regarding in-kind contributions of personnel, space and equipment are secured¹⁷. A summary of the actual (2009) and 5-year financial projections (2010 – 2014) are provided below (Table 3) with details by area given in Annex 1.

	2009	2010	2011	2012	2013	2014
Investment per annum	259.918	4.695.513	5.491.244	292.565	287.565	55.000
Total Investment (accum.)	259.918	4.955.431	10.446.675	10.739.240	11.026.805	11.081.805
Operations per annum	143.103	500.679	884.456	1.246.129	1.263.609	1.267.359
Personnel per annum	263.045	718.011	991.332	1.185.354	1.154.764	1.154.764
Total Costs per annum	406.148	1.218.690	1.875.788	2.431.483	2.418.373	2.422.123
Total Costs (accum.)	406.148	1.624.838	3.500.626	5.932.109	8.350.482	10.772.604
Total Costs and Investments	666.066	6.580.269	13.947.301	16.671.349	19.377.286	21.854.409
Income per annum	143.418	207.630	60.000	209.030	300.322	300.322
Total Income (accum.)	174.079	381.709	441.709	650.739	951.061	1.251.384
Cash Flow (inc. 2007 and 2008)	8.149.216	5.367.358	1.546.721	887.025	324.445	-21.719

Table 3: Summary of financial projections

Investment: Most investment occurs in 2010 – 2011, during the Construction and Equipment Phase. The final total invested is 11,081,805 €, which is approximately 500,000 € less than the funds provided for investment (see discussion below).

Operations and Personnel Costs: These are low for 2009, during the Design Phase, and, as with investments, grow in 2010 and 2011 as the SOCIB infrastructure is developed during the Construction and Equipment Phase, primarily through the addition of engineering and technical personnel. The operations and personnel costs stabilise in 2012 as SOCIB enters the Operational Phase. It can be noted that the costs of operation exceed funding for operations by approximately 420,000 € per annum in the Operational phase (see discussion below).

¹⁷ As presented also to the Executive Commission 06/12/2009 of the initial draft of SOCIB Implementation Plan.

Income and Cash flow: The income is primarily from interest on payments and externally funded (public/commercial) research vessel operations. The cash flow remains positive until end 2014 (see discussion below).

The budgets have been prepared to be both realistic (from the bottom up) and to maximize the impact of the considerable public funding invested in this area. The operational budget is carefully balanced, however the budgets presented indicate an ongoing requirement for approximately 200,000 € per annum to support operations. It is anticipated that over the course of the 5-year Implementation Plan period that this will be secured from external funding sources (mainly at a European level) by the Office of the Director as a result of participation, at a European level, in ocean monitoring and forecasting activities.

8.5 Human Resources Plan

The table below (Table 4) indicates, in the anticipated growth in human resources for the essential new staff required to maintain the mission of SOCIB as outlined in this document.

SOCIB Personnel by Grade	2009	2010	2011	2012	2013	2014
Senior Managers	0,5	1,0	1,0	2,0	2,0	2,0
Senior Technician/Engineers	0,9	3,5	4,0	5,0	5,0	5,0
Postdoc/Specialist	1,3	1,6	2,8	3,3	3,3	3,3
Technician/Engineers	1,3	6,5	10,5	11,0	10,0	9,0
Administration	1,3	3,0	2,5	2,5	2,5	2,5
Total (years)	5,3	15,6	20,8	23,8	22,8	21,8

Table 4: SOCIB growth in human resources calculated from the total of the man months (MM) per year expressed in units years (i.e. 12 MM). Note some personnel are part-time or commence part way during a year and so the table represents the total years of work contracted rather than the total personnel, details on contracted persons can be found in Annex 2.

It is anticipated, but not included in the Table 10, that there will additional support funded through external project orientated sources and/or available tools from the I3 Program, Ramon y Cajal and Juan de la Cierva postdoctoral contracts for the incorporation of early stage researchers. This second source of additional support is also part of the role SOCIB role will take in the training and development of young scientific/technical talent in the Balearic Islands.

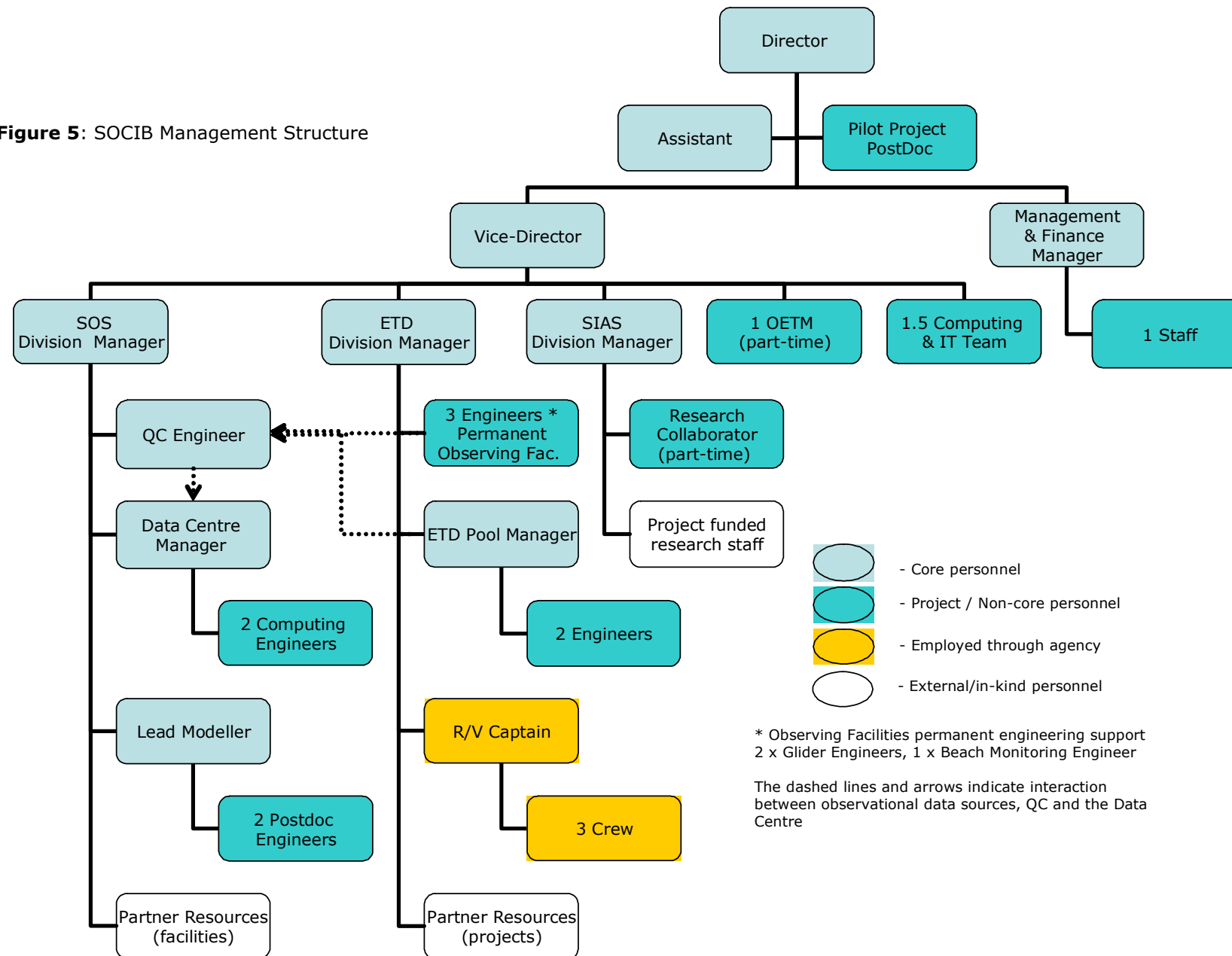
Finally, a minimal level of additional support in the form of in-kind personnel from the key SOCIB research partners has been assumed in the development of this Implementation Plan¹⁸.

Fig. 5 indicates the SOCIB Management Structure. Core personnel are full-time staff that is in principle located at the SOCIB Office and form a core of scientific, technical and operational competence that enables the consortium to function and deliver the data streams of oceanographic observations and forecasts¹⁹. The latter three will meet on weekly basis to plan SOCIB operational activities. Initially the two roles of Vice Director and ETD Division Manager are accomplished by one person, however as operations grow it is possible that the complexity of this role would increase to the level that it requires two people, especially if a number of external projects are initiated. However this would be funded through these or other external sources. The none-core personnel are those employed on short term contracts (from months to 4 years) to advance SOCIB objectives on a project by project basis and the crew of the SOCIB research vessel are employed on annual contracts through a specialised agency. There will be a number of personnel involved in projects (e.g. scientific or technical) whose input will be managed by SOCIB personnel.

¹⁸ As anticipated from Partnership Agreements currently in draft

¹⁹ Note some of these personnel are provided in-kind.

Figure 5: SOCIB Management Structure



8.6 Location Plan

SOCIB has established a base office of 250 m² in ParcBit (Balearic Islands Technology Park), located here is the Director, Office of the Director, Services, Data Centre and Strategic Issues and Applications for Society Division. This office also has space for visiting scientists and houses the initial general computing capability, with onsite storage and backup. This is expanding by 50 m² in 2010 to enable more office and meeting room space to accommodate the expansion of SOCIB human resources in 2010.

The Facilities engineers, ETD Division, will be located in Esporles (2 km from ParcBit) in laboratory, workshop, warehouse and office space provided in-kind by CSIC at IMEDEA (CSIC-UIB), see details below. Computing space, in terms of racks, is also provided in-kind by both IMEDEA (formal agreement in progress) and in the future, the SOCIB parallel computing cluster will be combined with that of UIB and hosted at UIB. Some additional office space will be provided by IEO to support the human resources provided in-kind to the projects and facilities (such as for the Bluefin Tuna and Fishing Fleet Monitoring Project). Table 4 shows a summary of the space contracted by SOCIB directly and provided in-kind.

Although at start up the use of the existing IMEDEA technical space is seen as the most efficient use of public funds (avoiding duplication of application in the Balearic Islands) over the course of the Operations phase it is envisioned that SOCIB, in its role of concentrating and providing a centre of excellence for operational oceanography in the Balearic Islands, will seek investment to create a new centralised technical space at ParcBit, as originally outlined in original SOCIB proposal²⁰ (2006). This is indicated in Table 4 and includes a new Marine Technology Lab, an Engineering Lab, office space and space for the housing of commercial spin off activity. This would consolidate the currently dispersed laboratory, technical and office space in one location, custom designed for operational oceanography activities and aid SOCIB in fulfilling its stated mission to - consolidate operational oceanography and associated marine technology development in the Balearic Islands and in Spain, contributing to the establishment of a well structured centre of excellence within the international framework of ocean observing systems. This new development is dependant on securing

²⁰ Memoria científica del proyecto ICTS-SOCIB (2006)

additional support. A detailed analysis of the space requirements for a Balearic Islands Centre of Excellence for Operational Oceanography is provided in Annex 7.

SOCIB Space (m²)	Existing	Estimated for Centre of Excellence (ParcBit)
Office Space	290	415
General Space		620
Marine Technology Lab		425
Physical Oceanography Instrument Lab (1) Operational Oceanography / AUV and Gliders Lab Coastal Morphodynamics Lab		
Marine Engineering Lab		250
Electronics Lab Workshop (2)		
Warehouse and Garage		1.500
Computing (aircon/secure)	10	150
Data Centre and Remote Sensing		
Spin Off Companies		500
Total SOCIB	300	3.860
In-kind Space (m²)		
TMOOS allocated space at IMEDEA (CSIC-UIB)		
Coastal Oceanography and ICOM Lab	35	
Physical Oceanography Instrument Lab (1)	50	
Operational Oceanography / AUV and Gliders Lab	30	
Coastal Morphodynamics Lab	30	
Data Centre and Remote Sensing Lab	25	
Electronics Lab	30	
Warehouse (2)	60	
Warehouse	30	
Customs Warehouse	15	
Computing	1	
UIB		
Computing (aircon/secure)	2	
Total In-kind (estimated)	308	0
Total Space for SOCIB Operations	608	3.860

(1) inc. equipment for ballasting, crane and pool

(2) inc. 1. Design Workshop, 2. Mechanical Workshop, 3. Annex and Pressure Chamber

Table 4: Summary of office and technical/laboratory space, existing and in planning for future SOCIB activities

8.7 Risk Assessment and Mitigation

The development of a world class ocean observing and forecasting facility in the Balearic Islands, which responds to the changing needs of science, technology and society is not a trivial task. There are a variety of risks associated with this development. The risks are summarised in Table 5, below, divided into short term risks associated with the Design, Construction and Equipment phases and longer term Operational phase risks. The specific risks associated with implementation of

each of the SOCIB elements will be assessed as part of the ongoing reporting on SOCIB structural development.

Risk	Likelihood Rating	Impact Rating	Net Risk Assessed	Mitigation of Risk
Design, Construction and Equipment phase:				
Partnership agreements not secured	Unlikely	Major	Moderate	Ensure significant benefits are to both parties
Key staff not secured	Unlikely	Moderate	Low	Offer competitive salary
Price Changes	Highly likely	Low	Low	Effort has been made to secure accurate pricing, however there will be some price changes over the course of the Plan, some will rise and some fall (current economic climate)
Agreement to construct advanced catamaran R/V not secured	Possible	Moderate	Moderate	An alternative budget has been outlined (see below for further discussion and budget highlights)
Operational phase:				
Unforeseen operational events	Highly likely	Low	Low	Management of contingencies
Pilot projects not successful	Possible	Low	Low	Not become operational and other technologies developed
Additional external funding/income not secured	Possible	Moderate	Moderate	For many Facilities this would have no impact as the Plan is not heavily reliant on external funding (a few projects might have to be reduced). It would affect the R/V operations however with regional agreement this scenario is far less likely
Changing needs and priorities of the marine community	Likely	Moderate	Moderate	This is addressed through scientific steering committee, the research projects that use facilities and the focus on well developed national / international external relations
Changing needs and priorities of society	Likely	Moderate	Moderate	This is addressed through the SIA Division research and through the work of the Office of the Director
Continuity of funding of SOCIB beyond 2021	Unlikely	High	Moderate	It is unlikely given current climate predictions and pressures on resources that all problems in the marine environment will be solved by 2021. However the onus is on SOCIB to evolve as scientific knowledge, technology and societal concerns evolve, to ensure that monitoring and forecasting role remains relevant.

Table 5: Risk and Mitigation of Risk

Alternative Budget: Mitigation for non agreement by regional and national marine science institutions to the construction of a SOCIB advanced catamaran research vessel. The investment in the SOCIB advanced catamaran research vessel is such that it needs to be a useful regional tool to be justified and so the agreement of the Board of Trustees is sought specifically on this issue. If approval is not forthcoming then, as described in the mitigation of risk strategy, an alternative budget has been outlined that contains all the planned SOCIB elements previously discussed, with the exception of the SOCIB research vessel and the addition of the following elements:

- 3 coastal buoys and 2 open ocean buoys (Oceanor type) and specific moorings in the Ibiza channel to monitor variability (seasonal – interannual) in north south exchanges
- Ship time - purchased from other providers (e.g. IEO and CSIC) for the planned monitoring activity, technical trials etc.
- 2 additional HF radar locations (4 stations) – NE Mallorca/SW Menorca and SW Mallorca
- Purchase of a larger RIB -
- Additional personnel - employed on 5-year contracts to speed technology development projects e.g. Wave modeling project, Ecosystem variability, Connectivity focused Program.
- Additional investment in instruments and sensors - to create a regional pool of operational oceanography tools

Although fulfilling the SOCIB mission the alternative budget does not have the same impetus in terms of significantly adding to the regional oceanographic capability, advancing science in the region and both attracting public outreach opportunities and engendering cooperation and participation between institutions.

8.8 Objectives and Evaluation

Investing in SOCIB is about evolving from a fragmented, proposal based approach to ocean monitoring, to a strategic regional approach of sustained long term data acquisition and the provision of these critical, observational datasets, 2011 to 2021 and beyond.

Evaluation will be based on:

- Meeting milestones

- Delivery of products and services, namely
 - o data streams
 - o access
 - o number/type of users
 - o publications using SOCIB data
- OETM Outcomes

Detailed evaluation criteria will be adapted as operations start, and will in particular follow the general reporting requirements for ICTS organisations and form part of the ongoing reporting on SOCIB structural development.

Annex 1: Summary of Financial Projections

INVESTMENTS	Units	Capital Investment						Total Investment
		2009 (1)	2010	2011	2012	2013	2014	2009 - 2014
DIVISIONS								
Systems, Operations and Support		0	0	0	0	0	0	0
Observing Facilities:								
Coastal Research Vessel	1	24.000	2.065.000	3.025.604	0	0	0	5.114.604
Coastal HF Radar	1	0	554.345	0	0	0	0	554.345
Gliders	6	0	359.600	354.000	177.000	177.000	0	1.067.600
Drifters	8 + 16	0	0	72.000	42.000	42.000	42.000	198.000
Moorings	4	0	531.000	0	0	0	0	531.000
Marine and Terrestrial Beach Monitoring	4	0	253.228	0	0	0	0	253.228
Data Centre Facility (2)	1	0	0	0	0	0	0	0
Modelling and Forecasting Facility (2)	1	0	0	0	0	0	0	0
Subtotal		24.000	3.763.173	3.451.604	219.000	219.000	42.000	7.718.777
Engineering and Technology Development								
Facility Support and Technology Development		0	414.000	150.000	20.000	0	0	584.000
New Technology Pilot Programmes:								
Near Shore Station	1	0	170.000	1.211.000	0	0	0	1.381.000
Ships of Opportunity/Fishing Fleet Monitoring	10	0	10.263	80.075	0	0	0	90.338
Subtotal		0	594.263	1.441.075	20.000	0	0	2.055.338
Strategic Issues and Applications for Society (2)								
Subtotal		0	0	0	0	0	0	0
Subtotal Divisions		24.000	4.357.437	4.892.679	239.000	219.000	42.000	9.774.115
SERVICES								
Management & Finance		154.317	113.000	48.000	3.000	3.000	3.000	324.317
Computing & IT		81.601	204.794	510.000	10.000	25.000	10.000	841.395
Outreach, Education, Training & Mobility		0	0	0	0	0	0	0
Subtotal Services		235.918	317.794	558.000	13.000	28.000	13.000	1.165.712
OFFICE OF THE DIRECTOR								
Scientific Advisory Committee		0	0	0	0	0	0	0
Focused Research Programme		0	20.283	40.565	40.565	40.565	0	141.978
RTD Relations		50	0	0	0	0	0	0
Subtotal Office of the Director		0	20.283	40.565	40.565	40.565	0	141.978
TOTAL SOCIB Investment		259.918	4.695.513	5.491.244	292.565	287.565	55.000	11.081.805

COSTS - Operational	2009 (1)	2010	2011	2012	2013	2014
<u>DIVISIONS</u>						
Systems, Operations and Support	0	3.990	6.000	6.000	6.000	6.000
Observing Facilities:	0	0	0	0	0	0
Coastal Research Vessel	7.200	12.000	12.000	186.807	225.537	225.537
Coastal HF Radar	0	0	59.534	59.534	59.534	59.534
Gliders	0	43.500	106.500	210.000	228.750	232.500
Drifters	0	0	50.000	50.000	50.000	50.000
Moorings	0	16.000	64.000	64.000	64.000	64.000
Marine and Terrestrial Beach Monitoring	0	0	72.530	103.930	103.930	103.930
Data Centre Facility (2)	0	15.000	6.000	6.000	6.000	6.000
Modelling and Forecasting Facility (2)	0	7.500	17.500	23.000	23.000	23.000
Subtotal	7.200	97.990	394.064	709.271	766.751	770.501
Engineering and Technology Development		0	0	0	0	0
Facility Support and Technology Development	0	54.000	96.500	104.000	84.000	84.000
New Technology Pilot Programmes:	0	0	0	0	0	0
Near Shore Station	0	0	0	67.500	67.500	67.500
Ships of Opportunity/Fishing Fleet Monitoring	0	794	7.935	7.935	7.935	7.935
Subtotal	0	54.794	104.435	179.435	159.435	159.435
Strategic Issues and Applications for Society (2)	0	0	0	0	0	0
Subtotal	5.515	10.000	10.000	10.000	10.000	10.000
Subtotal Divisions	12.715	162.784	508.499	898.706	936.186	939.936
<u>SERVICES</u>	0	0	0	0	0	0
Management & Finance	83.404	154.195	172.257	169.723	169.723	169.723
Computing & IT	0	12.700	18.700	42.700	22.700	22.700
Outreach, Education, Training & Mobility	17.200	86.000	100.000	50.000	50.000	50.000
Subtotal Services	100.604	252.895	290.957	262.423	242.423	242.423
<u>OFFICE OF THE DIRECTOR</u>	0	0	0	0	0	0
Scientific Advisory Committee	0	13.000	13.000	13.000	13.000	13.000
Focused Research Programme	0	32.000	32.000	32.000	32.000	32.000
RTD Relations	29.784	40.000	40.000	40.000	40.000	40.000
Subtotal Office of the Director	29.784	85.000	85.000	85.000	85.000	85.000
TOTAL SOCIB Operational Costs	143.103	500.679	884.456	1.246.129	1.263.609	1.267.359

(1) 2007, 2008, 2009 figures are actual, 2010 - 2014 are 5 Year Forecast

(2) Investments are in computing equipment and software and therefore under Computing and IT Budget

COSTS - Personnel	2009	2010	2011	2012	2013	2014
<u>DIVISIONS</u>						
Systems, Operations and Support	11.195	66.607	85.780	85.780	85.780	85.780
Observing Facilities:	0	0	0	0	0	0
Coastal Research Vessel	0	23.322	46.643	230.000	230.000	230.000
Coastal HF Radar	0	0	0	0	0	0
Gliders	0	27.894	79.109	102.431	102.431	102.431
Drifters	0	0	0	0	0	0
Moorings	0	0	0	0	0	0
Marine and Terrestrial Beach Monitoring	0	18.487	36.974	36.974	36.974	36.974
Data Centre Facility (2)	35.573	121.536	155.318	155.318	124.728	124.728
Modelling and Forecasting Facility (2)	19.382	68.825	127.129	150.450	150.450	150.450
Subtotal	66.150	326.671	530.953	760.953	730.363	730.363
Engineering and Technology Development		0	0	0	0	0
Facility Support and Technology Development	0	46.693	130.360	130.360	130.360	130.360
New Technology Pilot Programmes:	0	0	0	0	0	0
Near Shore Station	0	0	0	0	0	0
Ships of Opportunity/Fishing Fleet Monitoring	0	0	0	0	0	0
Subtotal	0	46.693	130.360	130.360	130.360	130.360
Strategic Issues and Applications for Society (2)						
Subtotal	103.915	128.541	114.541	77.567	77.567	77.567
Subtotal Divisions	12.715	162.784	508.499	898.706	936.186	939.936
<u>SERVICES</u>	0	0	0	0	0	0
Management & Finance	33.764	65.010	80.305	80.305	80.305	80.305
Computing & IT	0	52.269	36.974	36.974	36.974	36.974
Outreach, Education, Training & Mobility	0	7.648	15.295	15.295	15.295	15.295
Subtotal Services	33.764	124.927	132.574	132.574	132.574	132.574
<u>OFFICE OF THE DIRECTOR</u>						
Scientific Advisory Committee	0	0	0	0	0	0
Focused Research Programme	0	0	0	0	0	0
RTD Relations	0	0	0	0	0	0
Subtotal Office of the Director	59.216	91.180	82.903	83.899	83.899	83.899
TOTAL SOCIB Personnel Costs	263.045	718.011	991.332	1.185.354	1.154.764	1.154.764
TOTAL Costs (Operations and Personnel)	406.148	1.218.690	1.875.788	2.431.483	2.418.373	2.422.123
TOTAL Costs plus IPC @ 2%	406.148	1.218.690	1.913.304	2.528.742	2.563.475	2.615.893

(1) 2007, 2008, 2009 figures are actual, 2010 - 2014 are 5 Year Forecast

(2) Investments are in computing equipment and software and therefore under Computing and IT Budget

FUNDING AND CASH FLOW	2007(1)	2008 (1)	2009 (1)	2010	2011	2012	2013	2014
Funds Recieved for Investment								
Funds received for investment (MICINN & CAIB Agreement)	2.000.000	2.904.830	2.354.830	2.354.830	1.921.855			
Funds recieved other sources (2)								
Total investment funds available (3)	2.000.000	4.904.830	7.257.232	9.352.144	6.578.486	1.087.242	794.677	507.112
Funds invested per annum	0	2.428	259.918	4.695.513	5.491.244	292.565	287.565	55.000
Residual Investment Funds	2.000.000	4.902.402	6.997.314	4.656.631	1.087.242	794.677	507.112	452.112
Funds Recieved for Operations								
Funds received for operations (MICINN & CAIB Agreement)	54.000	769.885	569.885	569.885	1.602.055	1.952.581	1.988.138	2.024.407
Funds recieved other sources (2)								
Total operational funds available (3)	54.000	823.885	1.383.971	1.547.708	1.931.073	1.970.351	1.429.746	890.678
Funds spent (Costs + IPC) (1)	0	9.799	406.148	1.218.690	1.913.304	2.528.742	2.563.475	2.615.893
Residual Operations Funds	54.000	814.086	977.823	329.018	17.770	-558.392	-1.133.729	-1.725.215
Income from Operations								
Vessel Operations (external operations)	0	0	0	0	0	167.030	273.322	273.322
Glider Operations (dynamic/relocatable)	0	0	0	0	0	27.000	27.000	27.000
Bank interest	0	30.661	143.418	207.630	60.000	15.000	0	0
Total Income	0	30.661	174.079	381.709	441.709	650.739	951.061	1.251.384
OceanBit Cash Flow								
Residual Investment Funds	2.000.000	4.902.402	6.997.314	4.656.631	1.087.242	794.677	507.112	452.112
Residual Operations Funds	54.000	814.086	977.823	329.018	17.770	-558.392	-1.133.729	-1.725.215
Total Income	0	30.661	174.079	381.709	441.709	650.739	951.061	1.251.384
Cash Flow	2.054.000	5.747.149	8.149.216	5.367.358	1.546.721	887.025	324.445	-21.719

(1) 2007, 2008, 2009 figures are actual, 2010 - 2014 are 5 Year Forecast

(2) Result of successful application for project funding, primarily at a European level

(3) Includes unspent from previous years

Annex 2: Initial Infrastructure Investment

In this annex, we present, for each of the major elements of SOCIB Observing and Forecasting Systems, incorporated in the different SOCIB Divisions and Services, a brief description of the characteristics, and budget. Also, where appropriate, we have also provided a brief international review of similar facilities and an initial deployment configuration.

Infrastructure Investment 01: Coastal Ocean Research Vessel

The Coastal Ocean R/V represents a major infrastructure investment and is one of the flagships for SOCIB. Therefore, we provide below a brief overview of the proposed vessel and the budgets while the detailed information is given in a separate annex, Annex 4, which contains a detailed description of the needs, the proposed vessel, current regional operational platforms and studies of the viability of constructing the research vessel in Spain.

1. Proposed SOCIB R/V

A fast catamaran hull with overall length of approximately 24 m (less than 24 m registered LOA) is proposed, as this design maximizes space, in terms of availability for scientific operations (wet and dry laboratories and an aft platform for one or two 10 foot containers) and accommodation for crew and scientists/technicians, whilst offering high speed capabilities and manoeuvrability. The flexibility of this modern design, in terms of space, speed, stability and layout, gives this vessel the ability to adapt to the goals of different projects making it a valuable tool for the scientific community of the region. The small crew requirements mean operations are at a minimal cost.



Figure 1: Image of an existing coastal catamaran research vessel, the NOAA R/V Manta

2. Budget Overview

Investment: consists of the design and construction of an advanced technology and high speed coastal catamaran particularly suitable for coastal operations and around 24 m LOA, in line with NOAA R/V Manta (USA) launched in 2008. It is anticipated that a tender will be published during the second semester of 2010 and construction is foreseen during 2011 with sea trials (3 months) in early 2012. With SOCIB monitoring operations estimated to initiate April 2012 or earlier. Scientific equipment is purchased for coastal monitoring and is available onboard, as detailed in Annex 4. The construction cost is based on a quotation from CYPsa, incorporating the New Zealand based Manta design project (see Section 8 - Supporting Documents for details) and representing a middle range cost estimate at 4.050.000 €.

Maintenance and operation: Maintenance and operations is considered from launch in early 2012. The number days available for oceanographic operations is estimated at around 115 days in 2012, thereafter 150 (the maximum under maritime employment law for one crew team). From this 150 days, 60 will be directly related to SOCIB monitoring operations in the Balearic Sea and 90 will be available for external access. Operations costs are estimated from figures obtained from R/V Manta and the CYPsa Estudio De Viabilidad (see Section 8 – Supporting Documents for details). The estimation of costs include, crew, victuals, maintenance, annual haul out, insurance (estimated at 1%) and fuel (estimated at 1113.84 € per days at sea, personal communication Luis Ansorena, CSIC). Giving an estimated cost per day for the SOCIB R/V of approximately 3.000 €.

It is anticipated that SOCIB monitoring programmes will be undertaken as well as externally funded open access research or commercial projects (e.g. to monitor water quality) in the Balearic region. The IEO operated RADMED cruises (PI. JL Lopez-Jurado, COB-IEO) are presently undertaken every 3 months in the Balearic and Alborán sea by the IEO R/V Odón de Buén, taking an estimated at 100 days of ship time per year. It is anticipated that the SOCIB R/V would be able to complete the surveys in 50% of the time with continuous operations. In addition there will be a number of weeks per annum available for external operations in the Balearic region for example water quality surveys, seabed mapping, MPA monitoring.

Personnel: The crew will be contracted through a specialised agency, starting from the sea trials anticipated in early 2012. The crew will be adjusted depending on the operations and monitoring programmes (4 for daily 8 hours operation and 7 for 24 hour operations during a maximum of 7 days). For daily operations this would be a Captain, Chief Engineer, Seaman and a Seaman/Cook. The Captain and Chief Engineer are responsible for the safe running of the vessel and the ETD Engineers for the operation and maintenance of the scientific equipment. A naval engineer will be contracted from June 2010 to end 2011 to manage the construction of the SOCIB R/V.

Institutional agreements: The IEO operated RADMED cruises could be part of a Partnership Agreement currently under discussion with IEO. In-kind contributions, in terms of knowledge and expertise, from UTM CSIC and IEO personnel are essential during the construction phase and the possibility of an in-kind contribution to the crew from one or another organization (related to the ceasing of operations of existing old coastal R/V) has also been explored and will be further analysed once the general lines of the SOCIB Implementation Plan are approved.

Income: Externally funded operations of four different types are foreseen for 82 days per year, from 2013 onward, based on existing needs and know how in the Balearic Islands. They could include:

- Routine oceanographic monitoring from research organization (45 days)
- Research projects from different funding agencies (25 days)
- Balearic Islands Government²¹ (10)
- Private Companies²² (10)

Will be funded by the organisations undertaking the cruises at a calculated SOCIB R/V daily rate of approximately 3.000 €, to cover fuel, crew and victuals costs with a contribution to maintenance. These costs will be adjusted as operations start and might be modified in particular in relation to external use by private companies.

Budget Overview	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment	24.000	2.065.000	3.025.604	0	0	0	5.114.604
Operations	7.200	12.000	12.000	186.807	225.537	225.537	669.081
Personnel	0	23.322	46.643	230.000	230.000	230.000	759.965
Income	0	0	0	167.030	273.322	273.322	713.675

Budget Detail	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment							
Vessel construction	0	2.025.000	2.025.000	0	0	0	4.050.000
Scientific equipment	0	0	1.000.604	0	0	0	1.000.604
Studies (inc. Manta Visit)	24.000	40.000	0	0	0	0	64.000
Total	24.000	2.065.000	3.025.604	0	0	0	5.114.604
Operations							
Travel	7.200	12.000	12.000	0	0	0	31.200
Fuel	0	0	0	125.307	125.307	125.307	375.921
Maintenance	0	0	0	0	38.730	38.730	77.460
Insurance	0	0	0	40.500	40.500	40.500	121.500
Victuals	0	0	0	21.000	21.000	21.000	63.000
Subtotal	7.200	12.000	12.000	186.807	225.537	225.537	669.081
Personnel							
Captain	0	0	0	80.000	80.000	80.000	240.000
Chief Engineer	0	0	0	80.000	80.000	80.000	240.000
Marinero	0	0	0	70.000	70.000	70.000	210.000
Project engineer	0	23.322	46.643	0	0	0	69.965
Subtotal	0	23.322	46.643	230.000	230.000	230.000	759.965
Income							
External Operations	0	0	0	167.030	273.322	273.322	713.675
Subtotal	0	0	0	167.030	273.322	273.322	713.675

Timeline	2009	2010	2011	2012	2013	2014
	Studies	studies / open call / selection	Build	Sea Trials / Initial Operations	Full Operation	Full Operation
Purchase		0,5	0,5			
Operations (days)						
Days operation available	0	0	0	150	150	150
Sea trials	0	0	0	35	0	0
Permanent SOCIB	0	0	0	60	60	60
External Operations	0	0	0	55	90	90
Subtotal	0	0	0	150	150	150
Days at sea	0	0	0	113	113	113
People (numbers)						
Captain	0,0	0,0	0,0	1,0	1,0	1,0
Chief Engineer	0,0	0,0	0,0	1,0	1,0	1,0
Marinero	0,0	0,0	0,0	2,0	2,0	2,0
Project engineer	0,0	0,5	1,0	0,0	0,0	0,0
Subtotal	0,0	0,5	1,0	4,0	4,0	4,0

²¹ Such as: DG Emergencias, DG Pesca, DG Medi Ambient

²² Electricity cables, communication cables, pipelines, environmental consulting

Infrastructure Investment 02: Coastal HF Radar Facility

1. Brief international review of similar type of facilities

Surface currents are identified as a high priority product for coastal ocean observing systems. Shore-based high-frequency (HF) radars that broadcast and then observe back-scattered radio signals from the oceans surface are now a mature technology that has been implemented and is routinely operating in numerous locations worldwide. The Mid-Atlantic HF Radar Consortium (MAHFRC) along the Eastern US Coast has established a 26-site network that is a reference worldwide (<http://marine.rutgers.edu/cool/codar.html>). The US West Coast HF radar network is another worldwide reference (<http://www.cocmp.org/>). These facilities combine several radar stations of different resolution and ranges and are integrated into the National High Frequency Surface Current Mapping Radar Network, developed as a backbone system within IOOS (<http://hfradar.ndbc.noaa.gov/>). Outside the US, in Australia IMOS has recently established the Australian National Facility for Coastal Radar Network (ACORN). There are also several initiatives around Europe to establish radar networks for surface current measurements and to incorporate them into operation coastal ocean observing systems, providing real-time surface current and wave data. Spain (Puertos del Estado), Portugal, France, Norway, England, Italy and Croatia already have HF radar networks operating in real time.

2. Facility description and contribution to objectives

HF radars are used to measure and identify surface current fields and waves (Barrick et al, 1977) at different spatial resolutions (ranging from 500 m to 6 km) and different ranges (from nearshore up to 200 km offshore). Several studies around the world have confirmed the reliability of the current radar measurements (Kohut, 2003), and the utility of this system in providing real-time information as a shore-based monitoring technology.

The Coastal HF Radar Facility (12 MHz) will contribute to the SOCIB objectives through:

Science: HF radar will contribute to the understanding of coastal ocean dynamics, more specifically the variability of the coastal currents, eddies (especially small scale eddies that are difficult to model), and the interactions between large and small scale features. Also important is the contribution in terms of obtaining high quality 2D surface observations in an area where oceanic climatologies are of limited use, given the very few historical observations available. As a result, the radar observations will be used to compare numerical model outputs with observations in the Balearic Sea sub-basin. This lack of historical climatologies is particularly an issue in the Ibiza Channel region and is especially relevant in the context of understanding north/south exchanges in the Mediterranean through this channel.

Technology/Operational: HF radar is one of the most advanced remote ocean monitoring technologies available, capable of providing observations year round independent of atmospheric and sea conditions. HF radar technology is used to identify surface current fields, from which trajectories of passive bodies can be computed, and to produce observational data products of current and wave statistics. In the future, surface radar currents will contribute to improve ocean currents 3D fields, through data assimilation into numerical models.

Society: Radars will help in monitoring coastal waters around the Balearic Islands in relation to water quality, therefore providing specific data to support the science based implementation of the EU Water Directive. In addition, applications using currents and wave data that serve the needs of society, including real-time velocities, trajectories for search and rescue or hazardous material spill mitigation, wave observations and short term forecasts of currents and wave conditions can be developed with the data and models. With the surface data, researchers can create maps of sea-surface currents, wave features and ocean swell – factors which interact to affect everything from beach dynamics (e.g. in Palma Bay), to fish migrations, jellyfish trajectories and pollution drift.

Outreach and Education: Radar data through the website will be used to interest the students from UIB, from the Balearic Islands and nationwide in marine sciences and operational oceanography, and to make the ocean more accessible to the undergraduate community and society in general.

External: With other European radar facilities of coastal observatories in Europe (NURC and OGS in Italy) and with the already existing in USA (Rutgers University, NPS Monterey), and Australia (IMOS), therefore also contributing to reinforce the Spanish position in the international frame. SOCIB will promote strong collaborations with the other international Radar facilities to exchanges experiences, know-how and expertise in the use and application of HF radar technology in international forums e.g. the International Radiowave Oceanography Workshop (ROW) meetings.

3. Initial deployment configuration

One installation, of a long range HF system (1) with 2 radar stations, will be deployed to monitor the Ibiza Channel to monitor North/South exchanges. Note that to have total currents we need 2 radar sites to combine the radial velocity currents, shown in Fig. 2 is the coverage and the overlapping region.

A future extension of this facility, with another of a long range system (2) in NE Mallorca (to monitor the Mallorca-Menorca Channel) and a high resolution system (3) in the Bay of Palma is foreseen within the framework of research proposals.

The installation of the HF Radar Facility in the Balearic Islands will take into account the following priorities:

- To deploy technologies and work with methods that limit the environmental impact on the islands to the feasible minimum. Therefore special attention needs to be placed on the compactness of the antenna and in the proper design of the shelter, energy and communication solutions.
- The highest data quality in terms of accuracy, current maps coverage and time reliability.
- To employ technologies that allow frequency sharing in agreement with ITU standards with other systems that might operate in the islands or along continental Europe
- To select a technology with references of operation in networks with more than 2 stations
- To use the existing Data Centre experience for management of HF Radar data

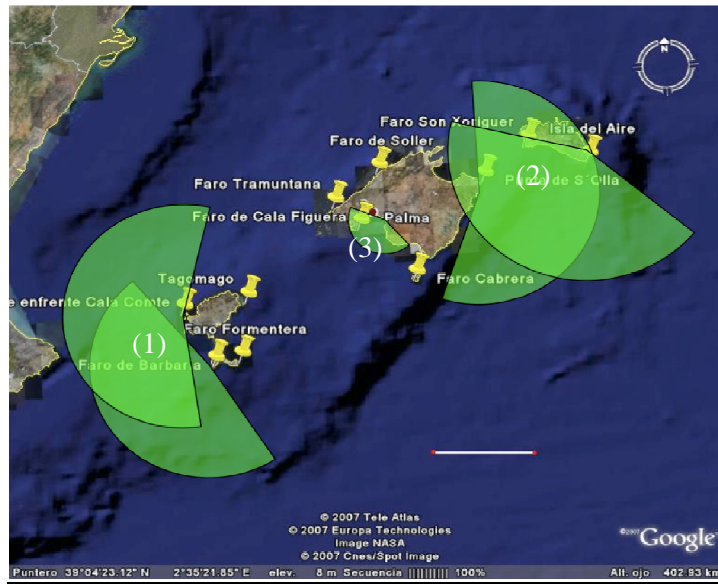


Figure 2. Initial and future potential deployments of the HF Radar facility for the long range systems in the Ibiza (1) and Menorca Channels (2) and a High Resolution system in the Bay of Palma (3)

4. Nature of investment:

Investment: will consist of 1 long range HF radar 12 MHz system, with two HF radar stations, to monitor exchanges in the Ibiza Channel. To be purchased during 2010.

Maintenance and operations: commencing in 2011 and undertaken by the HF radar supplier on a fixed price 5-year contract basis. This will encompass:

- repair and hot spare part service
- remote technical support line service
- remote system QA/QC service
- onsite preventive and corrective system support service
- yearly system software update service

In addition there will be some limited SOCIB operating expenses for energy supply and communications.

Personnel: no specific personnel from SOCIB will be required to support this Facility.

Space: 3 Units in SOCIB Computing Rack

In-kind: A relationship with the Engineering Faculty of UIB will be established to incorporate their experience and add to the existing data processing methods.

5. Budget:

Budget Overview	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment	0	554.345	0	0	0	0	554.345
Operations	0	0	59.534	59.534	59.534	59.534	238.137
Personnel	0	0	0	0	0	0	0

Budget Detail	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment							
HF Installations	0	554.345	0	0	0	0	554.345
Subtotal	0	554.345	0	0	0	0	554.345
Operations							
Maintenance	0	0	59.534	59.534	59.534	59.534	238.137
Subtotal	0	0	59.534	59.534	59.534	59.534	238.137
Personnel							
Engineer	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0

Timeline	2009	2010	2011	2012	2013	2014
Purchase						
HF Installations	0	1	0	0	0	0
Operational						
HF Installations	0	0	1	1	1	1

6. References

- Barrick, D.E., M.W. Evens and B.L. Weber, 1977: Ocean surface currents mapped by radar. *Science*, 198, 138-144.
- Kohut, J.T. and S.M. Glenn, 2003. Calibration of HF radar surface current measurements using measured antenna beam patterns. *J. Atmos. Ocean. Tech.*, 1303-1316.

Infrastructure Investment 03: Glider Facility

1. Brief international review of similar type of facilities

Gliders are becoming today a key component of any new ocean observing system. For example, the Integrated Marine Observing System (IMOS) in Australia has established the Australian National Facility for Ocean Gliders (ANFOG, <http://imos.org.au/anfog.html>). This facility consists of a glider fleet of 10 vehicles for different applications such as monitoring boundary currents and eddies. The IMOS facility combines coastal gliders for shelf areas ($z < 200$ m) and deep gliders for operations in the open ocean ($z < 1000$ m) and deployments cover periods of between 3 weeks and 6 months. In the USA, both IOOS and OOI include glider deployments, as is also the case in the UK at NOCS, in Germany at COSYNA, and other leading ocean monitoring countries.

In France, CNRS-INSU is planning an initiative, the Mediterranean Ocean Observation on Environment (MOOSE), to establish an integrated multi-sites system of marine and atmospheric observatories in the NW Mediterranean. In this initiative a glider fleet (4 gliders so far, developing to a fleet of 10-12 within a few years) will operate in the north western Mediterranean Sea providing real-time data to contribute to a better understanding of the physical and biogeochemical processes in the area e.g. winter convection, mesoscale variability of the Northern Current, etc.

2. Facility description and contribution to objectives

Gliders will allow the autonomous and sustained collection of CTD data and biogeochemical measurements (fluorescence, oxygen, etc) at high spatial resolutions (1 km) and at low costs compared to conventional methods. Novel studies carried out in the last 2 years in the Mediterranean Sea have confirmed the feasibility of using coastal and deep gliders to monitor the spatial and low frequency variability of the coastal ocean (Alvarez et al., 2007; Ruiz et al., 2009a; Ruiz et al., 2009b). Gliders have proved to be highly robust platforms to monitor the ocean even under adverse meteorological conditions and/or in challenging oceanic areas such as the Alborán Sea (Ruiz et al., 2009c).

The Glider Facility will contribute to the SOCIB objectives through:

Science: Gliders will specifically contribute to the understanding of mesoscale and submesoscale dynamics and multidisciplinary interactions, currently a topic of the high international scientific interest and where contributions from SOCIB can be of global interest. Also important is the contribution to routine monitoring in the Balearic Sea, obtaining high quality 3D observations in an area where oceanic climatologies are of very limited use given the very few historical observations available. As a result, the observation is both a scientific and a strategic objective, as currently numerical model outputs are very hard to compare with observations in the Balearic Sea sub-basin. This lack of historical climatologies is a particularity important in the Southern Balearic Sea region and is relevant in a general context of understanding north/south exchanges in the Mediterranean, Modified Atlantic Water propagation.

Technology/Operational: Gliders are important platforms for the development of new operational oceanography tools and applications. They are a useful platform on which to develop and implement new sensors for ocean monitoring and for increasing the safety of glider operations and navigation through for example the incorporation of technology such as AIS. In addition the development of new tools

for the in depth analysis and visualization of glider data is now a worldwide requirement. As with gliders a very high vertical and horizontal sampling rate is combined with a low horizontal velocity, generating both large data files and resulting in non-synopticity of the monitoring. Spatial averages need to be considered to reduce noise and take full advantage of the intense sampling. Additionally gliders will contribute to obtaining high quality products such as ocean currents 3D fields through data assimilation into numerical models.

Society: Gliders will help in monitoring coastal waters around the Balearic Islands in relation to water quality, therefore providing specific data to support the science based implementation of the EU Water Directive.

Outreach and Education: Glider will be used to interest the students from UIB, more general from the Balearic Islands and nationwide through the web, in marine sciences and operational oceanography, and make the ocean more accessible to the undergraduate community and society in general. Contact with the Balearic Island government department responsible for this area (D.G. Recursos Hidricos) is being established.

International collaboration: SOCIB will promote strong collaborations with the other international glider facilities to exchanges experiences, know-how and expertise on gliders. Establishing collaboration with the glider facilities of other European coastal observatories (MOOSE in France, NURC in Italy, etc) and maintain existing contact with facilities in USA (Rutgers University, University of Washington) and Australia (IMOS), thus contributing to reinforcing the Spanish position in the international frame.

3. Initial deployment configuration

The Glider Facility will be responsible for (a) permanent monitoring operations on selected transects (2 gliders – 12 months) and for (b) providing gliders for re-locatable, open access, operations (6 months total per annum, 1 or 2 gliders). A glider repository is maintained, as based on the 5 years of operational experience at IMEDEA (CSIC-UIB), it can be assumed that gliders are non-operational for a percentage of the monitoring period due to either routine maintenance or operational repair issues (this is estimated at 35% of operational time) and it is therefore necessary to have several replacement units in a repository to maintain an operational monitoring system.

- Initial key transects for permanent glider operations:
- Balearic Sea (satellite tracks, Balearic front)
- Balearic channels (North/South exchanges)

In addition to the above, systems and procedures will be developed for glider fleet management, training, service and maintenance, pressure testing, sensor calibrations, satellite data communications, web based glider command-control and a real time data delivery system.

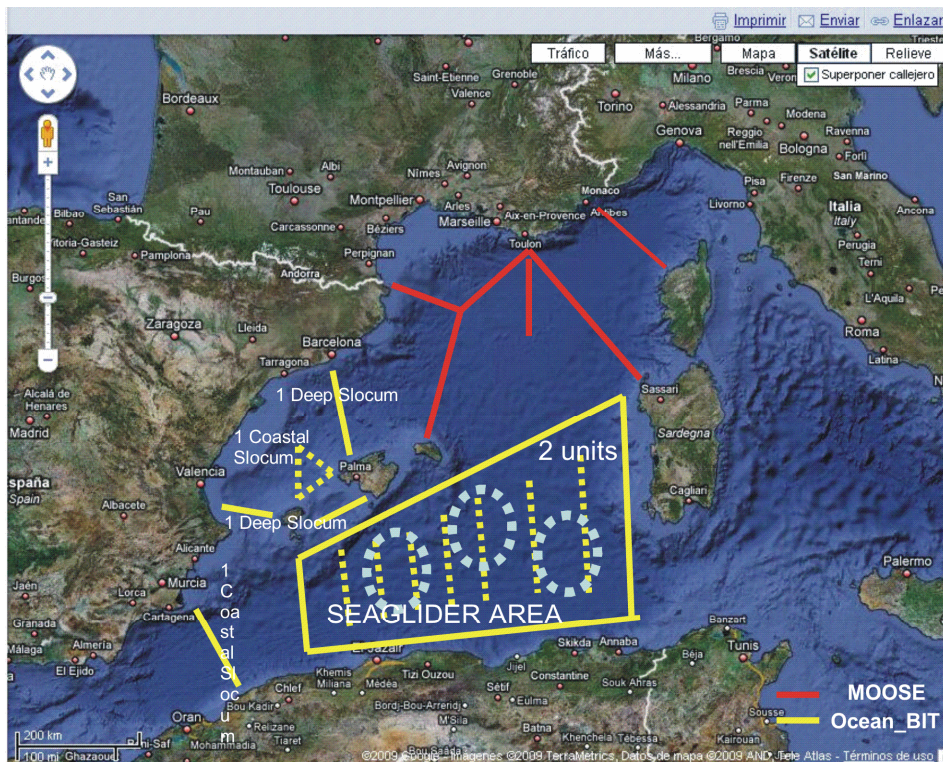


Figure 3. Initial deployments included in the SOCIB glider facility

4. Nature of investment:

Investment: 6 gliders, a combination of Slocum deep gliders and iRobot Seaglidors, will be purchased; 2 in 2010, 2 in 2011 and 1 in 2012 and 1 in 2013. A 10 - 12 m RIB for glider launch and recovery will be purchased in 2010 and a pressure chamber for glider testing and development in 2011 (part of the ETD development budget), when a suitable laboratory location has been identified. A van will also be purchased (part of the Management and Finance budgets) and equipped to transport gliders.

Maintenance and operation: will initiate as pilot operations during 2010, 3 months using the in kind IMEDEA (CSIC-UIB) gliders. In 2011 it is anticipated that a full year (12 months) of continuous monitoring operations will be initiated using the new gliders purchased in 2010, with additional support from the existing in-kind gliders. Operations will continue to expand during 2011 with two gliders full time (24 months) and in 2012 an additional 6 months open access operational time will be available from 1 or 2 gliders depending on the projects. Functioning of the routine SOCIB glider facility: the gliders will be considered at four levels: (a) available for routine operations/missions, (b) available in the repository, (c) at the glider's lab under repair, and (d) sent for annual calibration/maintenance. The open access element of the SOCIB Glider Facility is partially supported, SOCIB supplying engineers and calibrated gliders, the outside research organization funding the glider communications, batteries and ship time for launch and recovery operations.

Personnel: two full time engineers will be contracted to support the Glider Facility. The first in 2010 and the second in 2011, the initial glider engineer will be fully supported by existing IMEDEA (CSIC-UIB) and SOCIB expertise in establishing the

foundations of the glider facility in relation to mission design, operation, data communication and download, quality control, etc.

Space: See in-kind contributions below

In-kind contributions: This facility is additionally supported through important in-kind contributions from IMEDEA (CSIC-UIB)²³, specifically:

Personnel - IMEDEA (CSIC-UIB):

- Post doctorate researcher, RyC Fellow: 12 MM
- Permanent research staff (estimated 2 MM from two TS, 1 MM from 1 PI 1 MM from 1 CT): 6 MM
- Engineer (Electronics): 6 MM
- Technician (Electronics): 2 MM
- PhD student (Argo and Glider data)

Space - IMEDEA (CSIC-UIB):

- Electronics Lab: 30 m²
- Operational Oceanography / AUV and Gliders Lab: 30 m²
- Warehouse: 20 m²
- Physical Oceanography Instrument Lab, including equipment for ballasting (crane and pool): 50 m²
- Workshop, including pressure chamber (to 150 m): 25 m²
- Coastal Oceanography and ICOM Lab: 30 m²

Equipment - IMEDEA (CSIC-UIB):

- 3 coastal Slocum gliders
- 1 deep Slocum glider

Summary in-kind contributions:

- Total personnel: 26 MM per annum
- Total space: 175 m² per annum
- Total equipment: 4 gliders

²³ As described in the IMEDEA (CSIC-UIB) Strategic Plan 2010 - 2013

5. Budget

Budget Overview	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment	0	359.600	354.000	177.000	177.000	0	1.067.600
Operations	0	43.500	106.500	210.000	228.750	232.500	821.250
Personnel	0	27.894	79.109	102.431	102.431	102.431	414.294
Income	0	0	0	27.000	27.000	27.000	81.000

Budget Detail	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment							
Gliders	0	354.000	354.000	177.000	177.000	0	1.062.000
Training	0	5.600	0	0	0	0	5.600
Subtotal	0	359.600	354.000	177.000	177.000	0	1.067.600
Operations							
Permanent Operations	0	13.500	54.000	108.000	108.000	108.000	391.500
Open Access Operations	0	0	0	27.000	27.000	27.000	81.000
Recalibration	0	15.000	30.000	45.000	60.000	60.000	210.000
Insurance	0	15.000	22.500	30.000	33.750	37.500	138.750
Subtotal	0	43.500	106.500	210.000	228.750	232.500	821.250
Personnel							
1st Glider operator	0	27.894	55.787	55.787	55.787	55.787	251.044
2nd Glider operator	0	0	23.322	46.643	46.643	46.643	163.251
Subtotal	0	27.894	79.109	102.431	102.431	102.431	414.294
Income							
Open Access	0	0	0	27.000	27.000	27.000	81.000
Subtotal	0	0	0	27.000	27.000	27.000	81.000

Timeline	2009	2010	2011	2012	2013	2014
Purchase						
Gliders Purchase	0	2	2	1	1	0
Gliders in kind	0	4	0	0	0	0
Subtotal Gliders	0	6	8	9	10	10
Operational						
Potential Operational (gliders)	0	4	6	8	9	10
Permanent Operations (months)	0	3	12	24	24	24
Open Access Operations (months)	0	0	0	6	6	6
Lab/repairs (months)	0	36	5	12	12	12
Recalibration (gliders)	0	1	2	3	4	4
Repository (gliders)	0	0	4	4	4	5
People (numbers)						
1st Glider operator	0,0	0,5	1,0	1,0	1,0	1,0
2nd Glider operator	0,0	0,0	0,5	1,0	1,0	1,0
Subtotal	0,0	0,5	1,5	2,0	2,0	2,0

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Infrastructure Investment 04: Drifter Facility (Argo and surface drifters)

Brief international review of similar type of facilities

The global array of Argo floats has been demonstrated [Roemmich et al., 2009] to be one of the major components of the Global Climate Observing System/Global Ocean Observing System (GCOS/GOOS). It provides a quantitative description of the changing state of the upper ocean and the patterns of ocean climate variability, from months to decades, including heat and freshwater storage and transport. Besides that, an estimation of the actual surface ocean velocities is also necessary to describe non-geostrophically balanced dynamics [Niiler et al., 2003a]. Together with the need for ocean atmospheric pressure, winds and salinity, the rationale that supports the Global Drifter Program (GDP), also part of the GCOS/GOOS.

In order to sustain the coverage of both arrays, many research institutions have developed their Argo and drifter contributions in their region of influence or research interest. For instance, in the USA, the multi-agency National Ocean Partnership supports half of the global Argo array, with a world-wide deployment rate of about 410 Argo floats per year, and about 85% of the global drifter program. IMOS in Australia has established the National Australian Argo contribution as one of its facilities and are committed to deploying 50 floats per year to maintain the Argo array in the Australasian region and in the Southern Ocean, together with drifter deployments for selected experiments. IFREMER provides 50 floats per year to support ocean research in different ocean regions, mainly the North and South Atlantic and also has several research projects that support the France contribution to the global drifter program. Many other ocean institutions have an Argo and drifter program as a important part of their ocean observing strategy, among others the Japan Agency for Marine-Earth Science and Technology, the UK Met Office and NOCS, and Alfred Wegener Institute for Polar and Marine Research.

2. Facility description and contribution to objectives

Argo floats are battery-powered autonomous floats that measure high-quality temperature and salinity profiles from the upper 2000 m of the ocean profile, they spend most of their life drifting at 700 m and every 5 days floats rise to the surface while measuring temperature and salinity. Every 10 - 50 days (depending on the program) a deep profile to 2000 m is carried in order to sample deep water mass properties. Floats are designed to make about 150 such cycles, giving an expected lifecycle of 2 years, in practice however Argo floats generally have a lifespan of 3 - 4 years or more.

Surface drifters provide data on salinity, temperature and ocean velocity along the lagrangian trajectory at the surface. The data is usually provided every 2 hours and the drifters are designed to survive up to 2 years.

The use of Argo data is proven to be a valid method to observe and understand large-scale ocean inter-annual variability in water-mass properties [Vélez-Belchi et al., 2009] and to complement traditional CTD measurements. In addition Argo data combined with deep velocities estimated from Argo float trajectories, has permitted the monitoring of ocean heat and mass transports for the meridional overturning circulation (MOC) at a higher temporal resolution than those obtained from traditional CTD measurements and at a small fraction of the cost of large scale mooring arrays (Hernández-Guerra et al., 2009).

The combination of drifter surface velocity and sea level anomaly provided by satellites enables the obtaining of a consistent horizontally and vertically dynamically balanced, near-surface pressure field. This new way of observing the ocean surface has permitted the discovery of new features in ocean circulation (Centurioni et al., 2008, Niiler et al., 2003b) not observed before due to the geostrophic view of the ocean provided by most of observing systems.

Recent changes in the Western Mediterranean Deep Waters [López-Jurado et al, 2005] suggest that variability in the deep and intermediate waters in the Mediterranean can occur in scales shorter than previously thought and therefore continuous monitoring of deep and intermediate waters is need.

The Drifter Facility (ARGO and Surface Drifter) will contribute to the SOCIB objectives through:

Science: Argo profilers will be an invaluable tool in understanding the large scale variability of the Mediterranean deep and intermediates waters, and therefore gaining insight into the role of the atmosphere in the large scale circulation in the Mediterranean. A sustained Argo observation of the Mediterranean Sea will help overcome the lack of continuous intermediate and deep observations which has led to an inaccurate representation of the Eastern Alboran and Balearic Sea region in ocean forecasting. Measurements of surface velocity and mean sea level anomaly will enhance and enable a description of the unknown seasonal cycle of the surface currents in the Western Mediterranean. Research in the fields of climate science, physical oceanography, ocean forecasting, coastal ocean dynamics and ecosystem and fisheries influenced by physical variability will benefit from the data stream. In close coordination with routine glider data, the Drifter Facility will contribute to obtaining baseline data on heat content, essential in the present context of climate change to establish and understand the inter-annual variability in the Western Mediterranean and will also play a key role in operational SOCIB activities through data assimilation.

Technology/operational: For the Argo floats there are still many challenging technological problems; from managing the incoming two-way communication, to maximizing the data gathering at deep levels and when the float drifts near the coastline, to the use of new sensors such as oxygen and subsurface position indicators. The calibration in delayed mode of the Argo profilers is also still a open question for the Argo community. In the same, sense, the drifter community is facing also challenging new technology issues, such as those related to the spectral wave sensors being developed at low cost for lagrangian platforms. Argo will contribute to obtaining high quality temperature and salinity measurements, including important deep observations, in addition Argo and drifter data, through data assimilation into numerical models such as HOPS and ROMS, can be used to verify products such as ocean current 3D fields.

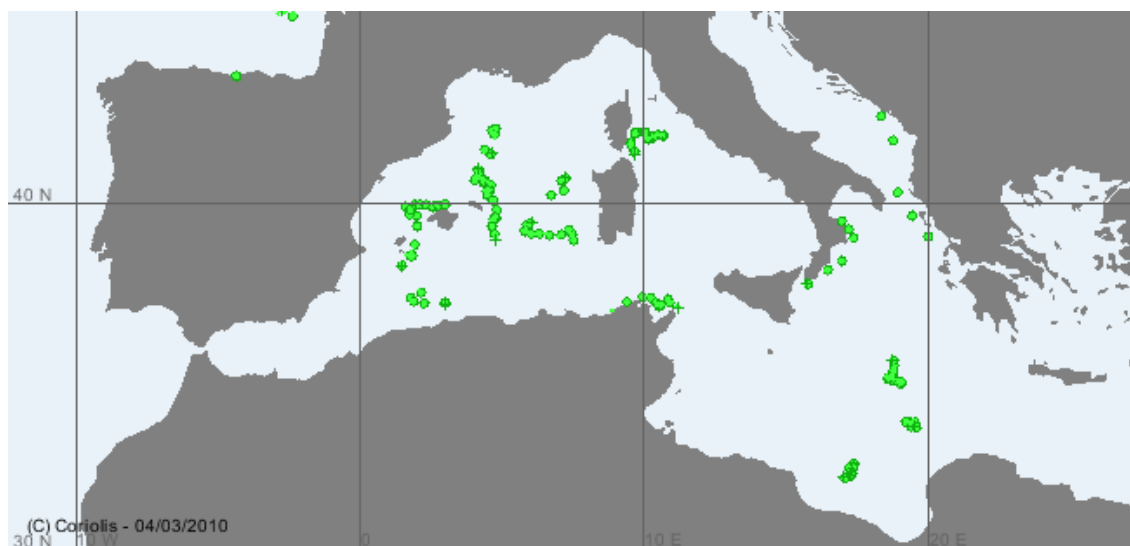
Society: The Argo and drifter data will contribute significantly to the accuracy of mid-range forecasting.

Outreach and Education: The Argo and the Drifter program has already experience in using the data it provides for educational purpose, with programs a as NOAA's 'Adopt a Drifter' Program (<http://www.adp.noaa.gov/>), currently running in the US and encouraging the interest for ocean research in schools and colleges. Argo float data is also viewable through Google Earth (<http://www.nodc.noaa.gov/argo/argoGE.htm>).

International collaboration: The SOCIB Drifter Facility will represent an important contribution to the Western Mediterranean component of the international Argo Project and the Global Drifter Program. Consequently, strong collaboration in the scientific and technological issues will be an automatic consequence of operating this facility. Additionally, this facility will contribute to reinforce the Spanish position in the international ocean research community.

3. Initial Deployment Configuration

The implementation program of the Argo Project is based on the objective of solving ocean patterns in scales longer than months and therefore a coverage of 1 float every $3^\circ \times 3^\circ$ was established. However the different ocean dynamics of the Mediterranean Sea make it necessary to increase the coverage to at least 1 float every $2^\circ \times 2^\circ$ in order to keep the same scientific objective. For the Global Drifter Program, the planned density was 1 drifter every $5^\circ \times 5^\circ$, which is again increased to $3^\circ \times 3^\circ$ for the Mediterranean Sea. An active fleet of 8 Argo floats and 16 Surface Drifters will provide about half the design density in the western Mediterranean Sea, which corresponds to a deployment of 4 Argo floats and 8 Surface Drifters per annum. Through the SOCIB Drifter Facility combined with the contributions from other regional the Argo Program expects to achieve 100% coverage in western Mediterranean waters.



- Argo profiles
- Argo trajectories

Figure 4. Sample of distribution of Argo profiles and trajectories available for download between 01/01/2010 to 04/03/2010, from <http://www.argodatamgt.org/Access-to-data/Argo-data-selection>

Through building and maintaining a fleet of 8 Argo profiling floats and 16 Surface Drifters in the western Mediterranean Sea, this facility will monitor in real-time, the broad scale ocean structure (temperature, salinity and deep currents) in the western Mediterranean, thus contributing to the Spanish participation in Euro-Argo, the European component of the world wide Argo in situ global ocean observing system and one of the 35 projects selected by European Strategy Forum on Research Infrastructures (ESFRI).

4. Nature of investment:

Investment: 4 Argo profilers and 8 Surface Drifters will be launched in 2011, with an estimated 2 Argo floats and 8 surface drifters launched per annum thereafter. Based on lifespan estimates of 2-4 years for the Argo floats and 1.8 for the drifters this should provide an operational fleet of 8 Argo floats and 16 Drifters, the numbers of active floats will be monitored and the numbers adjusted to provide the required coverage.

Maintenance and operations: operations include data transmission through satellite and GSM, as well as one day of coastal ship time for deployment. Personnel: the estimated requirement is for one engineering technician for 3 MM (6 MM in the first year 2011), this support will be managed and provided by the ETD Technical Pool.

Space: no specific space needs from SOCIB will be required to support this Facility, however see in-kind contribution below.

In-kind contributions: This facility is additionally supported through in-kind contributions from IMEDEA (CSIC-UIB) and IEO, specifically:

Personnel - IEO

- Scientist in Charge of Operations: 1.5 MM (3 MM in 2011)

Personnel - IMEDEA (CSIC-UIB):

- Technician (electronics): 1 MM
- PhD student (Argo and Glider data)

Space - IMEDEA (CSIC-UIB) shared with other facilities, i.e. Glider:

- Electronics Lab (electronics and sensors): 30 m²
- Warehouse: 20 m²
- Workshop, including pressure chamber (to 150 m): 25 m²
- Physical Oceanography Instrument Lab, including equipment for ballasting (crane and pool): 50 m²

Equipment IMEDEA (CSIC-UIB):

- 4 Argo profile floats, the data from which will be assimilated into the SOCIB Data Centre (2010) IMEDEA (CSIC-UIB)

Summary in-kind contributions:

Total personnel: 2.5 MM per annum

Total space: 125 m² per annum (shared with other facilities, i.e. Glider)

Total equipment: 4 Argo floats (2010)

5. Budget:

Budget Overview	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment	0	0	72.000	42.000	42.000	42.000	198.000
Operations	0	0	50.000	50.000	50.000	50.000	200.000
Personnel	0	0	0	0	0	0	0

Budget Detail	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment							
Argo	0	0	60000	30000	30000	30000	150.000
Drifters	0	0	12000	12000	12000	12000	48.000
Subtotal	0	0	72000	42000	42000	42000	198.000
Operations							
Maintenance	0	0	50.000	50.000	50.000	50.000	200.000
Subtotal	0	0	50.000	50.000	50.000	50.000	200.000
Personnel							
Engineer	0,0	0,0	0,0	0,0	0,0	0,0	0
Subtotal	0,0	0,0	0,0	0,0	0,0	0,0	0

Timeline	2009	2010	2011	2012	2013	2013
Purchase						
Argo Floats	0	0	4	2	2	2
Surface Drifters	0	0	8	8	8	8
Operational						
Argo Floats	0	0	4	6	8	8
Surface Drifters	0	0	8	16	16	16
People (numbers)						
Engineer	0,0	0,0	0,0	0,0	0,0	0,0
Subtotal	0,0	0,0	0,0	0,0	0,0	0,0

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Infrastructure Investment 05: Mooring Facility

1. Brief international review of similar type of facilities

Time series observations from moored instrumentation have traditionally played a major role in the study of oceans, especially important are some of the longer time series such as those from the Hawaiian Oceanographic Time Series (HOTS) in the Pacific and the in the Atlantic the Bermuda Atlantic Time-Series Study (BATS). Moored instruments still play a significant role in the new oceanographic observatory systems; IMOS has two facilities that involved moored instrumentation, the Australian National Mooring Network that covers the coastal requirements and the Southern Ocean Automated Time Series Observations (SOTS) focusing on sub-Antarctic studies (<http://imos.org.au/facilities.html>).

The coast and shelf area of North America are covered by instrumentation from several institutions; WHOI (<http://www.whoi.edu>), the Coastal Observation Laboratory in Rutgers (the State University of New Jersey <http://www.rucool.marine.rutgers.edu/>), the Centre for Operational Oceanographic Products and Services of NOAA (<http://tidesandcurrents.noaa.gov/index.shtml>) and the Offshore Buoy Network of Environmental Canada (http://atl.ec.gc.ca/index_e.html) amongst others

In Europe, Ocean Observing Systems also have data streams from instrumentation installed in the sea on permanent structures, e.g. Proudman Oceanographic Laboratory (<http://coastobs.pol.ac.uk/>), Irish Marine Network (<http://www.marine.ie/>), Channel Coastal Observatory (<http://www.channelcoast.org/>), COSYNA in Germany and others in the Mediterranean include, MOOSE in France, ADRISCOM in Italy and Poseidon in Greece.

2. Facility description and contribution to objectives

The development of new technologies has allowed us currently to have sensors capable of recording a wide range of parameters, with capabilities to control bio-fouling (reduces maintenance costs and enables year round continuous operations) and platforms to integrate sever sensors together.

Moreover, communication capabilities now allow the transmission of data directly from open ocean platforms or coastal structures to data servers in near real-time. This capability makes it possible to present and interpret data while an event is ongoing. In addition, it makes data assimilation into models possible in near real-time.

The aim of the Mooring Facility is to provide the Balearic Coast with instruments for time-series observations of physical, biological and chemical properties with respect to their long term variability.

The Mooring Facility will contribute to the SOCIB objectives through:

Science: Time-series of observations are crucial to resolving ecosystem processes that affect carbon cycling, ocean productivity, marine responses to climate change, ocean acidification, fishing and other stresses.

Technology/Operational: Development of real-time data transmission from buoys

Society: Implementation of water framework directive and coastal zone management.

3. Initial deployment configuration

Initial implementation consists of 4 Coastal Buoys as detailed below:

Location	Type	Requirements	Operational
Menorca, Mahón	Coastal Buoy	Purchase and install sensors	2010
Mallorca, Bay of Palma	Coastal Buoy	Operations only	2011
Mallorca, Cabrera	Coastal Buoy	Operations only	2011
Menorca Cuitadella	Coastal Buoy	Purchase buoy and sensors	2011
Ibiza, TBD	Coastal Buoy	Purchase buoy and sensors	2010 or considered for future

Table 1: Buoy Locations

All buoys will be equipped with data transmission systems via radio frequency (VHF/GSM/satellite) so that the data will be available in quasi-real time. The data will be downloaded on a bi-monthly basis. Initially (2010) the following sensors and instruments will be deployed for each mooring:

- Meteorological sensors (wind, air temperature, air pressure and net radiation)
- Upward looking ADCP (wave height, frequency, phase, current velocity)
- CTD (conductivity (salinity), temperature, pressure (depth))
- Thermistors for all depths of the water column (temperature)

At a second stage (2012) additional biogeochemical sensors will be deployed for each mooring:

- Fluorescence
- Dissolved Oxygen
- Turbidity (optical backscatter/OBS)

4. Nature of investment:

Investment: in 2010 the purchase of two instrumented coastal buoys are planned one to be located at Ciutadella, Menorca (2011) and one for repository/future applications. In addition the purchase of instruments for an existing buoy located in the Port of Mahón, Menorca or as an alternative in Ibiza.

Operations and Maintenance: from 2011 onwards the operation and maintenance of 4 coastal buoys, visits to service sensors clear biofouling, an additional contingency for biofouling is considered during the summer season. The Moorings Facility will also require the use of an equipped van and RIB, these are included as investments in the Engineering and Technology Division and Management & Finance budgets.

Personnel: the estimated requirement is for one engineering technician at 6 MM, this support will be provided by the Engineering and Technology Division.

In-kind contributions: This facility is additionally supported through in-kind contributions from IMEDEA (CSIC-UIB), the Parque Nacional Marítimo-Terrestre and the Autoridad Portuaria de Balears, specifically:

Space - IMEDEA (CSIC-UIB):
Physical Oceanography Instrumentation Lab: 30 m²
Warehouse: 20 m²

Equipment - IMEDEA (CSIC-UIB):
- 1 x equipped coastal buoy (Bay of Palma)
Equipment - Parque Nacional Marítimo-Terrestre del Archipiélago de Cabrera:
1 x equipped coastal buoy (Cabrera)
Equipment - Autoridad Portuaria de Balears:
- 1 x coastal buoy (Mahón)

Summary in-kind contributions:
Total space: 50 m² per annum
Total equipment: 2 x equipped coastal buoys, 1 x coastal buoy

5. Budget

Budget Overview	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment	0	531.000	0	0	0	0	531.000
Operations	0	16.000	64.000	64.000	64.000	64.000	272.000
Personnel	0	0	0	0	0	0	0

Budget Detail	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment							
Coastal buoy	0	531.000	0	0	0	0	531.000
Subtotal	0	531.000	0	0	0	0	531.000
Operational							
Maintenance	0	6.000	24.000	24.000	24.000	24.000	102.000
Boat Fuel	0	1.500	6.000	6.000	6.000	6.000	25.500
Insurance	0	7.500	30.000	30.000	30.000	30.000	127.500
Biofouling contingency	0	1.000	4.000	4.000	4.000	4.000	17.000
Subtotal	0	16.000	64.000	64.000	64.000	64.000	272.000
Personnel							
Engineer	0,0	0,0	0,0	0,0	0,0	0,0	0
Subtotal	0,0	0,0	0,0	0,0	0,0	0,0	0

Timeline	2009	2010	2011	2012	2013	2014
Purchase						
Coastal buoy	0	3	0	0	0	0
Existing						
Coastal buoy	0	2	0	0	0	0
Maintenance						
Coastal buoy	0	1	4	4	4	4
Stores	0	0	1	1	1	1
People (numbers)						
Engineer	0,0	0,0	0,0	0,0	0,0	0,0
Subtotal	0,0	0,0	0,0	0,0	0,0	0,0

Infrastructure Investment 06: Marine/Terrestrial Beach Monitoring Facility

1. Brief international review of similar type of facilities

Several experiments and coastal monitoring facilities have been developed and implemented in the last decade. The most complex approaches are field based coastal and oceanographic facilities, which have a broad capacity to produce spatial and temporal measurements of physical and environmental variables. However these facilities require a large economical investment and have a relatively long installation and set-up time before producing useful data sets (Proctor et al., 2004). An alternative is to measure coastal processes based on high resolution remote sensors, in this way, information can be acquired automatically and continuously from systems that combine large coverage observing (low frequency, large area and superficial processes) with in situ observing by moorings (high frequency, point measurements and process based observations). This is an alternative that utilizes a significantly lower amount of human, economic and computational resources, allowing a better continuity and frequency in data acquisition.

Among remote sensors, fixed digital video cameras are an attractive alternative for coastal monitoring. Beach video monitoring systems are becoming a powerful tool for the coastal scientist and they have recently been incorporated in many Coastal Monitoring Stations. In fact, recent advances in the understanding nearshore morphodynamics largely rely on the analysis of the products of these systems combined with moored instrumentation datasets. A broad variety of coastal processes can be monitored using remote techniques. For instance, researchers have used video images to study several littoral processes such as sand bar morphology (Lippman and Holman, 1989), near-shore hydrodynamics (Chickadel et al., 2003) or beach and nearshore bathymetry extraction (Stockdon and Holman, 2000; Aarninkhof et al., 2003). Recently, beach video monitoring is also beginning to be used as a tool for Coastal Zone Management issues e.g. Egmond, NL.

In 1980 the Coastal Imaging Lab at Oregon State University (<http://cil-www.coas.oregonstate.edu/>) began early efforts in optical remote sensing with the use of time-lapse movie measurement on beach agents and processes. The discovery that ten-minute time-exposure (timex) images could be used to locate submerged sand bars and rip channels was a remarkable advance over traditional surveying approaches. This advance led to the development in 1992 of automated unmanned stations called Argus Stations (<http://www.planetargus.com/>), programmed to collect hourly images at any site of research interest. Since 1992, the Argus system has been installed in many localities in USA, Europe, Australia and Asia. The biggest success has been in Europe where Argus technologies are at the heart of the EU CoastView program. Other systems, developed in New Zealand by the National Institute of Water & Atmospheric Research (Cam-Era, <http://www.niwa.co.nz/our-science/coasts/tools-and-resources/cam-era>) or in Europe at the University of Cantabria (Horus) and at IMEDEA (Sirena), have also proved powerful tools for coastal monitoring. Even though remote sensing techniques can only provide certain features of coastal hydrodynamics, those inferred from superficial data, if they are combined with traditional mooring systems all temporal and spatial variability of coastal systems can be inferred.

2. Facility description and contribution to objectives

The SOCIB Marine and Terrestrial Beach Monitoring Facility will consist of Modular Beach Integral Monitoring Systems (MOBIMS) which will enable the autonomous and sustained collection of physical data on hydrodynamics and sediment transport. Each one of the MOBIMS consists of a video monitoring system (SIRENA), an Acoustic Doppler Current Profiler (ADCP) and a programme of bathymetric surveys and sediment sampling. This system is modular in order to gradually expand the number of beaches under observation to cover different types of energetic input.

The Coastal Marine and Terrestrial Beach Monitoring Facility will contribute to the SOCIB objectives through:

Science: MOBIMS will contribute to the understanding of hydrodynamics and sediments transport at different scales, and thus can contribute to unravelling the beach response models to the global change scenarios. It should be stressed that a change in the mean energy flux direction of 1° can distort the beach equilibrium profile. In addition, there is a lack of historical beach monitoring of microtidal carbonate beaches, despite this being a characteristic type of beach in the western Mediterranean and a key resource for socio-economic development. It is therefore important to obtain a large dataset in order to understand and modelling these natural systems. As a scientific facility the MOBIMS should provide:

- Continuous monitoring and the generation of a combined database of morphology, waves, currents and sediment transport
- Punctual and detailed observation of coastal processes
- Development of physical theories that will allow the definition of new models for the study of coastal processes short and large term predictions

Technology/Operational: The MOBINS (video monitoring SIRENA systems combined with "in situ" moorings) is a low cost and expandable coastal observing system, and this product can be the basis for beach and coastal zone management activities (e.g. beach users, beach cleaning, rip currents) and also for time beach evolution analysis. However to be able to implement tools for decision makers based on MOBINS technology development is needed, as outlined below.

High frequency observations from the remote stations will be implemented in time-stacks, these will consist of cross-shore transects perpendicular to the coast where all pixel intensity is stored. These pseudo-images are spatial and temporal representation of wave rays consisting in the cross-shore position on the x-axis and the temporal evolution in the y-axis. Wave rays and breaking zones can be determined from these products. If waves propagate to the shore in a normal direction (in real world coordinates) these images allow the estimation of wave celerity and therefore bathymetry. However, in real situations, the wave incidence angle can be in any direction and the cross-shore time-stack only provides the wave number in the cross-shore direction. To obtain the wave number in the direction parallel to the coast, the software can be configured to store an array of adjacent pixels. During the image capture process, the system also stores a single snapshot. Hence, an hourly image is recorded. The user can choose which image to save or even saving any number of images during the acquisition process. The image variance can be used to filter some post processing products indicating those areas where variability is higher. The main task of the post processing software is to apply different algorithms to the stored images to detect features of interest (which are related to morphodynamic properties and wave dynamics of the study zone). First, using computer vision techniques, features like coastline and wave-breaking zones can be detected and located in the image space. Then through

applying different corrections to overcome the lens distortions as well as rectifying the perspective projection, these features are geo referenced in a world coordinate system, so that measurements of these features can be carried out in the real space.

Society: The public use of beaches and their importance as both an economic resource and environmental and ecological resource, imply that the social return of this facility is through a better knowledge of this resource to enhance proper management and beach safety. A specific joint project with the Balearic Government (D.G. Emergencies) will be designed to transfer tools and applications of interest, for example to lifeguards.

Outreach and Education: The MOBIMS system will be used to recruit students from different universities worldwide with interests in coastal variability, hydrodynamics and coastal zone management facilitating the understanding of beach processes and making the information more accessible to the undergraduate community and society in general.

International collaboration: With other coastal observatories in Spain (ICM, Barcelona and IH, Cantabria and UG) contributing to reinforce the Spanish position in the international frame. The SOCIB Marine and Terrestrial Beach Monitoring Facility will promote strong collaborations with the other international coastal observatories to exchanges experiences, know-how and expertise on video monitoring. More specifically, collaboration is anticipated with the team of Prof. Tony Darlymple in the area of rip current forecasting in relation to beach safety.

3. Initial deployment configuration

This Facility has been operated during 2008 as a pilot Programme at Cala Mayor, Mallorca, by IMEDEA (CSIC-UIB). In the initial deployment 4 SOCIB MOBIMS sites will be installed, in Mallorca, Formentera, Menorca and Ibiza, each site consisting of:

- 3 - 5 remote video stations
- 1 deep water ADCP per site
- RTK facility for beach topography
- 200kHz echo sounder for beach bathymetry
- Bi-annual program of nearshore bathymetry

At the end of the initial implementation period 4 study zones (Table 2) should be available in order to include different wave energetic conditions and beach types around the Balearic Islands.

Year	Beach	Type
2011	Mallorca, Cala Millor or Formentor,	Open beach, urban or Pocket beach, natural
2011	Menorca, Cala Tirant	Pocket beach, natural
2012	Formentera, Ses Salines	Open beach, natural
2012	Ibiza	Open beach, urban or Pocket beach, natural

Table 2: MOBINS Study zones

4. Nature of investment:

Investment: equipment for nearshore bathymetry, positioning, beach profiles and coastline monitoring as well as laboratory equipment (e.g. laser granulometer for measurements grain size) and related instrumentation are purchased, the investments are concentrated in 2010.

Maintenance and operations: The installation of 2 beach monitoring sites is foreseen in 2011, Mallorca and Menorca, and a further 2 sites in 2012, Formentera and Ibiza. Operations include the implementation of the beach monitoring systems, bathymetry surveys (undertaken bi-annually), beach profiles (undertaken quarterly) in order to characterise variability and establish long term reliable baseline data.

Personnel: a contract for one full time technician will start during 2011, with a short term need, 6 MM, for a computer engineer in 2010 to upgrade and standardize the SIRENA system (beach monitoring with cameras).

Space: Computer facility (2 computers per site).

In-kind contributions: This facility is additionally supported through important in-kind contributions from IMEDEA (CSIC-UIB), specifically:

Personnel:

- Post doctorate lead scientist: 3 MM

Space:

- Coastal Morphodynamics Lab: 30 m²
- Data Centre and Remote Sensing Lab: 25 m²

Equipment:

- 4 ADCP instruments

Summary in-kind contributions:

Total personnel: 3 MM per annum

Total space: 55 m² per annum

Total equipment: 4 ADCP

5. Budget:

Budget Overview	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment	0	253228	0	0	0	0	253.228
Operations	0	0	72530	103930	103930	103930	384.320
Personnel	0	18.487	36.974	36.974	36.974	36.974	166.383

Budget Detail	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment							
Equipment	0	253.228	0	0	0	0	253.228
Subtotal	0	253.228	0	0	0	0	253.228
Operations							
Maintenance	0	0	8.000	16.000	16.000	16.000	56.000
Maint Lab	0	0	1.800	3.600	3.600	3.600	12.600
Bathymetry	0	0	30.000	30.000	30.000	30.000	120.000
Internal campaigns	0	0	20.000	40.000	40.000	40.000	140.000
Travel	0	0	6.000	6.000	6.000	6.000	24.000
Insurance	0	0	6.730	8.330	8.330	8.330	31.720
Subtotal	0	0	72.530	103.930	103.930	103.930	384.320
Personnel							
Engineer	0	0	36.974	36.974	36.974	36.974	147.896
Project engineer	0	18.487	0	0	0	0	18.487
Total	0	18.487	36.974	36.974	36.974	36.974	166.383

Timeline	2009	2010	2011	2012	2013	2014
Purchase						
MOBINS	0	4	0	0	0	0
Sites						
Install	0	0	2	2	0	0
Operational	0	0	2	4	4	4
Bathymetry	0	0	2	2	2	2
People (numbers)						
Engineer	0,0	0,0	1,0	1,0	1,0	1,0
Project engineer	0,0	0,5	0,0	0,0	0,0	0,0
Subtotal	0,0	0,5	1,0	1,0	1,0	1,0

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Infrastructure Investment 07: Modelling and Forecasting Facility

1. Facility description and contribution to objectives

The Modeling and Forecasting Facility will contribute to the SOCIB objectives following international well established initiatives where SOCIB researchers have been and are presently involved. These types of initiatives were mostly peer reviewed research projects of usually 3 to 4 years duration. Among other, some of the projects more directly related to SOCIB objectives are: ESEOO in Spain, ECOOP and SESAME from EC FP6 and MyOcean from GMES FP7.

In the frame of internationally established activities such as MOON, SOCIB activities are mostly centered in the western Mediterranean, with focus on the Balearic Islands and adjacent sub-basins (specifically Algerian and Alboran/Gibraltar) and covering from the nearshore to the open ocean. On a long term, our aim is to advance on the understanding of physical and multidisciplinary processes and their non linear interactions, to detect and quantify changes in coastal systems, to understand the mechanism that regulate them and to forecast their evolution and or adaptation under, for example, different IPCC scenarios. To achieve this goal, the numerical modeling& forecasting facility will provide operational forecasting, hindcasting and monitoring of the western Mediterranean, and specifically coastal seas around the Balearic Islands.

These hindcast/forecasts combined with the use of satellite and SOCIB ocean based measuring systems will provide information on coastal and ocean currents and eddies, surface and subsurface ocean properties, and waves that impact and are linked to maritime and commercial operations, safety-at-sea, ecological sustainability, regional and global climate.

The models will assimilate ocean measurements and will use them to produce estimates of the full depth ocean state for the whole global ocean. Then, forced by the AEMET numerical weather prediction systems and SOCIB system (WRF), the models forecast waves, ocean currents, temperature, salinity and biology. Moreover, to improve the wave forecasting and to prevent storm effect, the coupling of a coastal wave model (SWAN) with ROMS and WRF is also foreseen. Physical variability can impact strongly the ecosystem, thus to have a better understanding of the physical processes which lead some changes on the ecosystem, we will implement the coupled ecosystem model provided by the ROMS community which include a 7-component NPZD model and a sediment transport model (USGS Community Model).

To sum up, the SOCIB modeling platform will comprise:

- Circulation models, forecast ocean currents Weather modeling
- Ecosystem modeling, provide forecasts and analysis of the ecosystems
- Wave modeling, to forecast wave conditions globally and locally
- Satellite data with particular emphasis on development of coastal products

Our multidisciplinary approach and the variability of scales involved, from meters to thousands of kilometers and from seconds to years as well as their nonlinear interactions and physical and biological processes makes the understanding of theses mechanisms a real challenge. To achieve this general objective, we will address the following specific objectives.

2. Facility description and contribution to objectives

Scientific: High quality coastal ocean studies and biogeochemical/ocean/atmosphere studies are the specific scientific qualitative goals of our research line. These activities are specifically focused towards:

1. A better understanding of global change in the coastal zone, focused on Mediterranean effects of climate change in circulation scenarios and biodiversity impacts at sub-basin scale.
2. Improving our knowledge on the mesoscale/submesoscale eddies filaments and fronts and then apprehend them strong interaction with the western Mediterranean circulation. We will study the contribution of mesoscale and sub-mesoscale interdisciplinary processes to 3-D upper ocean inter-annual variability specifically considering the relevance of eddy induced vertical motions and open ocean-coastal exchanges processes.
3. Ocean/Atmosphere interactions, and their key role both in the ocean dynamics and biogeochemical processes. To have a better representation of the ecosystem, take in account these interactions could be crucial.
4. Data Assimilation, Ensemble forecast, Ensemble Kalman filter, 4DVAR implementation in ROMS: In the frame of operational oceanography, it will correct bias in the model and locate with realism the (sub)mesoscale (like eddies).
5. Address biophysical coupling and biogeochemical fluxes (using 'simple' NPZD models) to (1) understand Physical/biological interactions focused on Atlantic/Mediterranean water masses interaction and relation to fish larvae trajectories and accumulation, with focus on bluefin tuna spawning areas and connectivity and MPA design and conservation and (2) study the eddies induced vertical motions relation to phytoplankton size structure and biogeochemical exchanges.
6. Apprehend HABS and/or jelly fish proliferation, coastal zone residence times, terrestrial and open ocean inputs
7. Coastal altimetry implementation and contribution to operational oceanography

Technological/Operational Objectives: From an initial core of physical oceanography and coastal dynamics, our goal is to establish a modelling platform to address to some ecosystem scientific studies and operational coastal oceanography scientific questions (see 1.1). Our approach will gather atmosphere/ocean bio-physical processes coupling, using numerical models and observations.

More specifically, our objectives focus on the following points:

- Modeling platform
- Operational forecast production at sub-basin and local scale
- Balearic Sea high resolution ocean currents forecast system combining observations (gliders, moorings, satellite, etc) to provide ocean currents, water masses, sea level.
- Balearic Sea high resolution wave forecasting
- Operational assimilation - Integration of model and data products
- Quality control procedures
- Tools for dissemination of forecast information, web based visualization tools for models and satellite data
- Model validation tools
- Coupling wave-currents
- Satellite based heat content models (using altimetry and SST-historical-) and validation with in situ data
- CO₂ fluxes based on carbon cycle, T, S and acidification data

Society: Based on our modelling platform, SOCIB will have the Capacity to respond to society needs like:

- beach erosion prediction and solution,
- Coastal zone management
- Early warning system to estimate the probabilities for occurrence for Rissaga events at Ciutadella,
- SAR, Oil spill and/or Jelly Fish invasions and trajectory estimations,
- Beach safety and rip current
- Marine conservation, sanctuaries

Outreach and Education: Outreach is considered a crucial element in which we will devote many efforts. We will carry out ocean and weather product but also dissemination conferences for the general public and newsletter will be proposed. Moreover, the SOCIB research line supports totally the transfer of knowledge to the public and private sectors as a socialization of quality research.

International Collaboration: Relations with the international modelling projects in the frame of MOON and/or EU funded initiatives such as for example ECOOP, SESAME or MyOcean will be continued. Moreover, active collaborations with some international universities or research group will be consolidated (i.e. Rutgers, Stony Brook, IRD, ISAAC, ICM, UTM, ICMAN, CLS).

3. Initial deployment configuration

3.1 ROMS model configuration

The Rutgers version of the Regional Ocean Modeling System (ROMS) has been implemented. ROMS is a 3d free-surface, sigma coordinate, split-explicit equation model with Boussinesq and hydrostatic approximation.

The model domain extends from 1°W to 5°E and from 38°N to 44°N. The grid is 256 × 320 points with a resolution of about 1.5km, which allows good representation of the first baroclinic Rossby radius of deformation (around 12 km) throughout the whole area. Accordingly, mesoscale and submesoscale structures are well resolved. The model has 30 sigma levels, and the vertical s coordinate is stretched for boundary layer resolution. The bottom topography is derived from a 2' resolution database.

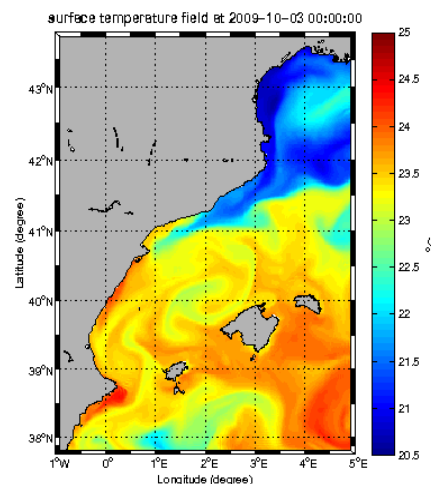


Fig. 5: The Balop operational model.

In a first version, the model was forced every 3 hours with an atmospheric forcing derived from AEMET/Hirlam and daily boundary conditions were provided by MFS. This configuration is provided without data assimilation.

The actual version of the forecasting system is forced each hour by the WRF derived fields (bulk parametrisation). The assimilation operational version is still on working.

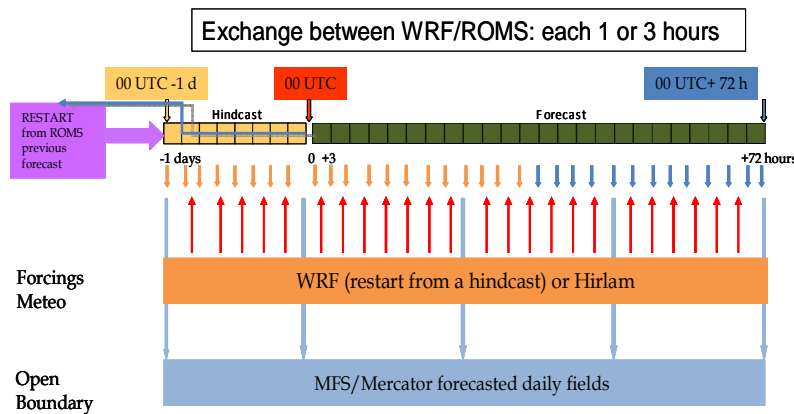


Fig. 6: Operational model scheme

3.2 Data assimilation

Recently, a suite of 4d-variational data assimilation tools (4DVAR) have been developed for ROMS including an incremental strong constraint formulation (IS4DVAR), and a represented-based weak constraint formulation (W4DVAR). In IS4DVAR the search for the optimal state estimate is performed in model space, while in W4DVAR the search is performed in observation space. In a first step, in collaboration with the Rutgers group, we implemented the 4DVAR version into our operational forecasting system

3.3 WRF configuration

We used the version 3.0.1 of the WRF-ARW model (Skamarock et al., 2005). WRF-ARW is a three-dimensional, non-hydrostatic, fully compressible primitive equation atmospheric model designed for simulations of atmospheric processes on scales ranging from meters to thousands of kilometers

The WRF model configuration consisted of three embedded grids each with 47 (or 97 in the case of the rissaga) vertical sigma levels. The domains have resolutions of 30 km, 6 km and 1.5 km, respectively, with a Mercator map projection and a two way interaction between nests. Boundary conditions are provided by NCEP 4x reanalysis and the Medspiron product for the SST.

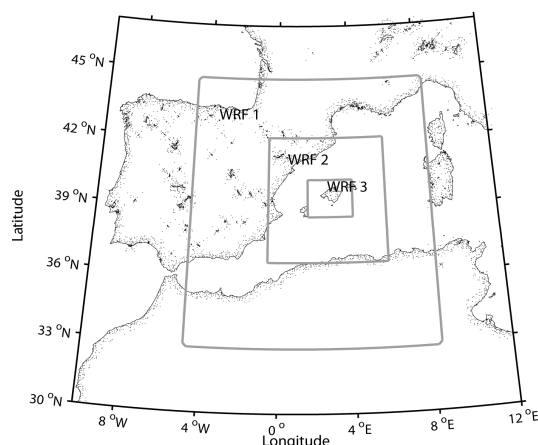


Fig. 7: The WRF model configuration

3.4 NPZD Model

The biological model currently coupled to ROMS consists of a so called Nutrient-Phytoplankton-Detritus-Zooplankton (NPZD) type model, with a single limiting nutrient (nitrogen) and a single phytoplankton functional type. The model consists of a system of seven coupled partial differential equations that include: nitrate, ammonium, small and large detritus, phytoplankton, zooplankton, and a dynamic phytoplankton carbon to chlorophyll ratio. The Fennel parameterization has been chosen to implement the first experimentation in the Alboran Sea.

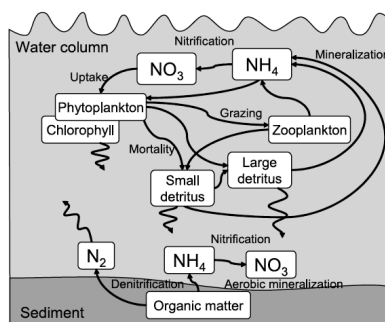


Fig. 4: The Fennel NPZD model

3.5 Satellite data, new products and contribution to SOCIB goals

The importance of satellite data for coastal operational oceanography cannot be overemphasized. Recent developments have shown the relevance of coastal altimetry products, but at the same time, for some data, still important developments are needed to reach a level of direct relevance for society. The major contributions are foreseen using joint approaches between SOCIB and in kind contributions from CSIC researchers from IMEDEA (CSIC-UIB), ICMAN, ICM and UTM mostly.

The main areas of expected contributions are: SST: (1) Balearic Satellite SST L2P Products: Produce/acquire standard, ocean remote sensing thematic products. Convert existing SST processing systems to produce near real-time and reprocessed (to ~1990), level 2 (swath and gridded), 1 km resolution SST data files. These will contribute as an important data stream to the SOCIB Forecasting Project producing high-quality regional 1-2 km resolution near real-time and reprocessed SST analyses. These activities are in line with EU priorities (e.g. MyOcean project). (2) Spanish Ocean Distributed Archive and Access Centre (SODAAC): establish an SODAAC to facilitate easy access to ocean remote sensing

thematic products. This will involve a number of agencies providing metadata and storing and serving various data sets which will be available via the Oceans Portal and coordinated via the Facility project. This is in line with IMOS satellite facility and will be achieved by the SOCIB Data Management facility. Ocean Color: (3) Specific ocean color products: Specific ocean color products for the Mediterranean Sea will be used. This will include specific retrieval algorithms. SMOS: (4) – Surface salinity images measured by SMOS satellite will be captured automatically. This task will be developed in collaboration with Dr. Jordi Font (CMIMA, CSIC, Barcelona).

Satellite altimetry: (5) - Development of a high resolution (HR) mean dynamic topography (MDT). The MDT will be built as a combination of sea surface height data derived from satellite altimetry, space gravity missions (GRACE and GOCE satellites), numerical model outputs and in situ oceanographic (T, S profiles and drifter currents) data. This task will be performed in collaboration with CLS. (6) - Development of HR absolute dynamic topography products by adding the HR MDT previously described to SLA fields obtained by merging different satellites with updated and dedicated coastal corrections (HR barotropic & tidal models, wet tropospheric), high frequency sampling (20 Hz) and specific editing and filtering. This task will be performed in collaboration with CLS. (7) Validation of coastal altimetric products: independent in situ data (mainly tide gauge but also drifter and mooring data) will be used to validate altimetric products. This task will be carried out by the operating institution. (8) – Development of methods for the combination of different sensors (including the estimation of geostrophic velocities close to the coast imposing a boundary condition). This task will be carried out by the operating institution. Tide gauges: (9) Deployment of 3 tide gauges (TG) along the coasts the Balearic Islands. The sea level measurements obtained from the TG data along the Northern coast of Mallorca (Andratx, Soller, Pollença) will provide a dynamical boundary condition to combine with satellite altimetry. Indicators: (10) Development of indicators (satellite and model based) indicators for sustainable fisheries, for example, combining ocean colour data (through an empirical algorithm linked to primary production) and combining with SST, Altimetry, and physical variables from model outputs. This task will be performed in collaboration with CLS.

4. Nature of investment

Investments: the computing technology infrastructure for the Modelling and Forecasting Facility will be purchased, implemented and managed under the Computing and IT Services budget, always in close coordination with UIB and CSIC C&IT's. The implementation of High Performance Clusters is foreseen in the near future. During 2010 an initial pilot cluster will be purchased to allow the implementation of the different models. In 2011, a more powerful HPC is planned, to guarantee operational activities and services provision. This HPC will be fully coordinated with UIB CTI, potentially even considering its installation at UIB locations. This HPC will have accordingly some of its time devoted to UIB researchers.

Operations: The operation of these tide gauges will be taken over by SOCIB from 2010 onwards, however the operations cost considered here is essentially related to the visits, exchanges and training of personnel, as well as longer term contributions to international meetings and workshops.

Personnel: 2 full time modellers will be employed, international post doctorate level, to develop and implement the coastal ocean currents forecasting system. The first contract started in July 2009 to implement ROMS and WRF in the Balearic

Sea, with high resolution and nested to MFS and NCEP. A second contract is anticipated for late 2010, to increase operational capabilities, develop calibration/validation activities and implement assimilation procedures. Coupling with simple biogeochemical NPZD model will be also foreseen. Additionally, 1 computer engineer for support and development of satellite related real-time services will be contracted in mid 2011.

In-kind contributions: This facility is additionally supported through important in-kind contributions from IMEDEA (CSIC-UIB), specifically:

Personnel:

- a post doctorate researcher holding a Juan de la Cierva contract: 4MM
- Titulado Superior in Operational Oceanography: 4MM
- Funding for new Post doctoral researcher to contribute to the satellite data and products priorities will be also searched.

Space:

- Data Centre and Remote Sensing Lab: 25 m²
- Computing and IT General IMEDEA Spaces (agreement in progress)

Equipment:

- 3 wave gauges installed at Andratx, Soller and Pollensa harbours (with 1 additional wave gauge as backup for operations and maintenance is anticipated from CSIC) the data will be transmitted real-time to IMEDEA (CSIC-UIB) and international quality control procedures implemented for the data, in-line with Puertos del Estado standards.

Summary in-kind contributions:

Total personnel: 10 MM per annum

Total space: 25 m² per annum

Total equipment: 4 wave gauges

5. Budget:

Budget Overview	2009	2010	2011	2012	2013	2014	Total (2009-2013)
Investment	0	0	0	0	0	0	0
Operations	0	7.500	17.500	23.000	23.000	23.000	94.000
Personnel	19.382	68.825	127.129	150.450	150.450	150.450	666.687

Budget Detail	2009	2010	2011	2012	2013	2013	Total (2009-2013)
Investment							
Computing	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0
Operations							
Travel	0	7.500	14.500	17.000	17.000	17.000	73.000
Various	0	0	3.000	6.000	6.000	6.000	21.000
Subtotal	0	7.500	17.500	23.000	23.000	23.000	94.000
Personnel							
Numerical Modeller	19.382	57.164	57.164	57.164	57.164	57.164	305.203
Numerical Modeller	0	11.661	46.643	46.643	46.643	46.643	198.233
Programming Specialist	0	0	23.322	46.643	46.643	46.643	163.251
Subtotal	19.382	68.825	127.129	150.450	150.450	150.450	666.687

Timeline	2009	2010	2011	2012	2013	2014
People (numbers)						
Numerical Modeller	0,30	1,00	1,00	1,00	1,00	1,00
Numerical Modeller	0,00	0,25	1,00	1,00	1,00	1,00
Programming Specialist	0,00	0,00	0,50	1,00	1,00	1,00
Subtotal	0,30	1,25	2,50	3,00	3,00	3,00

Infrastructure Investment 08: Data Centre Facility

1. Brief international review of similar type of facilities

Oceanographic data management has been defined as the process of entry, quality control, archival and dissemination of research or monitoring data collected in the world's seas and oceans (Ocean Challenge, Vol. 13, No. 3). In recent years European projects, like MERSEA, ECOOP and MyOcean, include oceanographic data management (hereafter ODM) as an important component of their project infrastructure in order to be able to share the data from the multi-disciplinary, multi-scale projects. They also show a clear evolution towards taking the gathered data and using for new purposes, enabling greater use and new studies and applications to come from the initial datasets.

Some of the most interesting examples of infrastructure for oceanographic data management integration come from the following three initiatives IMOS (Integrated Marine Observing System, Australia), IOOS (Integrated Ocean Observing System, USA) and the Coriolis project (France). IMOS has the eMII (eMarine Information Infrastructure) which provides a single integrative framework for data and information management that allows discovery and access of the data by scientists, managers and the public. IOOS has the DMAC (Data Management and Communication) that offers guidance, recommendations, and expert opinions on the development and implementation of the data management components. Coriolis contributes to the operational data oceanographic data of France, with the objective of developing continuous, automatic, and permanent observation networks.

Other examples include:

- The BODC (British Oceanographic Data Centre)
- Australian Oceanographic Data Centre Joint Facility (AODCJF)
- Canadian Oceanographic Data Centre (MEDS)
- Italian Oceanographic Data Centre (Istituto Nazionale di Oceanografia e di Geofisica)
- Japan Oceanographic Data Centre (JDOC)

All these Data Centres are integrated in the JCOMM (Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology) data management coordination group under the IODE (International Ocean Data Portal) integration.

2. Facility description and contribution to objectives

One of the main goals of SOCIB is to enable users to locate and download quality controlled data of interest in order to visualize, analyze and integrate the information. The SOCIB Data Centre is responsible for creating the data management infrastructure that will do this for both archived and real-time datasets. The conception of the SOCIB Data Centre has grown on one hand from the study of state-of-the-art international centres and on the other hand from the experience gained in recent years managing the TMOOS-IMEDEA (CSIC-UIB) datasets. The SOCIB Data Centre is envisioned as a 'full' data control system that manages the data lifecycle from the ocean to the end user.

The SOCIB Data Centre is responsible of the data management process; this is defined by the International Data Management Association as consisting of, "the development and execution of architectures, policies, practices and procedures that

properly manage the full data lifecycle need of an enterprise²⁴". The complex nature of the data management in SOCIB requires planning and oversight by a multidisciplinary team of experienced scientists and data managers. Figure 8, defines key elements that act in an oceanographic observatory which, similar to SOCIB, links observing platforms, data management and end users.

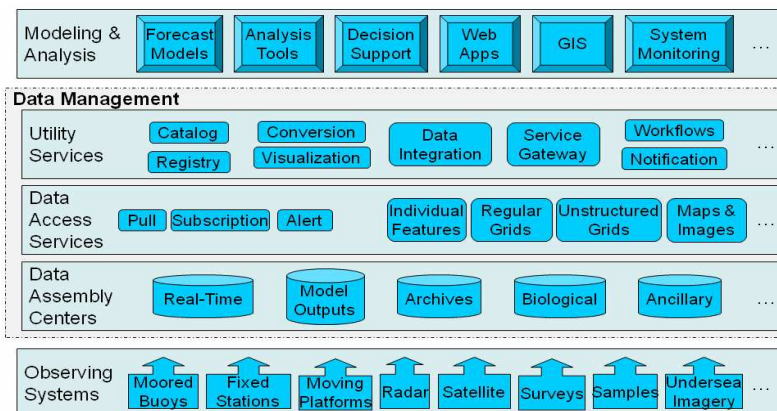


Figure 8: The middle three layers of this diagram comprise the data management process that connects the observing systems (bottom layer) to the users' modelling and analysis components (top layer). From de la Beaujardiere et al 2009.

The Data Centre Facility will contribute to the SOCIB objectives through:

Scientific: To benefit from the use of data.

Technological/operational: tools to monitor the platforms reducing the operations monitoring work load.

Society: will help decision makers by providing relevant information.

Outreach and Education: Through scholarship will attempt to transfer knowledge to the alumnus of the University.

International cooperation: SOCIB will integrate data with other centres of similar properties by making use of international standards. SOCIB will promote strong collaborations with the other international facilities to exchange experiences, know-how and expertise.

3. Initial deployment configuration

To accomplish full lifecycle data management the SOCIB Data Centre has defined seven components for the Data Management Process:

1. **Platform Management and Communication**: This first step involves the data process from the platform to an accessible computer. Is the most platform dependent step because on the data transmission system of the platform.
2. **Quality Control Assurance**: quality control assurance is one of the main goals of data management in SOCIB, is important to define good quality control (QC) routines following the existing standards.

²⁴ http://en.wikipedia.org/wiki/Data_management

3. **Metadata Aggregation:** all data available from SOCIB will have the metadata necessary to allow its discovery by powerful search tools. Initially we will follow the OceanSites Metadata directives and the ISO 19115/19139 w[4] standard for the second stage.
4. **Data Archive:** SOCIB will provide a Network Storage system to allow the archiving of the data, and also provide a File Naming convention ensuring a well organized data archive. Initially the common data format will be the self describing CF-convention netCDF. For the second stage we will add Geospatial information using OGC standards where-ever possible.
5. **Data Search and Discovery:** A catalogue with all metadata will be created allowing search and discovery of all data. The metadata aggregation is standards based to allow search by key text, by location, by parameter, by platform, etc.
6. **Data Policy and Distribution:** the data policy must be defined in general for each dataset. The Distribution methods will be OPeNDAP, HTTP, WMS, and NetCDFSubset.
7. **Data viewing:** the main idea is to create a portal allowing the visualization of all data and to create four sub portals for: time series, trajectories, grid data and general data.

These first components are really platform dependent; the following four components are more general steps that will work with common tools for our data sources.

In Fig. 9 shows a scheme for the SOCIB Data Management Process (DMP) is shown. The schema shows the different elements and technologies implicated. To add new data from a different source a procedure must be defined. Once the data is entered into the Data Management System (DMS) this is archived to allow the cataloguing, search, discovery and distribution of data. This process permits the creation of services allowing the SOCIB users to access the data in different ways.

The diagram is separated in three different stages with different colours. The first stage is planned to be operational, with the first data samples, by the end of 2010, and fully operational in June of 2011. On this date it is planned to have the second stage operational, adding GIS capabilities to the systems, and fully installed by the end of 2011. The third stage is planned to start at the end of 2011. This third stage tries to provide an automatic knowledge discovery giving a new view of the data analysis. Business Intelligence (BI) technologies provide historical, current, and predictive views of business operations data. Common functions of Business Intelligence technologies are reporting, online analytical processing, analytics, data mining, business performance management, benchmarking, text mining, and predictive analytics. Adapting the BI approach over oceanographic data will allow the creation of automatic knowledge.

	2009		2010		2011		201 2	201 3	201 4
Stage 1		D	D	D	O	M	M	M	M
Stage 2				D	D	O	M	M	M
Stage 3						D	D	O	M

D: Definition
O: Operational
M: Maintenance

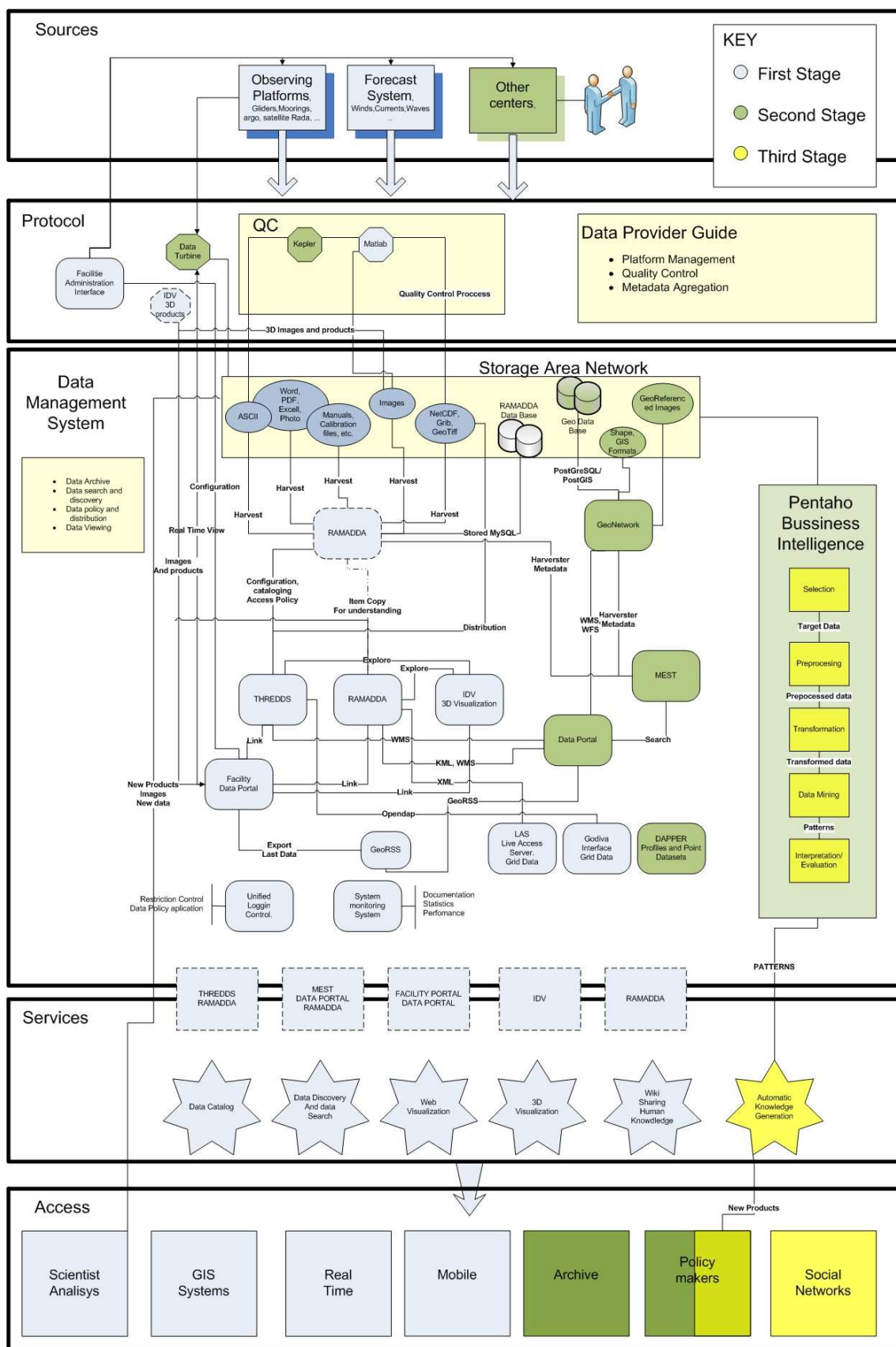


Figure 9: General Scheme of SOCIB Data Management Process.

From the Data Source to the DMS (Data Management System)

- Platform management and communications
- QC Assurance
- Metadata aggregation

The initial task will be to create and define the delivery process specifically for each dataset (in situ observation and modelling outputs). This process will then be described in a document to be integrated and automated in the DMS by the Data Management Team. As a first example see the table below, a general table describing the relationship between the different profiles of team members related to the steps of the Data Management Process.

	ETD (Engineering and Technology Development)	Scientific expertise	Data Management Team	Users
Platform Management and Communication	Collect data and give to Data Centre		Definition of data format and transmission	
Quality Control Assurance	Platform dependent quality control	Define quality control process for each data set	Automation tools development	
Metadata Aggregation	Platform identification	Cruise definition and goals	Tools for metadata handling	
Data Archive			Structured organization Name Conventions	
Data Search and Discovery			Data and Metadata search tools	
Data Policy and Distribution		Definition of data policy	Implementation of data policy	
Data Viewing	Monitoring	Analyze	Development	Define needs

Table 3: Data Process from source to the DMS

The documentation of the data process shown in Table 1 will be an important part, allowing the scientist to know all the procedures in the delivery of SOCIB data, e.g. who was involved in the process, QC control applied, etc.

Products:

Guide for data providers

Name conventions

- Data format
- Metadata aggregation

Web Interface for facility administration

- Platform management
- Platform monitoring systems
- Metadata handling tools
- Automated Quality Control Process

Technologies:

First Stage

- Matlab for data processing
- IDV for automated 3D product generation
- PHP/JavaScript/CSS/MySQL for web development

Second Stage

- Kepler to define the scientific work flow
- Data Turbine for data acquisition
- R-Project, Python, Octave.

Third Stage

- Kettle (Pentaho Data Integration) for ASCII transformation

From this point the Data Management System uses a data abstraction (Fig. 10). This data abstraction allows us to identify common tools instead of the creation of a specific tool for each dataset.

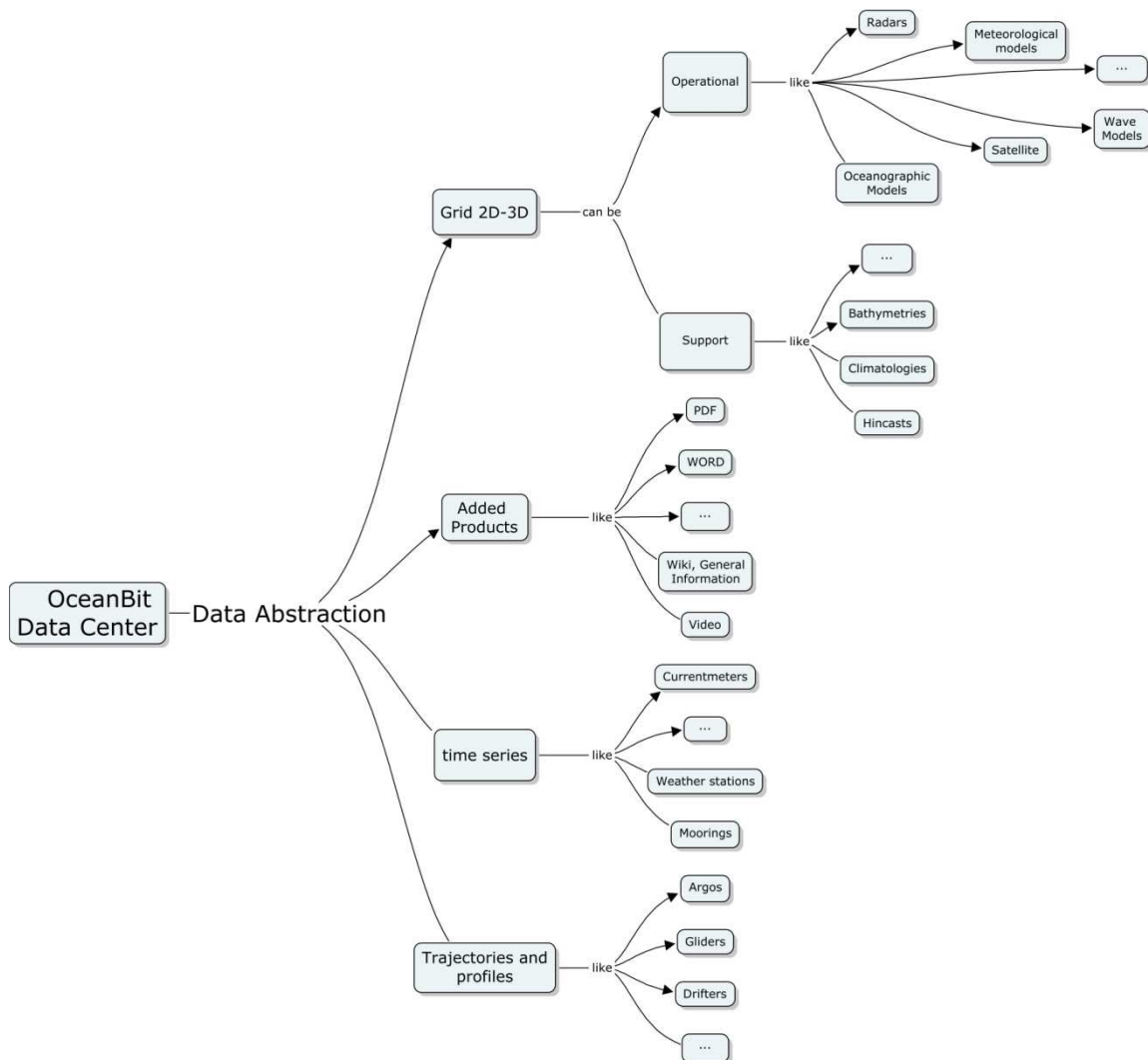


Figure 10: SOCIB Data Abstraction

The DMS (Data Management System)

1. Storage Area Network (Data Archive)

In the first stage a new Storage area network will be created to archive all data. On this storage system all the data and the information related to the data (the metadata) will be stored. As a second stage this will be upgraded depending on the needs of the system to a new storage system as an Integrated Rule-Oriented Data System to create a distributed storage area network when data from other centres will be integrated.

Data Formats:

First Stage

- NetCDF
- Images
- ASCII
- Video
- Word, PDF, Excel

Second Stage

- Geographic Data Base
- Shape Files
- GIS formats.

Technologies:

First Stage

- MySQL Data Base
- EMC storage system

Second Stage

- PostGreSQL/PostGIS Data Base
- iRODS (integrated Rule-Oriented Data System)

2. Unified login system (Data Policy)

All the logging system will be integrated into one system to define the policy and also the access to the different tools.

Technologies:

First Stage

- LDAP
- Second Stage
- Shibboleth, OpenID.

3. Monitoring system

Monitoring the system is an important task in order to increase the performance and availability of the system and also to create statistics about the system use, dataset access, etc. for strategic purposes.

Technologies: Munin, Zabbix or Nagios, Google Statistics

4a. Data software (First Stage)

Facility Portals: The facility portal will be a web interface that permits a quick visualization of the data, monitor the real time platforms and access the archived data for an in-depth analysis.

Technologies:

First stage:

- PHP, MySQL, JavaScript, CSS
- Second stage:
- Java/JSP/Servlets

THREDDS: THREDDS is used to catalog netCDF and also permit the distribution of the data with different methods: OPeNDAP, NetCDFSubset, WCS, WMS that allow the access from a set of different application clients (Matlab, R-Project, IDL, Excel, java tools, etc.).

Technologies: Tomcat, Java Web, netCDF-Java, NCML

RAMADDA: is a comprehensive content repository, publishing platform and collaboration environment for the Earth Sciences. Into our system RAMADDA will be used also for harvesting netCDF files and other formats, as an administration tool for the THREDDS Catalog, as a content management system created using a quick visualization tool for the data, and also as a search and discovery tool.

Technologies: Tomcat, Java Web, netCDF-Java, MySQL, JavaScript.

IDV (Integrated Data Viewer): is a 3D visualization environment that can explore a THREDDS catalog and RAMADDA catalog directly and display all data. Also the products created can be stored in the RAMADDA repository directly.

Technologies: Java3D.

LAS (Live Access Server): is a highly configurable web server designed to provide flexible access to geo-referenced scientific data. This tool will be used for quick analysis of gridded data.

Technologies: Tomcat, Java Web, Ferret.

Godiva: is a dynamic website that provides visual access to four-dimensional environmental data. Godiva has OPeNDAP access that let us directly connect to all data served on our THREDDS.

Technologies: Tomcat, Java, ncWMS.

4b. Data software (Second Stage)

GeoServer: is open source software that allows users to share and edit geospatial data. Designed for interoperability, it publishes data from any major spatial data source using open standards. In our system it will allow the inclusion of geospatial information from Geospatial Information Systems using the OGC standard formats.

Technologies: Tomcat, Java, WCS, WMS, WFS.

MEST (Metadata Entry and Search Tool): is a GeoNetwork version is an application for catalog applications to manage spatially referenced resources through the web. MEST is used as the backend catalogue to the IMOS Ocean Portal. The MEST can harvest THREDDS metadata and GeoServer metadata.

Technologies: Tomcat, Java Web, XML.

IMOS Ocean Data Portal: is open source software created at the IMOS/eMII for oceanographic data discovery. It permits a quick visualization of the data and

creates links to different downloading options. In our system it will be used as a Real Time viewer for all the data coming from the different sources.

Technologies: Tomcat, Java Web, JavaScript ZK framework, Ajax, Open Layer.

DAPPER: or DCHART: is a web application that allows you to visualize and download in-situ and gridded oceanographic and atmospheric data from files or OPeNDAP servers.

Technologies: Tomcat, Java, Ajax.

Data software (Third Stage)

Pentaho Business Intelligence (BI): refers to skills, processes, technologies, applications and practices used to support decision making. The Pentaho Suite provides a full spectrum of BI capabilities including query and reporting, interactive analysis, dashboards, data integration/ETL, data mining and a BI platform. This third stage tries to provide an automatic knowledge discovery giving a new view of the data analysis.

Technology summary

Stage 1: The main technologies used are: OPeNDAP / THREDDS server hosting CF-compliant netCDF; the open-source RAMADDA as a content management system and collaboration services for Earth Science data. These technologies permit the distribution, cataloguing and discovery of the oceanographic data.

Stage 2: This stage involves the addition of new GIS capabilities to the system with a GeoServer distributing Geospatial data and the MEST for Metadata Handling.

Stage 3: Add to the system new automatic knowledge discovery with business intelligence tools using the open source set of software PENTAHO.

The combination of all these software's technologies allows the creation of common services to access the data with the aspiration to cover all SOCIB data user needs.

Services

Using these technologies the Data Centre will ensure at least the following 5 services for each dataset:

- Wiki explaining how to use data.
- THREDDS Catalog with all data available.
- RAMADDA discovery service to search and manage content.
- Web visualization tools specific for each data (monitoring, visualization)
- 3D visualization tools.

Access:

The data management system will permit access to the data from different sources, Scientist analysis tools, GIS systems, etc. for both real-time and archived data, to the different SOCIB users groups in different ways web, mobile, social networks, etc.

Users:

The potential end users are classified into four main groups:

- Scientists

- Environmental managers and policy makers.
- General Public
- Educators and Students

4. Nature of investment:

Investment: the computing technology infrastructure for the Data Centre Facility is purchased, implemented and managed under the Computing and IT Services budget. See Infrastructure Investment 11: Services – 2. See Services – 2. Computing and IT for budget details, the main components are:

First Stage

- Data storage: new EMC Celerra NS120 with 12 Terabytes of capacity.
- 3 Dell computer servers
- One for Common services with virtual machines inside.
- One for Data Distribution and DMS services
- One spare server for data balancing.

Second Stage

- Upgrade of the EMC Celerra NS120 with more capacity depending on the volume of data (to be assessed during Stage 1).
- Upgrade the systems if required
- Increase the number of servers to data distribution.

Maintenance and operations: the Data Centre services are developed based on open source software and therefore operational costs are low, mainly related to travel, particularly for training during the initial years (2010, 2011).

Personnel: 2 computing engineers are currently developing the Data Centre Facility; an additional 2 computing engineers will be employed for the second half of 2010. Longer term, from 2013, onwards 3 computer engineers will manage the Data Centre.

Space: General office space at SOCIB offices. Computing space defined as a part of Computing and IT budget.

In-kind Contribution: See defined as a part of Computing and IT budget.

5. Budget:

Budget Overview	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment	0	0	0	0	0	0	0
Operations	0	15.000	6.000	6.000	6.000	6.000	39.000
Personnel	35.573	121.536	155.318	155.318	124.728	124.728	717.202

Budget Detail	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment							
Computing	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0
Operations							
Travel		15.000	6.000	6.000	6.000	6.000	39.000
Subtotal	0	15.000	6.000	6.000	6.000	6.000	39.000
Personnel							
Unit Manager	20.394	57.164	57.164	57.164	57.164	57.164	306.215
Computer Programming Specialist	0	18.487	36.974	36.974	36.974	36.974	166.383
Analyst Programmer	15.179	30.590	30.590	30.590	30.590	30.590	168.129
Tech support	0	15.295	30.590	30.590	0	0	76.475
Total	35.573	121.536	155.318	155.318	124.728	124.728	717.202

Timeline	2009	2010	2011	2012	2013	2014
People (numbers)						
Facility Manager	0,30	1,00	1,00	1,00	1,00	1,00
Computer Programming Specialist	0,00	0,50	1,00	1,00	1,00	1,00
Analyst Programmer	0,30	1,00	1,00	1,00	1,00	1,00
Tech support	0,00	0,50	1,00	1,00	0,00	0,00
Subtotal	0,60	3,00	4,00	4,00	3,00	3,00

6. References

De La Beaujardiere et al (2009) OceanObs, Ocean Challenge, Vol. 13, No.3 Ocean and Coastal Data Management

General Supporting Investment - Systems, Operations and Support Division

Below are additional central budgetary items for the Systems Operations and Support Division (SOS). The deployments of the individual facilities are outlined previously under the individual facility headings. However to manage and support the Division a Manager will be hired in 2010 (October) until that point the deployments will be coordinated through the Office of the Director. A quality control (QC) Engineer is also employed to support the development of quality control procedures, from sensor to Data Centre, across the Division.

1. Nature of investment

Maintenance and operations: the operations cost considered here is essentially related to the visits and training exchanges of personnel as well as contributions to international meetings and workshops. The travel budget estimated as 3,000 € per full time contract per year.

Personnel: Two people work full time across the various facilities of the Systems Operations and the Support Division. A Systems Operation and Support Division Manager (in kind) and a QC Engineer contracted full time.

Space: No special space requirements, the central team require office space.

In-kind: The Systems Operation and Support Division Manager is an in-kind contribution from CSIC under the CSIC Partnership Agreement (contribution to salary from SOCIB depending on formal agreement-estimated at 30%), see Section 4 - Partners.

2. Budget

Budget Overview	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment	0	0	0	0	0	0	0
Operations	0	3.990	6.000	6.000	6.000	6.000	27.990
Personnel	11.195	66.607	85.780	85.780	85.780	85.780	420.922

Budget Detail	2009	2010	2011	2012	2013	2014	Total (2009-2013)
Investment							
General	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0
Operations							
Travel	0	3.990	6.000	6.000	6.000	6.000	27.990
Subtotal	0	3.990	6.000	6.000	6.000	6.000	27.990
Personnel							
Division Manager	0	9.443	28.616	28.616	28.616	28.616	123.906
Quality Control Engineer	11.195	57.164	57.164	57.164	57.164	57.164	297.016
Subtotal	11.195	66.607	85.780	85.780	85.780	85.780	420.922

Timeline	2009	2010	2011	2012	2013	2014
People (numbers)						
Division Manager	0,0	0,3	1,0	1,0	1,0	1,0
Quality Control Engineer	0,3	1,0	1,0	1,0	1,0	1,0
Subtotal	0,3	1,3	2,0	2,0	2,0	2,0

Infrastructure Investment 09: Engineering and Technology Development Division

1. Facility description and contribution to objectives

The Engineering and Technology Development (ETD) Division is divided into two sub-units (1) Facility Support and Technology Development and (2) New Technology Implementation/Pilot Programme.

The activities encompassed by the two units are:

1. Facility Support and Technology Development Unit

Facility Support and Technology Development encompasses the maintenance, calibration, testing, preparation and operation of all instruments, planning of routine maintenance, support for scientific surveys and operation of equipment at sea, new data analysis tools and visualization elements. A core of well trained engineers and technicians will be the foundation of this unit which will coordinate its activities with the existing base of marine and technology development initiatives in the Balearic Islands. Specific coordination is envisioned with IMEDEA given the existing expertise and laboratories located at the IMEDEA (CSIC-UIB) Esporles building.

2. New Technology Implementation/Pilot Programme Unit

The development to operational level of new observing technologies through projects, these will start with a pilot phase, which if successful, will then develop into an operational development phase. Two Projects will start in 2010 (1) Ships of Opportunity/Fishing Fleet Monitoring Project (RECOPECA equipment and developed in conjunction with IEO and IFREMER) and (2) Near Shore Station Project (which encompasses ROV and AUV development and habitat monitoring developed in collaboration with, the Balearic Government (D.G. Fisheries), IMEDEA (CSIC-UIB), UIB and UTM in Formentera.

The ETD Division is responsible for directing and coordinating the support to the Observing Facilities, managing instruments, laboratories and warehouses and directing the operations of the SOCIB R/V, though liaising with the Captain and the SOS Division Manger. In terms of personnel the daily, weekly and monthly activities are coordinated by the Vice-Director (ETD Division Manager)²⁵ across the various responsibilities of the unit, according to the following priorities:

1. Observing Facility operational emergencies
2. Observing Facilities maintenance and routine operations
3. Management of laboratories and equipment/sensors, e.g. instrument calibration, repair, and operations
4. Pilot program operations
5. Pilot program development
6. Other technological development
7. Management of warehouses and inventory

The ETD Pool Manager will manage technical/engineering project resources (personnel, space or equipment) provided by partners participating in SOCIB projects and programmes, such as IEO, IMEDEA (CSIC-UIB), UIB or local companies.

²⁵ Note in the initial implementation the role of ETD Manager is undertaken by the Vice Director

It is important to note that the engineers dedicated to specific facilities (2 x Engineers for the Glider Facility and 1 x Engineer for Marine and Terrestrial Beach Monitoring Facility) will work in close coordination with the ETD team and will be located in the same building in shared laboratories (CSIC in kind).

The Engineering and Technology Development Division will contribute to the SOCIB objectives through:

Science: RECOPECA and Nearshore Station

Technology/Operational: Nearshore Station, RECOPECA and new technology development

Society: Providing habitat mapping

Outreach and Education: 'real-time' coastal ocean data nearshore station

International Collaboration: Cooperation anticipated with VENUS, Canada

3. Initial deployment configuration

The ETD Division will commence operations in 2010 with the hiring of the Vice Director (Division Manager) and 3 engineers, one of which will be the ETD Pool Manager. Initial activities will include the establishment of the Division priorities (long and short-term) and channels of communication to ensure the effective management of the engineering resources to meet the SOCIB objectives and establishing coordination with the Systems Operation and Support Division and SOCIB Partners to support the Facilities.

1. Facility Support and Technology Development Unit

The SOCIB laboratories and warehouse are initially a shared resource provided in-kind by IMEDEA, the initial deployment encompasses the purchase of additional equipment and the setting up of the SOCIB ETD capability, including the implementation of procedures for the calibration, repair and maintenance of all SOCIB maintained oceanographic equipment. Support for the implementation and maintenance of moorings facilities is anticipated in 2010, and in 2011 the drifter Facility, coordination of additional support for the Glider Facility and Marine and Terrestrial Beach Monitoring, will also need to be considered and coordinated.

2. New Technology Implementation/Pilot Programme Unit

Two Projects will commence in 2010:

(1) The Ships of Opportunity/Fishing Fleet Monitoring Project aims to implement a technology pilot for monitoring the coastal ocean using the fishing fleet based in the Balearic Islands. The specific objective is to collect data about the state of the coastal ocean (T, S) at time of fish capture, using an autonomous monitoring system (RECOPECA system) installed on fishing vessels. The long term aim is to have 10 fishing vessels operating throughout the Balearic Islands to obtain information on the water column (to the depth of the fishing nets, usually between 50 and 300 m and for the shrimp fleet reaching 800m) enabling the monitoring of the evolution of the thermocline and halocline spatially and temporally, and the relation of this with catch yield in order to progress towards sustainable fisheries. A pilot phase, commencing in June 2010 for 9 months, will test the possibilities of the sensor and data transmission system through the installation and operation of one RECOPECA system on a fish vessel operating out of Palma harbour. This project is

a partnership with IEO and IFREMER, IOE will provide a the PI some engineering resources for calibration and testing, data integration will commence with support from the Data Centre and the Systems Operations and Support Division QC engineer. As the pilot project commences in June before the incorporation of the ETD Manager it will be initially coordinated through the Office of the Director. (See Ships of Opportunity/Fishing Fleet Monitoring Project Plan for more details).

(2) The Near Shore Station Project objective is to set up a near shore monitoring station, an underwater observatory system that will combine a near shore cable (up to approximately 50 m depth) instrumented with state of the art sensors and AUV/ROV monitoring of the Natural Park area to the east of Formentera. The planned monitoring activity is original in that it combines fixed point measurements from the nearshore cable with spatial sampling using AUV/ROV's. The system is being designed in conjunction with leading international teams (VENUS and OBSEA²⁶) and will comprise of the following components:

1. Dissemination and user interfaces, infrastructure management
2. Databases
3. Technical supervision infrastructures
4. Onshore network
5. Land base termination of sea infrastructure – raw data archiving
6. Land-sea communication segment
7. Node from branching unit to node extension interface
8. Branch extension of the network
9. Junction box
10. Link to instruments
11. Individual instrument/sensor

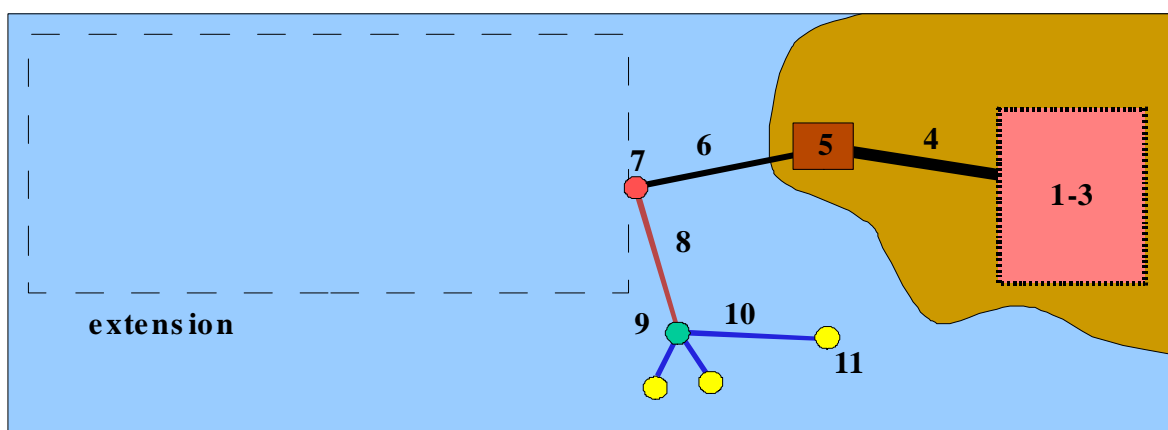


Figure 11: Diagram Nearshore Station

A pilot phase will run from 2010 through to 2012.

4. Nature of investment:

Investment:

1. Facility Support and Technology Development Unit: for 2010 major investments include; a 10 – 12 m RIB to support glider operations and other coastal work and a larger pressure chamber for glider and ROV/AUV laboratory testing in 2011.

²⁶ <http://www.venus.uvic.ca> and http://sites.upc.edu/~www-sarti/OBSEA/info/intro/intro_es.html

2. New Technology Implementation/Pilot Programme Unit - Ships of Opportunity/Fishing Fleet Monitoring Project: An initial 9 month pilot Programme will start in 2010, with the purchase, training and installation of one sensor system in one fishing vessel. If the pilot is successful an additional 9 sensor systems will be installed aboard fishing vessels in Mallorca, Menorca, Ibiza and Formentera, to provide a monitoring fleet of 10 from 2011 onwards. New Technology Implementation/Pilot Programme Unit - Nearshore Station: a two year pilot programme will initiate in 2010 to install and operate the Nearshore Station Program. An AUV and an ROV will be purchased end 2010/early 2011 and a nearshore cable will be purchased in 2011, with the pilot facility initially installed and operated in 2012.

Maintenance and operations:

1. Facility Support and Technology Development: encompasses general supplies for the calibration, testing, repair and maintenance of monitoring instrumentation, operational support for the Projects and fuel for RIB operations. In addition the purchased equipment and the RIB is insured.
2. New Technology Implementation/Pilot Programme Unit - Ships of Opportunity/Fishing Fleet Monitoring Project: estimated at 10% of the investment. New Technology Implementation/Pilot Programme Unit - Nearshore Station: annual maintenance and operation of the AUV and ROV are estimated at around 15% of the cost of purchase per annum.

Personnel: 1 engineer will be contracted from mid 2010 onwards and a second engineer in early 2011. The engineers will support the Ships of Opportunity/Fishing Fleet Monitoring Project (with SOCIB responsible for ensuring the instruments are maintained (3 MM) and that the real-time quality controlled data is integrated into the Data Centre (3 MM Data Centre and 4 MM SOS Division QC Engineer in 2010 only), the Mooring (estimated at 6MM each year) and the Drifter Facility from 2011 (estimated at 3 MM per annum, with 6 MM at start up in 2011) and the Nearshore Station Pilot Project (estimated at 12 MM from the end of 2011 onwards). ETD manager is also involved in supporting these activities (see in-kind below).

Space: For laboratory and warehouse space see in-kind contribution from CSIC and IEO below.

In-kind Contributions: There are important in-kind contributions to be considered in the development of the SOCIB Engineering and Technology Division. The ETD Division Manager/Vice Director and the Engineers Manager are planned to be part of the in-kind contribution from CSIC (contribution to salary from SOCIB depending on formal agreement-estimated at 30%-), the laboratory and warehouse space are planned to be part of the in-kind contribution from IMEDEA (CSIC-UIB) and IEO will provide sensor testing, calibration, engineering and project management support for pilot installation and contacts within the fishing fleet.

The space required across all the System Operation and Support and Engineering and technology Division are summarized in and the implications for the long term discussed in the Section 8 – Implementation Plan and Financial Projections

Personnel - CSIC:

- Division Manager/Vice Director: 12 MM
- ETD Pool Manager: 12 MM

Personnel - IMEDEA (CSIC-UIB):

- Technician (CSIC): 12 MM

Personnel – IEO:

- Engineers and technicians: 3 MM

Space - IMEDEA (CSIC-UIB):

- Warehouse: 30 m²
- Workshop: 20 m²
- Physical Oceanography Instrument Lab: 50 m²

Summary in-kind contributions:

Total personnel: 36 MM per annum

Total space: 100 m² per annum

5. Budget

Budget Overview	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment	0	594.263	1.441.075	20.000	0	0	2.055.338
Operations	0	54.794	104.435	179.435	159.435	159.435	657.534
Personnel	0	46.693	130.360	130.360	130.360	130.360	568.134

Budget Detail	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment							
1. Support & Technology Development							
Technology Development	0	60.000	150.000	20.000	0	0	230.000
RIB	0	354.000	0	0	0	0	354.000
Subtotal	0	414.000	150.000	20.000	0	0	584.000
2. New Technology Pilot Programmes							
Near Shore Station	0	170.000	1.211.000	0	0	0	1.381.000
Ships of Opportunity/Fishing Fleet	0	10.263	80.075	0	0	0	90.338
Subtotal	0	180.263	1.291.075	0	0	0	1.471.338
Subtotal ETD	0	594.263	1.441.075	20.000	0	0	2.055.338
Operations							
1. Support & Technology Development							
Development Projects	0	16.000	16.000	21.000	21.000	21.000	95.000
Lab equipment (various)	0	10.000	50.000	50.000	30.000	30.000	170.000
3D Animation and Visualisation Tools	0	20.000	20.000	0	0	0	40.000
RIB Fuel	0	5.000	7.500	7.500	7.500	7.500	35.000
Insurance (AUV, ROV)	0	0	0	22.500	22.500	22.500	67.500
Insurance RIB	0	3.000	3.000	3.000	3.000	3.000	15.000
Subtotal	0	54.000	96.500	104.000	84.000	84.000	422.500
2. New Technology Pilot Programmes							
Near Shore Station	0	0	0	67.500	67.500	67.500	202.500
Ships of Opportunity/Fishing Fleet	0	794	7.935	7.935	7.935	7.935	32.534
Subtotal	0	794	7.935	75.435	75.435	75.435	235.034
Subtotal ETD	0	54.794	104.435	179.435	159.435	159.435	657.534
Personnel							
Vice Director (Division Manager)	0	14.308	28.616	28.616	28.616	28.616	128.771
ETD Pool Manager	0	12.103	24.206	24.206	24.206	24.206	108.925
Engineer	0	20.283	40.565	40.565	40.565	40.565	182.543
Technical Field Support	0	0	36.974	36.974	36.974	36.974	147.896
Subtotal ETD	0	46.693	130.360	130.360	130.360	130.360	568.134

Timeline	2009	2010	2011	2012	2013	2014
Purchases						
AUV	0	0	1	0	0	0
ROV	0	0	1	0	0	0
Near shore cable	0	0,2	0,8	0	0	0
Sensor systems (fishing fleet)		1	9	0	0	0
Existing						
AUV	0	0	1	1	1	1
ROV	0	0	1	1	1	1
Operational						
AUV	0	0	0	1	1	1
ROV	0	0	0	1	1	1
Sensor systems operational		1	10	10	10	10
People (numbers)						
Vice Director (Division Manager)	0,00	0,50	1,00	1,00	1,00	1,00
ETD Pool Manager	0,00	0,50	1,00	1,00	1,00	1,00
Engineer	0,00	0,50	1,00	1,00	1,00	1,00
Technical Field Support	0,00	0,00	1,00	1,00	1,00	1,00
Subtotal ETD	0,00	1,50	4,00	4,00	4,00	4,00

Infrastructure Investment 10: Strategic Issues and Applications for Society Division

1. Historical Context

In 2005-2008 the Mediterranean Institute of Advanced Studies (IMEDEA (CSIC-UIB)), a joint institute of the Spanish National Research Council (CSIC) and the University of the Balearic Islands (UIB), implemented a project with the Government of the Balearic Islands (DG Research, Technological Development and Innovation) to support science-based Integrated Coastal Zone Management (ICZM). The project (i+D+I GIZC) represents the first major collaborative step towards establishing ICZM in the Islands. The project activities of fell under three major categories: (1) Targeted, disciplinary research aimed at addressing specific data needs and priorities to progress towards ICZM, (2) interdisciplinary research aimed at addressing cross-cutting issues, and (3) the development of technological and conceptual tools and models to assist decision-makers to effectively manage the coastal zone and address specific issues related to ICZM. Involvement and collaboration of stakeholders and the continuous transfer of information in useable, comprehensible format to decision-makers were important components of this initiative²⁷.

Following a recommendation in 2008 from the Board of Trustees, since 2009, the research and objectives associated with the i+D+I GIZC project are being continued as part of the Strategic Issues and Applications for Society Division (SIA) Division of SOCIB. The SIA Division research team consists of original members of the ICZM research group from the Department of Marine Technologies, Operational Oceanography and Sustainability (TMOOS) of IMEDEA (CSIC-UIB) with some additional members. A number of the projects that are currently being implemented were initiated by the current team members while they were in IMEDEA (CSIC-UIB), which continues to collaborate closely with ICTS SOCIB through the TMOOS department.

2. International Context

Global change is making the achievement of sustainability increasingly challenging

The sustainable management of coastal and marine ecosystems has become one of the greatest environmental challenges in the last decade. Sustainable Regional Development and the achievement of a good environmental status of coastal and marine zones have become two of the main priorities of the European Union (e.g. European Marine Directive, Integrated Maritime Policy, Integrated Coastal Zone Management Protocol, and Water Framework Directive).

Global change, which may be defined as, "changes in the global environment (including alterations in climate, land productivity, oceans or other water resources, atmospheric chemistry, and ecological systems) that may alter the capacity of the Earth to sustain life"²⁸ is increasing the susceptibility and vulnerability of coastal ecosystems to negative impacts of human and natural pressures, making the achievement of sustainability all the more challenging. Population pressure and associated sustenance and economic needs are also growing, reaching increasingly deeper into new, "unspoiled" areas in order to satisfy the desires of humans' search

²⁷ Further details, results, etc can be found at <http://www.costabalearsostenible.es>

²⁸ Global Change Research Act of 1990, PL 101-606.

for “pristine” environments. Total protection of marine and coastal ecosystems, through banning all types of use across large areas is becoming a decreasingly realistic management option. Rather, the reality is shifting towards a need to manage human activity as part of coastal and marine ecosystems. Understanding the effects of global change and the complexity of the coastal zone require a solid base in scientific research directed at addressing existing and emerging sustainability challenges.

Balancing tourism activity and conservation goals is an important goal for achieving sustainability in coastal and marine areas of the Balearic Islands

Tourism, the world’s fastest growing industry and the most important economic activity in a substantial proportion of the world’s coastal zone (Spain and the Mediterranean in particular), represents one of the only non-extractive uses of coastal and marine environments, which can improve the quality of life of coastal residents and support conservation efforts, particularly through the implementation of marine and coastal protected areas. However, where coastal tourism is entirely dependent on a healthy and attractive natural environment, paradoxically, it represents one of the largest threats to these areas. The Balearic Islands is a mature island destination, historically characterized by “sun, sea and sand” tourism. Despite the fact that the Islands have maintained a substantially high standard of environmental quality in many coastal areas, there is evidence of social, economic and environmental repercussions related to tourism. In addition to facing threats which are characteristic of many coastal zones throughout the world, the Islands possess the elements of insularity that specifically challenge the achievement of sustainability including limited space, resources and waste assimilation capacity. These threats are becoming increasingly significant with the prevalence of global change. Furthermore, the characteristics of mature tourism destinations, including mass tourism, seasonal pressure on natural resources, residuals and unplanned coastal development, make the achievement of sustainability in the Islands all the more important and difficult. The Government of the Balearic Islands and additional civil society groups such as the Chamber of Commerce and the Economic and Social Council (CES) have demonstrated strong support for scientific research aimed at addressing these challenges and ensuring the sustainable development of the coastal zone in the future. In this context, the Islands represent an ideal and necessary location for advancing scientific research related to sustainability science, particularly as it relates to managing critical economic activities such as tourism.

Towards Sustainability Science²⁹ and integrated approaches to managing ecosystems

In the last decade, the scientific community has dedicated increasing attention to the need to manage human activity as part of coastal and marine ecosystems, often referred to in the context of social-ecological systems.³⁰ This is reflected in new, integrated scientific approaches that seek to combine assessment, monitoring, prediction and decision making into frameworks for managing marine and coastal social-ecological systems (e.g. ICZM, Coastal and Maritime Spatial Planning, Marine Protected Areas, sustainability science, ecosystem approach). The recent award of the Nobel Prize in Economics to Elinor Ostrom for her work on governing common

²⁹ Clark, WC. Sustainability Science: A Room of its own, PNAS, Feb 2007, 104(6): 1737-1738.

³⁰ Conference on Coping with Global Change in Marine Social-Ecological Systems, FAO, Rome, July 2008 <http://www.confmanager.com/main.cfm?cid=846>

pool resources is a testament to the importance that is being attributed to human dimensions of natural resource management and sustainability issues at a global scale. This emerging science is more applied, interdisciplinary and problem orientated than traditional scientific approaches. There is a need to advance these new forms of science in order to support emerging marine and coastal management strategies in Europe and internationally. This requires rigorous, quantitative social science research that complements the natural and physical sciences (and vice versa) aimed at understanding, modelling and monitoring social-ecological systems and associated sustainability problems. The work carried out during the I+D+i GIZC project (2005-08)³¹, which is now being continued within the strategic research area of Sustainability Science and ICOM³² of ICTS SOCIB³³, are examples of initiatives that are based on this approach.

ICOM seeks to develop an integrated framework for sustainable development of coastal and marine areas that is based on finding points of equilibrium among governance, economic needs, quality of life and preservation of natural resources. If properly implemented, it is an effective process for advancing towards sustainability in coastal and marine zones, ensuring conservation and preservation of ecosystems, equitable use of coastal and marine resources (natural, physical, socioeconomic, and cultural) and integration among uses, sectors, and administrative zones. Coastal and marine zones of Mediterranean countries, especially islands, which are particularly vulnerable, continue to show evidence of negative environmental impacts, suggesting that management of these areas has been largely unsuccessful in responding to sustainability challenges. Scientific research related to ICOM has been fragmented and, in many cases, has failed to support or improve maritime governance and integrated management approaches.

Since ICOM is an interdisciplinary topic, it can potentially include research related to any aspect of the coastal zone. Due to this, a considerable amount of scientific research has been carried out under the auspices of ICOM without enough consideration as to how it might actually benefit or be incorporated into the ICOM framework. In this context, ICOM research in the future needs to be focused, carried out by entities with real experience conducting scientific research within ICOM or complementary frameworks, and with a clear objective of improving the management of Mediterranean coastlines and marine areas. There are a number of dimensions related to ICOM which, in our opinion, require attention in future research projects in the Mediterranean, which may also be relevant in Europe's other regional seas and internationally. These aspects, which are summarized in more detail in the following paragraphs include, but are not limited to, the following major research lines:

1. Applied, problem orientated science directed at developing and evaluating decision-making tools and frameworks for managing social-ecological systems.
2. Monitoring and the use of interdisciplinary scientific data for decision making.
3. Research targeted towards effective governance systems for supporting science-based, integrated approaches to managing coastal and marine ecosystems, including the transfer of science to society.

³¹ http://www.costabalearsostenible.com/en_index.html

³² ICTS-SOCIB research is focused in coastal and maritime zones, with emphasis on integrated research across spatial boundaries (e.g. coastal zone, territorial sea, EEZ, continental shelf, which represents the whole of the Mediterranean sea). In this context, we have chosen to use the term Integrated Coastal and Ocean Management (ICOM) to encompass research across various spatial scales in coastal and marine areas. The basic principles are the same as for Integrated Coastal Zone Management (ICZM), but are applied to a larger spatial scale.

³³ <http://SOCIB.org/>

Applied, problem orientated science directed at developing and evaluating decision-making tools and frameworks for managing social-ecological systems

Scientific research that provides practical and effective management tools and frameworks for conforming conservation goals to local socio-political realities is necessary. Well preserved marine and coastal areas are critical to ensuring the well-being of Mediterranean society and its visitors. Scientific research aimed at understanding and supporting decisions related to such realities may be limited, particularly in Europe, by the relatively recent emergence of academic programmes that provide appropriate training for scientists to address these problems, in addition to limited support for such researchers in the current academic environment (i.e. limited relevant journals, low SCI rankings, limited research funding mechanisms, scholarships etc.). In this context, research groups such as the Ocean BIT Sustainability Science and ICOM Research Group represent an emerging, necessary class of academic that could provide positive, practical contributions to improving environmental sustainability in today's global change climate.

Monitoring and the use of interdisciplinary scientific data for decision making

The success of ICOM in supporting sustainability goals in Europe has been limited by the challenge of translating scientific data into appropriate formats for decision-making. Indicators, monitoring, observing and prediction systems are critical to the success of ICOM but need to be integrated into the ICOM framework in order to be effective for supporting sustainability goals. New Coastal Observing and Forecasting Systems in the Mediterranean such as ICTS SOCIB, or other initiatives in the USA (OOI, IOOS) or Australia (IMOS) generate data that contribute to establishing the state of ecosystems, their changes (implies the existence of baseline data in multiple areas), forecasting their evolution, thus providing valuable technological, scientific support to new approaches to coastal management.³⁴ The data provided by such systems, including social science data, will need to be effectively integrated into the ICOM framework. Existing and emerging data integration tools, particularly as they relate to coastal and maritime spatial planning³⁵, need to be evaluated and developed to determine how they can be used to facilitate this goal, with the transfer of scientific information in meaningful formats to policy makers being an integral, important challenge.

Effective governance systems for supporting science-based, integrated approaches to managing coastal and marine ecosystems.

In an ICOM context, governance may be defined as the process by which governments, institutions and society in general generate, influence, and implement policies to support sustainability goals in the coastal zone. A functioning governance system should include all of the elements necessary to support the ICOM process which include, among others, institutions, legislation, and mechanisms for coordination, public participation, conflict management and enforcement.

³⁴ OceanObs Conference Statement, September 2009:

http://www.ioc-unesco.org/index.php?option=com_content&task=view&id=163&Itemid=112

³⁵ Maritime Spatial Planning is a priority for the next European Commission; see

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/1530&format=HTML>

There is a clear need to improve coastal and marine governance, particularly in the Mediterranean, in order to support integrated management approaches. This may be achieved through research that aims to evaluate existing governance systems and mechanisms in order to establish the factors that determine their effectiveness or failure, in addition to research that responds to and works within the existing governance system. Governance related research should be used to establish a management framework that makes full use of available quantitative and qualitative scientific and management tools (e.g. assessment, monitoring, prediction, communication, conflict management, decision-making, public participation), resulting in a systematic management process that could be applied to a variety of sustainability scenarios and at different spatial scales.

The Balearic Indicators Project is an example of a project that was developed and implemented with a view to influencing ICZM governance in the Islands. This was achieved through a participatory approach and through collaboration with the Economic and Social Council of the Balearic Islands (CES) and members of this research team. The project resulted in a system of indicators and associated implementation guide, which was formally presented to the Government of the Balearic Islands in January 2009 as Dictamen (official opinion) 5/2007 of the CES.

3. Vision, Mission and Objectives

Vision

We believe that in order to respond to the challenges associated with achieving successful, integrated management of coastal and marine ecosystems, there is a need for research which focuses on evaluating, understanding and improving social-ecological systems, including governance, developing associated management frameworks, and developing tools that make full, appropriate use of scientific data for supporting ICOM. Research must be truly interdisciplinary, integrated, and crosscutting, involving scientists and decision-makers with experience working in ICOM and related fields and communicating across the science-policy interface. Research projects should be participatory, involving local stakeholders wherever relevant in order to ensure the results that are generated respond to societal needs and are useful and applicable to decision-making. The socio-economic impact of triggering these approaches in Europe should have tangible positive effects on key sectors in Europe (tourism, sustainable marine resources, safety of at sea operations, etc), by this also re-in forcing the role of science and technology as the backbone of sustainable development.

Mission

The mission of this research group is to advance sustainability science, with special emphasis on ICOM, through conducting research at local, regional and international scales (e.g. Balearic Islands, Mediterranean and Europe, including other countries/islands where the results may be comparable and used to advance general scientific theory). Specifically, research will be aimed at understanding human-environment interactions across coastal and marine zones and providing practical solutions to solving sustainability problems.

Objectives

Specific research objectives, which will evolve in accordance with new scientific developments, including local, regional and international priorities, are:

1. To develop and evaluate decision-making tools and frameworks, with emphasis on coastal and maritime spatial planning, the ecosystem approach, marine protected areas, risk analysis, indicators and monitoring.

2. To improve understanding and application of concepts related to carrying capacity such as limits to growth, resilience, and critical thresholds in coastal and marine environments.
3. To conduct research targeted at influencing environmental governance and management systems, including the transfer and communication of science to society.

This will be achieved through collaborations with researchers from different disciplines (within ICTS SOCIB and from other institutes) and by working with stakeholders and decision makers in order to bridge the science-policy gap and shift concepts and frameworks such as sustainability and ICOM from theory into effective management.

4. Research Activities³⁶

The current and planned projects for the next 4 years respond to the 3 interrelated objectives listed previously. New objectives may emerge in the coming years as a result of scientific evolution or in response to societal needs. Current and future projects will be funded partially by ICTS SOCIB through the basic budgetary needs defined in section 5 and through external sources of funding. A number of the current initiatives of this research group are being funded in part by other entities (see details for each initiative below). One of the primary tasks of the group over the next 4 years will be to identify and secure additional potential funding sources through the development of project proposals and collaboration with other research entities. External funding sources include (but are not limited to):

- Foundations (e.g. Tinker Foundation, Tiffany Foundation)
- European Commission (e.g. 7th Framework Programme)
- International organizations (e.g. UNESCO)
- Local organizations (e.g. Chamber of Commerce)
- Government (National and regional)

Currently, the research group is implementing five major research activities (RA) in response to the three research objectives. Specifically:

The Development of Coastal and Marine Special Area Management Plans (SAMPs) in the Balearic Islands (11/2009 – 12/2013)

Principal Investigators: Amy Diedrich, Pablo Balaguer

Funding: ICTS SOCIB is currently funding the initial stages of this project through dedication of personnel. Additional funding will be secured by the lead researcher from the potential sources listed previously in this section.

Responds to:

- Objective 1. To develop and evaluate decision-making tools and frameworks, with emphasis on coastal and maritime spatial planning, the ecosystem approach, marine protected areas, risk analysis, indicators and monitoring.
- Objective 2. To improve understanding and application of concepts related to carrying capacity such as limits to growth, resilience, and critical thresholds in coastal and marine environments.
- Objective 3. To conduct research targeted at influencing environmental governance and management systems, including the transfer and communication of science to society.

SAMPs, which gained recognition through the USA Coastal Zone Management Act (1972) may be defined as "resource management plans and implementation programs developed to improve the management of a discreet geographic area.

³⁶ to March 2010

SAMPs are employed most often to supplement existing management programs, in specific areas where the broad program policies are not working well, or where there is a need to better align coastal policy or to address complex multi-jurisdictional coastal issues" (<http://coastalmanagement.noaa.gov/special.html>).

The similar concept of Maritime Spatial Planning (MSP) has recently become a priority topic for the European Commission³⁷, including influential scientific groups such as ICES (International Council on the Exploration of the Seas). MSP may be defined as, "a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that area usually specified through a political process"³⁸.

The development of SAMPs through the application of a MSP approach, extended to include coastal areas, will be a priority research area for the Sustainability Science and ICOM research team over the coming years. The plans will be developed using an approach similar (adapted to local reality where needed) to that described in Ehler and Douvere 2009 (see footnote 9) and following the standards set by the European Commission. This approach encompasses many of the basic principles of the team's research approach including the need for:

- a participatory approach,
- improved governance through the use of science-based decision making tools,
- making best use of available data,
- an interdisciplinary approach (i.e. integrating data from the natural, physical and social sciences)

The process for the development of the SAMPs will be tested in two selected pilot areas: one urban and one natural. These plans will serve as points of convergence for the majority of past, current, and planned research foci's of this group including indicators, limits to growth, zoning, beach monitoring, ETD (Environmental Technology Development) programs on habitat protection and MPAs, and oil spill decision support tools, in addition to establishing a link between social-ecological dimensions and the oceanographic and data collected generated by other departments of ICTS SOCIB. This research area will also serve to identify emerging research needs in order to develop future project proposals for the group.

KNOWSeas (04/2009 – 03/2013)

ICTS SOCIB/IMEDEA (CSIC-UIB) collaborators: Amy Diedrich, Joaquín Tintoré, Guillermo Vizoso

Funding: EC 7th Framework Programme (in kind contributions from IMEDEA (CSIC-UIB))

Responds to:

- Objective 1. To develop and evaluate decision-making tools and frameworks, with emphasis on coastal and maritime spatial planning, the ecosystem approach, marine protected areas, risk analysis, indicators and monitoring.
- Objective 3. To conduct research targeted at influencing environmental governance and management systems, including the transfer and communication of science to society.

³⁷ European Commission. 2008. Roadmap for Maritime Spatial Planning: Achieving Common Principles in the EU. COM(2008) 791 final; and

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/1530&format=HTML>

³⁸ Ehler, C, Douvere, F. 2009. Marine Spatial Planning: a step-by-step approach toward ecosystem-based management. Intergovernmental Oceanographic Commission and the Man and the Biosphere Programme. IOC Manuals and Guides 53. ICAM Dossier 6. Paris, UNESCO.

SOCIB researchers are working to further their research objectives through collaborating with IMEDEA (CSIC-UIB), which is a partner on the KnowSeas project (<http://www.knowseas.com/>). KnowSeas has the overall objective of generating a comprehensive scientific knowledge base and practical guidance for the application of the Ecosystem Approach to the sustainable development of Europe's regional seas. ICTS SOCIB is participating in work associated with the development of an ecosystem based management system (EBMS), a systematic process for implementing the ecosystem approach and in the Mediterranean case study for this project. Specifically, the team will work with the CSIC partner to develop the Risk Assessment tool, using a similar approach to the one that is being developed by the Department of Fisheries and Oceans of Canada (DFO, <http://www.dfo-mpo.gc.ca/science/coe-cde/ceara/index-eng.htm>). The ICTS SOCIB has a strong working relationship with the Habitats and Oceans Department of DFO, and have worked together in a number of meetings since 2009 to exchange experiences and ideas, and to develop the risk assessment tool and related integrated approaches to coastal and marine management.

LIMCosta Mallorca: Establishing limits to growth in the coastal zone of Mallorca (10/2007 – 03/2010)

Principal Investigators: Amy Diedrich, Joaquín Tintoré

Funding: Chamber of Commerce of Mallorca, SOCIB (since 2009)

Responds to:

- Objective 2. To improve understanding and application of concepts related to carrying capacity such as limits to growth, resilience, and critical thresholds in coastal and marine environments.
- Objective 3. To conduct research targeted at influencing environmental governance and management systems, including the transfer and communication of science to society.

This project, which was initiated in 2007, resulted from collaboration between the Chamber of Commerce of Mallorca and IMEDEA (CSIC-UIB) with the overall objective of studying limits to growth in the coastal zone of Mallorca and generating awareness at the societal level. Funding for this project was provided to IMEDEA (CSIC-UIB) by the Chamber of Commerce for 15 months of research. ICTS SOCIB has been continuing this work using internal funds since 2009 in addition to the continued collaboration of the Chamber of Commerce. Specific studies have included an extensive literature review; research on the carrying capacity (physical and social) of recreational boats in bays and beaches; and the establishment of priority objectives for sustainable development of local business owners. The partners are currently working on the development of a publication that will describe the results of the project and outline an innovative process for the management of limits to growth in coastal areas.

Balearic Indicators Project (11/2006 – 12/2010)

Principal investigators: Amy Diedrich, Ferran Navinés, Joaquín Tintoré

Funding: Government of the Balearic Islands, ICTS SOCIB (since 2009)

Responds to:

- Objective 1. To develop and evaluate decision-making tools and frameworks, with emphasis on coastal and maritime spatial planning, the ecosystem approach, marine protected areas, risk analysis, indicators and monitoring.
- Objective 2. To improve understanding and application of concepts related to carrying capacity such as limits to growth, resilience, and critical thresholds in coastal and marine environments.
- Objective 3. To conduct research targeted at influencing environmental governance and management systems, including the transfer and communication of science to society.

This project resulted from collaboration between IMEDEA (CSIC-UIB) and the Economic and Social Council of the Balearic Islands (CES), which was initiated in 2006. Funding was provided to IMEDEA by the Government of the Balearic Islands as part of the i+D+I GIZC project. The result of this project was a system of indicators for implementing ICZM in the Balearic Islands based on internationally established research on indicators, tailored to local needs through a participatory process. The system was published as a book, which also serves as an implementation guide for the system, and formally presented to the Government of the Balearic Islands in January 2009 as Dictamen (official opinion) 5/2007 of the CES. Since the start of 2009, ICTS SOCIB has been continuing this project with internal funds (dedication of staff and financing of one intern) to support the implementation of the system using Menorca as a pilot zone. This initiative that is being coordinated by IBESTAT in collaboration with ICTS SOCIB and OBSAM (Menorca). In April 2010, the pilot study will be extended to include the island of Mallorca.

Development of a proposal for an ICZM Governance Structure for the Balearic Islands (11/2009-12/2010)

Principal investigators: Ferran Navinés, Amy Diedrich

Funding: ICTS SOCIB

Responds to:

- Objective 3. To conduct research targeted at influencing environmental governance and management systems, including the transfer and communication of science to society.

The objective of this project is to develop a proposal for a governance structure (based primarily on existing organizations) that could support ICOM in the Balearic Islands, including the implementation of the System of Indicators for ICZM (Dictamen 05/2007). This structure will be developed using the recently developed AENOR (Spanish Association for Standardization and Certification) Guide for the implementation of a system of ICZM in Spain.

5. Nature of investment

Investment: investment required in computing equipment and software is purchased, implemented and managed under the Computing and IT Services budget.

Operations: the operations cost considered here is essentially related to the visits and training exchanges of personnel as well as contributions to international meetings and workshops. The travel budget is estimated as 10,000 € per annum and will be utilized on a selective basis for participation in conferences, meetings and work placements. Such activities will be selected on the basis that they will serve to advance the research objectives of the group through collaboration, learning and sharing of information with other researchers and institutions working in related fields. These activities will be in addition to other activities that are funded by external sources (i.e. European Projects, etc.). Anticipated activities that will require funding in 2010 include, but are not limited to:

- Participation in the International Conference on Coastal Conservation and Management in the Atlantic and the Mediterranean, Estoril, Portugal, 11-17 April (estimated 1500€ x 2 persons)
- Participation in the Littoral 2010 Conference: Adapting to Global Change in the Coast, London, UK, 21-23 September (estimated 1700€)

Personnel: two personnel, a lead researcher (postdoctoral researcher to lead the research activity of the group) and a senior technician (provides technical support

to this research team) have been employed since January 2009 to research and initiate contacts with local governmental organisations required to create ICOM tools for use in the Balearic region and beyond, they have been assisted by three part-time staff³⁹. From 2012 onwards the personnel employed under SOCIB contacts will reduce to one senior permanent staff and one part-time collaborating researcher, as it is anticipated that other support will be funded through external project relate funding to develop the science/societal tools.

In 2011, the team will contract a postdoctoral researcher to work with the lead researcher and the technician to further the objectives of the group. This researcher and the technician will be funded through projects (to be developed in 2010). Potential sources of funding for this research include, but are not limited to: Ramon y Cajal scholarship or equivalent international scholarship, European Commission and ICTS SOCIB Projects. It is intended therefore that the core team will be comprised of these three staff members as of 2011, with additional collaborating researchers or interns contracted on an as needs basis and contingent upon available resources.

Space: The team will require permanent office space for 6 people (including 1 space for visiting researchers). This space has already been made available.

In-kind: no specific in-kind needs will be required to support this Division

5. Budget

Budget Overview	2009	2010	2011	2012	2013	2014	Total (2009-2013)
Investment	0	0	0	0	0	0	0
Operations	5515	10000	10000	10000	10000	10000	55.515
Personnel	103915	138211	124211	77567,5	77567,5	77567,5	599.039

Budget Detail	2009	2010	2011	2012	2013	2014	Total (2009-2013)
Investment	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0
Operations							
Travel	5515	10.000	10.000	10.000	10.000	10.000	55.515
Subtotal	5515	10000	10000	10000	10000	10000	55.515
Personnel							
Postdoc Researcher	53.107	55.787	55.787	55.787	55.787	55.787	332.044
Technician	36.784	46643,1	46643,1	0	0	0	130.070
Predoctoral Researcher	3.857	14000	0	0	0	0	17.857
Collaborating Researcher	7.559	21780	21780	21780	21780	21780	116.459
Intern	2.608	0	0	0	0	0	2.608
Subtotal	103.915	138.211	124.211	77.567	77.567	77.567	599.039

Timeline	2009	2010	2011	2012	2013	2014
People						
Postdoc Researcher	1,0	1,0	1,0	1,0	1,0	1,0
Technician	1,0	1,0	1,0	0,0	0,0	0,0
Predoctoral Researcher	0,3	1,0	0,0	0,0	0,0	0,0
Collaborating Researcher	0,3	0,3	0,3	0,3	0,3	0,3
Intern	0,3	0,0	0,0	0,0	0,0	0,0
Subtotal	2,9	3,3	2,3	1,3	1,3	1,3

³⁹ Collaborating researcher: This researcher contributes 3 MM per year to the research objectives of the group. Pre-doctoral researcher: This researcher provides fulltime research support to the group. Pre-doctoral intern: This intern contributes part time 3 MM per year to the research objectives of the group.

Infrastructure Investment 11: Services

Management & Finance

1. Service description and initial implementation

The function of Management and finance is to develop the administrative structure required to manage the following tasks:

1. Human resources: management of contracts, social security payments and compliance with health and safety at work legislation (prevención de riesgos laborales).
2. Administration: management of purchase process, including specific rules governing the spending of public funds, management of suppliers and associated contracts, tender process and public calls, inventory and management of installations.
3. Finance: Creation and responsibility for managing financial budgets and annual accounts, auditing and public accountability, and creation of financial statements. Creation of annual accounts (Balance sheet, statement of losses and gains, and retained earnings (Balance, Cuenta de Pérdidas y Ganancias y Memoria e Informe de Gestion) and management reports.
4. Fiscal: Management of financial assets and payment of the relevant taxes.

The following Policies have been developed:

1. Human Resources Policy:

The SOCIB human resources policy is simple; to ensure that the health, safety and welfare of SOCIB personnel is considered throughout all operations, and to enhance the quality of the SOCIB office environment both for people who work here.

2. Environment and Sustainability Policy: SOCIB is committed to being a responsible and environmentally conscientious organization and as such recognizes the role it has in managing the impact of its day-to-day operations on the environment and in promoting the principles of sustainability in all its activities. ICTS SOCIB is committed to achieving environmental good practice through:

- The prevention of pollution
- Promoting the prudent use of natural resources and the minimization of waste, including working with suppliers and contractors, where possible, to ensure the best use of natural resources and to minimize the environmental impact
- As far as possible implementing a sustainable buildings policy
- Implementing a transport and travel policy that encourages appropriate sustainable use of the transport options available
- Complying with, and where appropriate, exceeding, applicable legal and other requirements relevant to its operations
- Working with the all relevant external authorities, environmental bodies and associations to keep up to date with latest developments
- Seeking to integrate sustainability into strategies, policies and operations

ICTS SOCIB will review this Policy and ensure that actions are taken to ensure continual improvement.

2. Nature of investment:

Investment: in 2009 investment has been made in setting up the SOCIB offices in ParcBit, Mallorca, including equipment, furniture and technical installations.

Ongoing investment in 2010/2011 will be in an access control system, transport and marine science and sustainable science literature/ books.

Operations and Maintenance: this budget encompasses a range of office support tasks, from lawyers and labour contract consultants to support contract processes, to office and equipment insurance, office supplies and cleaning services.

Personnel: one senior level Financial Manager has been contracted from mid 2009 to develop the manage the personnel and purchase contracts, to create and manage SOCIB financial accounting and financial reporting systems, to manage the human resources needs and the development of the office space in general. Additional support for the Financial Manager will be contracted full-time from 2010.

Space: General office space at ParcBit, 300 m²

In-kind: no specific in-kind needs will be required to support this Service.

3. Budget

See below for the combined Infrastructure Investment 12: Services Budget.

Computing & IT

1. Service description and initial implementation

IT (Information Technologies) and Computing infrastructures have become a key component of any modern organization, from small business to the largest company. This is even more important in a research centre and/or ocean observatory where 'data' is one of its main products.

Several international initiatives exist with similar objectives to ICTS SOCIB; however most of them, such as IMOS in Australia or IOOS in the USA are composed of a partnership of centres, each one with its own local computing infrastructure. It is therefore difficult to compare directly these distributed computing infrastructures with the needs of the SOCIB central computing infrastructure. For example the IOOS Cyberinfrastructure assumes a data lifecycle where data collection and pre-processing has already been made by the observing subsystem, similarly, it assumes that the modelling and analysis subsystem acts as a data consumer, however it does not take into account the computing infrastructure required for these two subsystems to perform their respective tasks.

In fact the TMOOS Department at IMEDEA (CSIC-UIB) acts as a useful pilot for the SOCIB Computing and IT infrastructure, as it supports all of the TMOOS Departments needs in terms of the whole data lifecycle, including data collection, archiving, discovery, download, distribution, modelling and visualization. The IMEDEA computing and IT facilities supports the department and researchers in associated areas (approx. 150 people) and is located in a 35 m² room. They currently have around 25 servers, a computing cluster with 20 nodes and a blade server. In terms of communications, they handle around 700 network points, a PABX and several switches at different speeds, while the communication to the outside is accomplished through an double optic fibre ring with UIB (University of the Balearic Islands). The total storage space is around 12 TB for storage and 10 TB for backup. Although the design of the IMEDEA Computing and IT infrastructure can be used as a blueprint for ICTS SOCIB in terms of structure, with data at the core of the SOCIB mission the infrastructure requirements for the collection,

archiving, discovery, download, distribution, modelling and visualization of data will be amplified and enhanced for ICTS SOCIB.

The SOCIB Computing and IT Service will provide the following; the major infrastructure to support Data Centre Facility and Modelling and Forecasting Facility, and the general infrastructure to support staff and administrative functions (requirements as outlined below). In addition the Computing and IT Service will encourage collaboration with other institutions, like UIB (University of the Balearic Islands) and IMEDEA (CSIC-UIB), in terms of sharing computing resources and spaces to increase joint computing capabilities and storage redundancy.

Data Centre Facility Infrastructure: a centralized storage and automated backup of scientific data gathered by the different facilities, including observational data as well as numerical models outputs. Storage and backup policies will ensure storage of data compliant with current legislation.

Forecasting and Modelling Facility Infrastructure: an HPC infrastructure for researchers, modellers will be able to run operational forecasting models as well as specific case studies.

General Infrastructure (Staff and Administrative functions): a centralized storage and automated backup for administrative data. It will also provide a platform where a possible centralized database and management applications will be executed. Storage and Backup policies will comply with current legislation regarding data storage and security of data. Staff data will be on a shared file system. Each user will be allowed to apply access permissions to their files or folders. Backups of this file system will be performed periodically and archiving will be limited. Scientific data will be on a shared file system. Access policies will be defined for every dataset. Backups of this file system will be performed following current legislation and defined policies. Communications support with an adequate connection to all user computers as well as all the servers. Administrative data will be on a shared file system. Administrative personnel will be allowed to apply access permissions to files or folders. Backups of this file system will be performed following current legislation.

The infrastructure required to support these three areas can be broken down under 5 headings; storage, backup (internal and external), general services, computing and communication and Fig. 11 below shows the initial infrastructure design, based on current estimations of SOCIB needs.

1. **Storage:** The storage under consideration consists of a unified storage system that provides several services in the same equipment. iSCSI service will provide the ability to store servers OS and configurations in this storage system. NFS and CIFS services will provide the ability to share centralized file systems between different users and servers. Data access from outside will pass through the services provided by the Data Management Facility. The initial capacity of the system will be 13TB on a RAID system, organized as follows:

- 8TB for scientific data (both observational and numerical)
- 1TB for staff data (Windows and Linux Users)
- 2TB for general services (virtual machines)
- 2TB for HPCC (both serial and parallel computing, scratch regions)

13TB are planned for the initial deployment of the Computing and IT infrastructure. The growth rate will then depend on the requirements of the different facilities.

SOCIB users will be able to store and share their own information and scientific data collected by the observing and modelling facilities will be available to users.

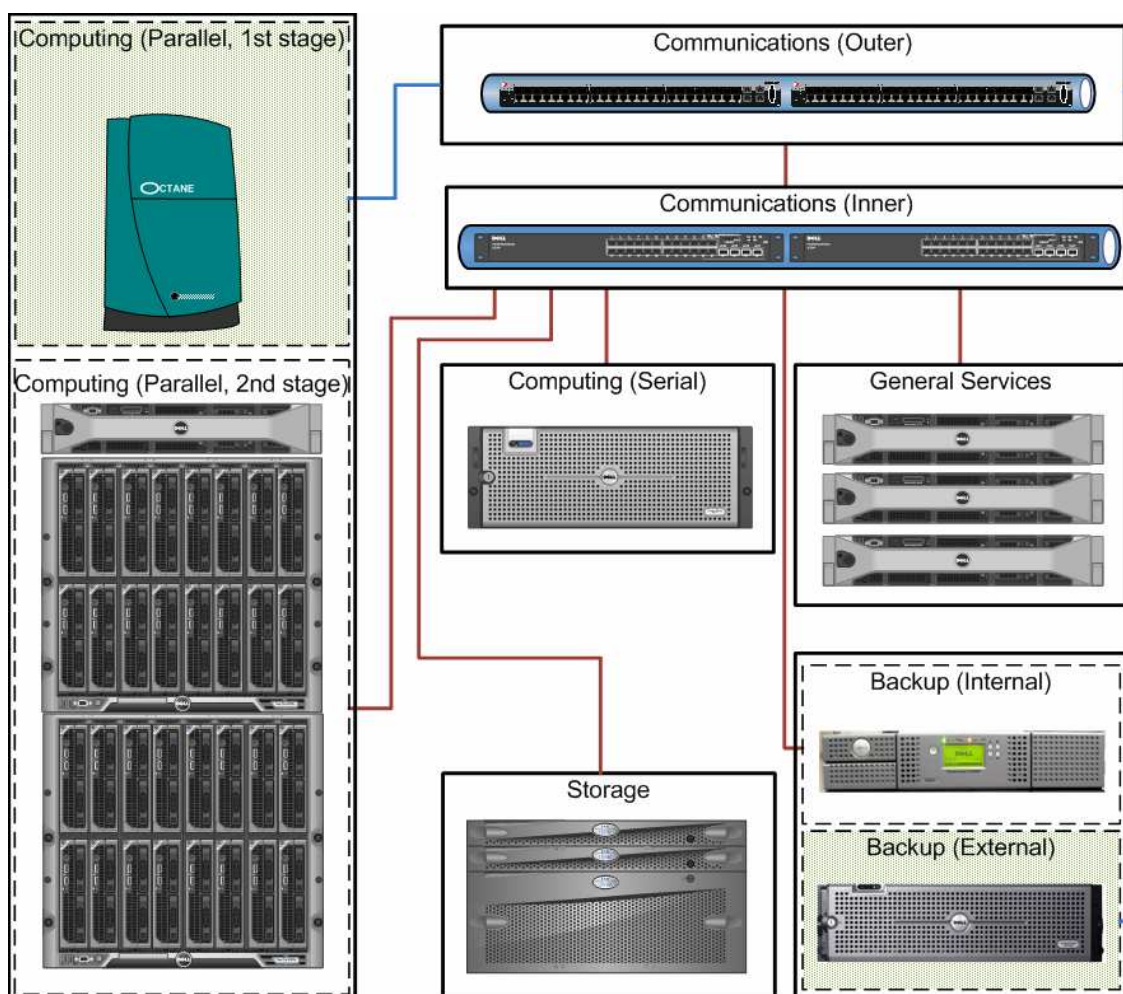


Figure 11: Hardware infrastructure of SOCIB Computing and IT Service. Green boxes mean equipment located outside of SOCIB offices. Red lines represent inner communications, and blue lines represent outer communications

2. Backup (internal and external): Archiving periods and recovery speed will determine if a unique backup system can cope with the different needs or if a hybrid system should be installed. The initial implementation (from early 2010) will consist of an external storage system, as in 2010 a small amount of the available storage will be used by SOCIB (mainly administrative and staff information) the rest of the storage system capacity will be used to store scientific data that is shared between SOCIB and the TMOOS Department at IMEDEA (CSIC-UIB). SOCIB will acquire the systems required to fulfil current legislation regarding security and storage, including a LTO04 tape system for permanent backup and a virtual tape system (implemented through hard disk storage) for fast recovery but limited archiving. An external placement for the backup system will be implemented to improve data safety in case of catastrophic event destroys the main storage system.

3. General services: The system proposal is based on three servers with exactly the same architecture and characteristics. In an initial phase, the different machines will handle different responsibilities.

- 1 virtual machines server: web, mail, LDAP, printers, etc.
- 1 data server: THREDDS, OPeNDAP, RAMADDA, etc.
- 1 spare server: to replace either of the other two in case of failure, in the meantime it will be used to test new configurations and procedures

The operating system configuration for each service will be stored in the unified storage system. Thus, a hardware failure in one machine can be overcome quickly and easily by booting its configuration from the spare equipment. This design will change in the second phase, where load balancing may be implemented between the servers to improve robustness and fault tolerance.

4. Computing: Two types of computing needs will be met by a High Performance Computing Centre (HPCC), composed of a serial and a parallel computing system. In terms of serial computing, a computing server for batch processing of serial job will be installed, this will be useful to run processes with a sequential code that require a large amount of shared memory. Most of the facilities will benefit from this server as it will allow data processing for observations as well as model inputs and outputs. The parallel computing system will be implemented in two stages, initially a personal supercomputing system will be installed in order to provide the modelling facility with the necessary infrastructure to deploy modelling applications and run initial tests. This system will initialize the collaboration between the modelling facility and the computing service, acting as a two-way test bed for:

- The Forecasting and Modelling Facility to run initial tests and tune-up the applications.
- The Computing and IT Service to see the workload on the system and to use this as a benchmark to evaluate throughput, scalability and other parameters of the parallel computing system.

Subsequently a cluster of computers will be acquired to increase the parallel computing capacity, combining this hardware with a similar system acquired by UIB will be initially trialled to assess if this would provide an enhanced platform accessible to both institutions as part of the partnership agreement.

Communications (outer and inner components): Outer communications includes the connection between SOCIB and the outer world through an internet connection provided by UIB, composed of a monomode optic fibre between SOCIB offices at ParcBit and UIB, an optic fibre connected to a router at the University and to a 48 port switch stacked with a second one with similar characteristics. Providing this connection a bandwidth of 1Gbps between SOCIB and UIB, the UIB connection to the WAN through a 2 Gbps connection (estimated) to RedIRIS, a Spanish national research network (with a maximum bandwidth of 10 Gbps). RedIRIS is connected to other networks all around the world, like Internet2 (USA) and Canarie (Canada) among others. Internet2 is the foremost U.S. advanced networking consortium. It provides a bandwidth of 100 Gbps to interconnect 200 U.S. universities in cooperation with 70 leading corporations, 45 government agencies, laboratories and other institutions of higher learning as well as over 50 international partner organizations. The Australian Academic and Research Network (AARNET) links IMOS regional nodes through fibre optic backbone (10 GBit Bandwidth between mainland sites), therefore ICTS SOCIB will be sufficiently served with bandwidth to the WAN in the immediate future, however this will be reviewed towards the end of this 5-year plan once data download and web site use is better known.

The core components are located at the SOCIB offices and currently consist of; two rack closets, one with storage systems and servers to support the general services and one for communications, SAI/UPS and a VideoWall management server. Power consumption of the whole system and temperature of the room has been evaluated to confirm that both power supply and air conditioning is sufficient for the installed equipment.

Finally the safety and security of the room and the following components are ongoing; adequate fire extinguishers for electronic devices and definition and communication of access policies, in line with legislation regarding data privacy and LOPD.

2. Nature of investment:

Investment: Investment in 2009 is mainly related to the setting up of the SOCIB personal computing and the network and communications systems. The major investment during 2010 and 2011 will be related to (a) data storage servers (13 TB), (b) general services computers and (c) high performance computing.

Operations and Maintenance: is mainly related to the annual/biannual purchase of software licenses.

Personnel: one full time employee computer engineer is responsible for the system management, with additional staff on short tem contract in 2010 to provide additional help desk and support to system management during the growth phase of the computing infrastructure system.

Space: Air conditioned space of 6 m² in SOCIB ParcBit offices

In-kind contributions: This facility is additionally supported through in-kind contributions from IMEDEA (CSIC-UIB) and UIB, specifically:

Space - IMEDEA (CSIC-UIB):

- Remote storage backup system (3U of a rack closet from TMOOS): 1 m²

Space - UIB:

- High Performance Computing Unit from 2011 (under discussion): approximately 2 racks, 2 m²

Equipment - UIB:

- 1 Gbps fibre optics link from UIB to the SOCIB Office at ParcBit

Summary in-kind contributions:

Total space: 3 m² per annum (with associated power supply and air conditioning)

Total equipment: fibre optic link

3. Budget:

See below for the combined Infrastructure Investment 12: Services Budget.

Outreach, Education, Training & Mobility

1. Service description and initial implementation

The role of the Outreach, Education, Training and Mobility Service is two fold, firstly to communicate the role, developments, successes, knowledge, research and

results of the SOCIB consortium at a regional, national and international level, and secondly to use the knowledge generated within the SOCIB activities to inform society and create education and training programs to help develop the next generation of marine scientists and managers. The work of the Outreach, Education, Training and Mobility Service is organized along two themes; Outreach and Education and Training and Mobility.

As a large, government-funded project, SOCIB will be presented through the traditional media paths and outlets, particularly at the start of the project. These include a variety of press releases through news papers, magazines, radio and television. In addition, taking advantage the internet's powerful communication capacity, SOCIB will also make use of the 'viral' information dissemination capabilities of social networking (FaceBook, Twitter, YouTube, etc.) and special emphasis will be placed on collaborating with educators, giving them the tools to engage the interest of their students, creating a good level of scientific culture and bringing new and young talent into the world of ocean science.

Key Target End Users:

- Coastal residents and citizens
- Educators (teachers)
- Students and young talent
- National and international research groups
- Marine workers (fishermen, commercial ships, etc)
- Recreational user groups
- Marine policy makers
- Government and environmental agencies that work in marine and coastal areas
- Conservationists / environmental groups

Outreach and Education: An important aspect of the Outreach and Education work will be to use multimedia as a vector to engage and educate the public through visually impacting content, specifically catered for the different target audiences, combining the solid development at SOCIB with a powerful visual and outreach element, developing a formula capable of bridging the gap between the general public and the world of science. The rate of change of technology and communications development is increasing and society, especially the younger generations, are fast at adapting and integrating these technologies into their daily life. In order for science to remain relevant, it must adapt alongside society and be open to new methods of communicating science.

In addition to the public outreach efforts, SOCIB requires that all outreach media and resources be well organized and easily accessible to the SOCIB personnel. This is necessary for use in scientific publications, posters, etc. This will be done through the maintenance of a searchable image/video databases, accessible online for any member of SOCIB.

In addition the Outreach and Education work will target the development of the next generation of marine scientists through the development of initiatives with the local education system (schools, colleges and universities) and through the creation of an SOCIB Advanced Study Programme. The idea of the Advanced Study Programme is to establish an educational program embedded within SOCIB, managed by FUEIB and delivered by UIB. This would initially offer a Diploma Programme (2013), followed by a Masters Degree Programme (2014) and finally a PhD Programme. The initiation of this project will depend however on securing additional external funding to finance the set-up and initial three years of operation. Over the longer term the Programme should become self funding through attracting national and international students.

The objectives of Outreach and Education work are as follows:

- Spreading knowledge about the ICTS SOCIB to the national and international scientific community and society in general.
- Make the science and technology development accomplished by SOCIB interesting and approachable for society, helping expose the complexity of the challenges we face and the important role played by science and technology development in the decision making process, and more particularly in the complex task involved in the research of our coasts and oceans.
- Attract young students into the world of science in order to maintain a continued base of quality scientists and researchers.
- Position SOCIB as one of the leading coastal ocean observing and forecasting systems, at a national / European level.

The impact and effectiveness of the outreach activity will be periodically assessed through surveys and questionnaires amongst the key user groups and suggestions and areas for improvement will be encouraged.

Training & Mobility: The Training and Mobility work centres around the organization of conferences, workshops, seminars and exchanges, primarily for professionals. Workshops will be given by professionals selected both for their specific experience in essential areas related to SOCIB activities, e.g. ICZM, data management. The intention is that these workshops are set up as a place for solid, scientific and effective discussion. The training of professionals working in coastal management in scientific issues and methods is a cornerstone for the implementation of an effective integrated coastal strategy that meets the requirements of the complexity of the coastal environment from different angles, disciplines and concerns. In addition an SOCIB Fellow Programme will facilitate scientific exchange at a senior and international level, through attracting a senior oceanographic scientist to work at SOCIB central office for a sustained period (6 months) providing their expertise to the mission and facilitating knowledge exchange with SOCIB staff in the crucial initial development of SOCIB during 2010 and 2011. Longer term this will also foster international cooperation and the participation of SOCIB in the global ocean observing network. If additional funding can be found beyond 2012 then the Programme will be continued.

2. Nature of investment:

Investment: No specific investment required

Operations: There is budget for the basic Outreach and Education work from 2010 – 2014, Training and Mobility also has a limited budget to support travel, seminars and workshops from 2010 – 2014. In addition there is operational budget to support one senior visiting scientist (SOCIB Fellow Programme) for 2010 and 2011. The Advanced Studies Programme will only be activated if specific additional funds are secured to support this.

Personnel: one part-time person will be contracted in 2010 to support this work, initially focused on Outreach and Education activities.

Space: General office space at ParcBit

Sponsorship/In-kind: Given the limited operational budget for the Outreach, education, Training and Mobility service it is envisioned sponsorship and/or in-kind investment will be sought to support additional specific initiatives, such as seminars, workshops, educational events and public events.

4. Combined Services Budget:

See below for the combined Infrastructure Investment 12: Services Budget.

Budget Overview	2009	2010	2011	2012	2013	2014	Total (2009-2013)
Management & Finance							
Investment	154.317	113.000	48.000	3.000	3.000	3.000	324.317
Operations	83.404	154.195	172.257	169.723	169.723	169.723	919.025
Personnel	33.764	65.010	80.305	80.305	80.305	80.305	419.994
Computing & IT							
Investment	81.601	204.794	510.000	10.000	25.000	10.000	841.395
Operations	0	12.700	18.700	42.700	22.700	22.700	119.500
Personnel	0	52.269	36.974	36.974	36.974	36.974	200.165
Outreach, Education, Training & Mobility							
Investment	0	0	0	0	0	0	0
Operations	17.200	86.000	100.000	50.000	50.000	50.000	353.200
Personnel	0	7.648	15.295	15.295	15.295	15.295	68.828
SERVICES							
Investment	235.918	317.794	558.000	13.000	28.000	13.000	1.165.712
Operations	83.404	154.195	172.257	169.723	169.723	169.723	919.025
Personnel	33.764	65.010	80.305	80.305	80.305	80.305	419.994

Budget Detail	2009	2010	2011	2012	2013	2014	Total (2009-2013)
Investment							
Management & Finance							
Constructions	12.206	10.000	0	0	0	0	22.206
Technical installations	38.961	0	0	0	0	0	38.961
Furniture	97.790	20.000	0	0	0	0	117.790
Office Equipment	5.360	3.000	3.000	3.000	3.000	3.000	20.360
Access Control System	0	30.000	0	0	0	0	30.000
Books/library		10.000	5.000	0	0	0	15.000
Van		40.000	40.000	0	0	0	80.000
Subtotal Management	154.317	113.000	48.000	3.000	3.000	3.000	324.317
Computing & IT							
Personal computing	39.009	30.000	20.000	10.000	10.000	10.000	119.009
Software (Idinet, ICOM)		40.000	5.000		0	0	45.000
Storage & backup	9.860	60.000	85.000	0	15.000	0	169.860
Videowall	22.292	0	0	0	0	0	22.292
Videowall portatil	10.440						
Serial computing	0	10.000	0	0	0	0	10.000
Parallel computing	0	55.000	400.000	0	0	0	455.000
Airconditioning/extinguishers	0	9.794	0	0	0	0	9.794
Subtotal Computing & IT	81.601	204.794	510.000	10.000	25.000	10.000	841.395
Outreach, Education, Training & Mobility							
Fellow Programme	0	0	0	0	0	0	0
Advanced Study Programme	0	0	0	0	0	0	0
Subtotal Outreach	0	0	0	0	0	0	0
Subtotal Services	235.918	317.794	558.000	13.000	28.000	13.000	1.165.712

	2009	2010	2011	2012	2013	2014	Total (2009-2013)
Operations							
Management & Finance							
Travel	1.100	2.000	2.000	2.000	2.000	2.000	11.100
Contract Consultants	32.480	10.500	11.000	12.000	12.000	12.000	89.980
Risk prevention services	800	2.000	2.500	3.000	3.000	3.000	14.300
Cleaning services	5.000	4.740	4.882	5.028	5.028	5.028	29.706
Legal services	8.600	26.575	27.375	28.195	28.195	28.195	147.135
Rental of space	0	24.000	30.000	30.000	30.000	30.000	144.000
Repairs	0	6.000	10.000	10.000	10.000	10.000	46.000
Other services	5.012	23.380	12.500	7.500	7.500	7.500	63.392
Transportation	0	6.000	6.000	6.000	6.000	6.000	30.000
Insurance premiums	0	10.000	10.000	10.000	10.000	10.000	50.000
Banking services	86	3.000	3.000	3.000	3.000	3.000	15.086
Telephone	6.000	12.000	25.000	25.000	25.000	25.000	118.000
Office material	5.000	6.000	6.000	6.000	6.000	6.000	35.000
Communications	4.100	3.000	3.000	3.000	3.000	3.000	19.100
Patents and logos	6.000	2.000	1.000	1.000	1.000	1.000	12.000
Printing	9.226	10.000	12.000	12.000	12.000	12.000	67.226
Journals/books	0	3.000	3.000	3.000	3.000	3.000	15.000
Access Control System	0	0	3.000	3.000	3.000	3.000	12.000
Subtotal Management	83.404	154.195	172.257	169.723	169.723	169.723	919.025
Computing & IT							
Matlab	0	10.000	10.000	10.000	10.000	10.000	50.000
Red Hat licence	0	1.200	1.200	1.200	1.200	1.200	6.000
VMWare licence	0	1.500	1.500	1.500	1.500	1.500	7.500
Storage licence/maintenance	0	0	0	20.000	0	0	20.000
Software Licences	0	0	6.000	10.000	10.000	10.000	36.000
Subtotal Computing	0	12.700	18.700	42.700	22.700	22.700	119.500
Outreach, Education, Training & Mobility							
Exchanges	0	20.000	30.000	30.000	30.000	30.000	140.000
Outreach (various)	17.200	16.000	20.000	20.000	20.000	20.000	113.200
Fellow Programme	0	50.000	50.000	0	0	0	100.000
Advanced Study Programme	0	0	0	0	0	0	0
Subtotal Outreach	17.200	86.000	100.000	50.000	50.000	50.000	353.200
Subtotal Services	100.604	252.895	290.957	262.423	242.423	242.423	1.391.725

Personnel							
Management & Finance							
Manager	33.764	49.715	49.715	49.715	49.715	49.715	282.339
Assistant	0	15.295	30.590	30.590	30.590	30.590	137.655
Subtotal Management	33.764	65.010	80.305	80.305	80.305	80.305	419.994
Computing & IT							
Computer Engineer	0	36.974	36.974	36.974	36.974	36.974	184.870
Tech support	0	15.295	0	0	0	0	15.295
Subtotal Computing	0	52.269	36.974	36.974	36.974	36.974	200.165
Outreach, Education, Training & Mobility							
Outreach Specialist	0	7.648	15.295	15.295	15.295	15.295	68.828
Subtotal Outreach	0	7.648	15.295	15.295	15.295	15.295	68.828
Subtotal Services	67.528	249.853	265.148	265.148	265.148	265.148	1.377.973

Timeline	2009	2010	2011	2012	2013	2014
People (numbers)						
Management & Finance						
Manager	0,50	1,00	1,00	1,00	1,00	1,00
Assistant	0,00	0,50	1,00	1,00	1,00	1,00
Subtotal Management	0,50	1,50	2,00	2,00	2,00	2,00
Computing & IT						
Computer Engineer	0,00	1,00	1,00	1,00	1,00	1,00
Tech support	0,00	0,50	0,00	0,00	0,00	0,00
Subtotal Computing	0,00	1,50	1,00	1,00	1,00	1,00
Outreach Education Training and Mobility						
Outreach Specialist	0,00	0,25	0,50	0,50	0,50	0,50
Subtotal Outreach	0,00	0,25	0,50	0,50	0,50	0,50
Subtotal Services	0,50	3,25	3,50	3,50	3,50	3,50

Infrastructure Investment 12: Office of the Director

1. Description and initial implementation

The Office of the Director is responsible for the overall coordination of SOCIB strategy and planning, communication with external bodies, open access procedures and the Focused Research Programme.

Strategy and planning: Create strategy, develop budgets and manage annual planning process with Vice Director and Division Managers.

External communications: The Director is responsible for communication with the external governing and advisory bodies, the Board of Trustees, the Executive Commission and the Scientific Advisory Board. In addition an important role of Office of the Director is the initiation and negotiation of Partnership Agreements with research institutes, universities and other organisations participating or contributing to the SOCIB mission.

Access: responsible for overseeing process for open call access to dynamic/re-locatable elements of the SOCIB facilities.

RTD Relations: For science of any discipline the exchange of experiences, views and good practices between working groups and research teams is vital to achieve an effective and high quality science through RTD Relations the Office of the Director aims to contribute to the communication, coordination and exchange of opinions within the scientific community on the development of SOCIB Coastal Ocean Observing and Forecasting System. Specifically to support exchange at an international and high level of marine scientists, in order to (a) support SOCIB development with additional specific expertise, (b) create partnerships with national and international institutions (c) facilitate the international profile of SOCIB as a centre of marine excellence located in the Balearic Islands.

Focused Research Programme: A limited number of carefully chosen research projects, generally of 5 years duration, that are carefully selected by the Office of the Director as representing research areas where SOCIB can offer a major contribution to issues of international scientific challenge through the investigation of regional oceanographic processes. The projects encompass the following elements, contribute to SOCIB research themes, involve a team of multi-institution and multi-national researchers at the highest level, focus on where the Balearics have an opportunity to accomplish world-leading research outcomes and use the datasets available through SOCIB⁴⁰. Initially, due to funding constraints, the Focused Research Programme will be represented by a single project, Bluefin Tuna (see below for details). An additional topic 'Marine Protected Areas - Design optimisation for connectivity' has been additionally identified and the intention is that this will be developed with the addition of external project specific funding.

To date the Office of the Director has been primarily focused on setting up the basic SOCIB infrastructure, in terms of key personnel, key partnerships, reporting mechanisms and office space, including for 2009:

- SOCIB office set-up ParcBit

⁴⁰ In this respect the intention is similar to RCOOS (Southeast Coastal Ocean observing Regional Association, USA) who have set up a subsystem (FAPSD) to utilize the information flow from the ocean observing system to develop higher level products

- Hire of Staff
- Development of Implementation Plan
- Partnership Agreements
- Reporting to Board of Trustees and Executive Commission
- Appointing the Scientific Advisory Committee
- Workshops to develop the Bluefin Tuna project and the Connectivity and Marine Protected Areas - Design optimisation MPAs project (see below for details)

Focused Research Programme Summary: Below is a summary of the two Projects currently proposed, the first of which, BlueFin Tuna, is further detailed in Annex 5.

Bluefin Tuna: This project will investigate the interannual variability in Atlantic bluefin tuna (*Thunnus thynnus*) spawning, in conjunction with IEO, CLS and IMEDEA TMOOS (CSIC-UIB). This is a project of clear economic interest and of particular relevance to the Balearic Islands, as one of only three known Atlantic bluefin tuna spawning grounds in the world. The interannual variability in spawning is believed to be related to the variability in local physical oceanographic conditions. Developing an understanding of the variability in the local physical conditions, namely the Atlantic/Mediterranean transition and mesoscale dynamics, and the associated physical-biological link is at the core of this research. The research is conducted in partnership with IEO, CLS and TMOOS (IMEDEA CSIC-UIB). IEO have expertise and data in the biology aspects of this research area, CLS have experience in use of satellite data this research area and TMOOS have experience in the physical aspects of the Balearic Islands oceanography.

Connectivity and Marine Protected Areas - Design optimisation MPAs project⁴¹: This project aims to establish how to optimise the design of Marine Protected Areas (MPA's) through a network or MPS node structure related to local physical processes. The project is based on a joint study of variability in physical oceanographic parameters and the mean paths and survival rates of fish larvae, to establish the optimal design of MPA (i.e. a design that encompasses both the hatching and distribution of larvae) and will be investigated in the Balearic Islands using the local network of MPA's and data regarding physical processes obtained through the SOCIB observing network of facilities. This is a topic of clear importance to marine sustainability and economics at both a local and international level. The research is conducted in partnership with IEO and TMOOS (IMEDEA CSIC-UIB).

Once the current Implementation Plan is accepted the work of the Office of the Director will centre on overseeing the roll-out of the Implementation Plan, securing partnership agreements, securing additional key personnel, developing international relationships with world leading institutions and reporting to the governing bodies, as well as longer term identifying future goals and developing additional European and international level funding opportunities.

2. Nature of investment:

Investment: Investment in the BlueFin Tuna project commences in 2010 and is ongoing for 3.5 years. A specific net for the Bluefin Tuna operations is included in the R/V equipment budget.

Maintenance and operations: Annual costs cover the Scientific Steering Committee, with one meeting per year, travel to Mallorca and accommodation for the 10

⁴¹ Dependant on the securing of additional external project funding

committee members. In 2009 RTD Relations costs include international travel related to the development of the Implementation Plan and preparation of SOCIB future activities. The Bluefin Tuna project costs will be centred on one specific cruise per year from 2010 onwards; with an anticipated 8 days of operations (estimated at 4.000 Euros/day) initially using the IEO operated R/V Francisco de Paula Navarro or similar R/V.

Personnel: The Office of the Director includes the Director, employed from 2009 under agreement with CSIC, and an Office manager to coordinate all activities.

Space: Office space in ParcBit

In-kind contributions: The Bluefin Tuna project is additionally supported through important in-kind contributions from IEO, specifically:

Personnel IEO:

- Bluefin Tuna PI (4 MM estimated), pending agreements.

Space IEO:

- Office space for project leader: 10 m²

Summary in-kind contributions:

Total personnel: 4 MM

Total space: 10 m² per annum

3. Budget

Budget Overview	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment	0	20.283	40.565	40.565	40.565	0	141.978
Operations	31.185	85.000	85.000	85.000	85.000	85.000	456.185
Personnel	59.216	91.180	82.903	83.899	83.899	83.899	484.996

Budget Detail	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment							
Science Advisory Committee	0	0	0	0	0	0	0
Focused Research Programme	0	20.283	40.565	40.565	40.565	0	141.978
RTD Relations	0	0	0	0	0	0	0
Subtotal	0	20.283	40.565	40.565	40.565	0	141.978
Operations							
Science Advisory Committee	0	13.000	13.000	13.000	13.000	13.000	65.000
Focused Research Programme	0	32.000	32.000	32.000	32.000	32.000	160.000
RTD Relations	29.784	40.000	40.000	40.000	40.000	40.000	229.784
Subtotal	31.185	85.000	85.000	85.000	85.000	85.000	456.185
Personnel							
Director	31.283	32.221	33.188	34.184	34.184	34.184	199.244
Office Manager	20.691	49.715	49.715	49.715	49.715	49.715	269.266
Implementation Plan	7.242	9.244	0	0	0	0	16.486
Subtotal	59.216	91.180	82.903	83.899	83.899	83.899	484.996
Focused Research Programme	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0
Subtotal Office of the Director	59.216	91.180	82.903	83.899	83.899	83.899	484.996

Timeline	2009	2010	2011	2012	2013	2014
People (numbers)						
Director	0,50	0,50	0,50	0,50	0,50	0,50
Office Manager	0,50	1,00	1,00	1,00	1,00	1,00
Implementation Plan	0,15	0,25	0,00	0,00	0,00	0,00
Advanced Research PostDoc	0,00	0,50	1,00	1,00	1,00	0,00
Subtotal	1,15	2,25	2,50	2,50	2,50	1,50

Annex 3: Implementation Strategy Details

For each of the major elements of SOCIB infrastructure (Facilities, Divisions and Services) Annex 3 contains a summary of the implementation strategy, a list of major assets and where appropriate a brief review of the anticipated products and services.

Infrastructure Investment 01: Coastal Ocean Research Vessel

1. Summary of Implementation Strategy

Activity No.	Activity	Phase	Duration (months)	Start	End
1	Visit to Manta R/V, USA	PDP	1	April 2010	May 2010
2	Public call	LP	3	May 2010	July 2010
3	Naval Engineer contract (18 months)	LP	1	July 2010	Aug 2010
4	Preparation of tenders	LP	2	Aug 2010	Sept 2010
5	Award Contract	LP	1	Oct 2010	Nov 2010
6	Scientific Equipment tenders	LP	12	Nov 2010	Nov 2011
7	Construction (+ 2 months buffer)	C	14	Nov 2010	Jan 2012
8	Sea Trials	IOC	3	Jan 2012	Mar 2012
9	Commence daily operations	FOC	-	April 2012	

CD - Concept Development

PDP - Planning, Design and Pilots

LP - Legal Procedure/Purchase

C - Construction/Installation

IOC - Achieve Initial Operational Capability

OM - Operation and Maintenance

FOC - Final Operation Capability

2. List of Major Assets

- 24 m fast catamaran R/V, including scientific equipment

3. Access and Data

- How will data be provided?

All data sets collected as a part of SOCIB funded or supported operations will be available online through the Data Centre Facility. For some operations such as when samples are collected and subsequently analysed, there may be a delay in making the data available, however researchers will be encouraged to provide the datasets within 2 months of collection. Externally funded research operations will be encouraged to use the Data Centre Facility to archive and make available the datasets collected.

- How will data and products be managed?

The data will be managed by the Data Centre Facility.

4. Products and Services

- The R/V will have some ship time allocated for outreach services
- Data and products depend on the operations, however are likely to include; CTD, physical, biogeochemical and biological samples, video from ROV/AUV and

dive operations, survey datasets from towed vehicle surveys, position (lat and long), u and v.

Infrastructure Investment 02: Coastal HF Radar Facility

1. Summary of Implementation Strategy

Activity No.	Activity	Phase	Duration (months)	Start	End
1	Issue of tender	LP	2	May 2010	Jun 2010
2	Award contract for 2 HF Radar Stations	LP	2	Jul 2010	Aug 2010
3	HF radar installation	C	4	Sep 2010	Dec 2010
4	HF radar tests and validation	C	6	Jan 2011	Jun 2011
5	Development of QC protocols	IOC	2	Feb 2011	Mar 2011
6	Integration of data streams	IOC	2	Feb 2011	Mar 2011
7	Operational Capability achieved	FOC	--	Jul 2011	--

CD - Concept Development

PDP - Planning, Design and Pilots

LP - Legal Procedure/Purchase

C - Construction/Installation

IOC - Achieve Initial Operational Capability

OM - Operation and Maintenance

FOC - Final Operation Capability

2. List of Major Assets

2 x long range HF radar stations

3. Access and Data

- How will data be provided?

HF radar provides data in near real-time through to the world-wide web. Data will be transmitted at regular intervals (~1 hour), without operator intervention, to the land station. Data will be freely available through a website to all users. Quality control will be applied to data before data distribution.

- How will data and products be managed?

Data from each of the station for each of the three systems (Ibiza, Palma and South of Menorca) will be combined and archived at a central location for processing the total velocity currents as well as for quality assurance and analysis. Appropriate QC/QA standards will be applied to ensure quality data standards and to be archived as part of the international datasets.

4. Products and Services

Real time (every hour) surface currents and waves (every half hour) data through web data and image server. Wind forcing in the area (from high resolution WRF SOCIB model) will be studied to increase the quality of the products.

Infrastructure Investment 03: Glider Facility

1. Summary of Implementation Strategy

Activity No.	Activity	Phase	Duration (months)	Start	End
1	Partnership Agreement with IMEDEA	LP	2	Feb 2010	April 2010
2	Gliders definition, Seaglider training	CD	1	March 2010	Mar 2010
3	Purchase of 2 deep gliders	LP	5	June 2010	Oct 2010
4	Hire Glider Operator (1)	C	2	June 2010	July 2010
5	Set up SOCIB Glider lab	C	2	July 2010	Sept 2010
6	1 permanent glider tests (in kind)	IOC	3	Oct 2010	Dec 2010
7	Development of QC protocols (in kind)	IOC	3	Oct 2010	Dec 2011
8	Integration of data streams	IOC	5	Nov 2011	Mar 2011
9	Purchase of 2 deep gliders	LP	5	Mar 2011	July 2011
10	Hire Glider Operator (2)	LP	2	June 2011	July 2011
11	2 permanent gliders operational	OM	1	June 2012	July 2012
12	1 open access gliders operational	OM	1	Sept 2012	Oct 2012
13	Purchase of 1 deep glider	LP	5	Jan 2012	May 2012
14	Purchase of 1 deep glider	LP	5	Jan 2013	May 2013
15	2 open access gliders operational	FOC	-	Mar 2013	

CD - Concept Development

PDP - Planning, Design and Pilots

LP - Legal Procedure/Purchase

C - Construction/Installation

IOC - Achieve Initial Operational Capability

OM - Operation and Maintenance

FOC - Final Operation Capability

2. List of Major Assets

6 SOCIB gliders

3. Access and Data

- How will data be provided?

Gliders provide data in near real-time through the iridium satellite system and the world-wide web. Data will be transmitted, at regular intervals (~6 hours), without operator intervention to the land station. Data will be freely available through a website to all users. Quality control data will be applied before data distribution.

- How will data and products be managed?

Data will be archived at a central location for processing, quality assurance and analysis. Additional calibration and data analysis will also be undertaken after the

recovery of the glider to access the complete glider mission data. Appropriate QC/QA standards will be applied, in particular for glider sensor calibration protocols to ensure climate-quality data standards and to be archived as part of the international climate data sets.

4. Products and Services

Real time (every 6 hours) vertical profiles from the surface down to depths of 1,000 m, physical and later biogeochemical data available through the SOCIB website. Specific parameters will include: temperature (T), salinity (S), Oxygen (O₂), turbidity, fluorescence and integrated current.

Infrastructure Investment 04: Drifter Facility (Argo and surface drifters)

1. Summary of Implementation Strategy

The goal is to build, and maintain, an array of 8 Argo floats, and 16 Surface Drifters in the western Mediterranean Sea. The program will be in principle (subject to final formal agreement) run by an IEO Scientist in Charge of Operations (Dr. Pedro Velez) who will work closely with the SOCIB technical and data-quality team. Below is a summary of the annual actions required to initiate and maintain this Facility.

1. At the beginning of every year a deployment plan is developed by the Scientist in Charge of Operations, taking into account the position of the Argo and Drifter arrays and the specific scientific objectives of ongoing research projects at SOCIB. A rough estimation of the deployment locations should be known before the floats are ordered from the manufacturer.
2. Floats will be acquired under a public call from any manufacturer that fulfill the technical specifications. The estimated required time for the acquisition process is 4 - 5 months.
3. On arrival, the technical team carefully weighs each float, carries out a detailed visual inspection, carries out an overnight air-system test, and checks the float operating parameters and float/drifter functionality. For the Argo floats, the alkaline battery packs are replaced with higher quality and higher energy lithium batteries, the leads are changed, the floats are re-ballasted and sealed, programs checked and the floats placed in dissolvable cardboard shock absorbent deployment boxes. In cases where many floats/drifters will be deployed from a ship-of opportunity, one of the technical team will go to sea to ensure a high deployment success rate.
4. Satellite communications will be carried out predominantly via the Service Argos, but the program will increase the use of the Iridium system to achieve much more detailed vertical profiles (from 70 points per profile to 1000 per profile). This upgrade appears largely cost neutral and it may be useful to consider using iridium on the oxygen floats to get more value out of the more expensive sensor package.
5. The Argo/Drifter technician will also monitor the engineering data returned by the array to quickly identify strange or unusual behaviour. In this way, any batch manufacturing problems can be quickly identified and float deployments stopped until the problem is fixed.
6. The SOCIB data centre, the Coriolis centre, the data assembly centre for the Argo project, will be responsible for constructing and maintaining the real-time Argo data stream and inserting Argo data onto the GTS. Argo data are required

at the Argo Global Data Centres (GDAC) and on the GTS within 24 hours of a float surfacing.

7. Since a highly quality controlled version of a profile must be at the GDAC 6 months after collection, the SOCIB data quality engineer and the Scientist in Charge will carry out the delayed-mode quality control of the data, requiring access to high-precision ship-based data, scientific ocean expertise and access to the data regarding sensor/float-controller pathologies.

2. List of Major Assets

An operating array, estimated (it might be more, depending on lifetime):

- 8 profiling Argo floats
- 16 Surface Drifters

3. Access and Data

- How will data be provided?

Argo profilers will provide data in near real-time through the Argos/iridium satellite system and the world-wide web. Data will be transmitted each time a float surfaces (every 5 days), without operator intervention, to the land station. Data will be freely available through the international Argo website/ftp site (www.argo.net) and the SOCIB website to all users. Besides that, the data will be sent to Global Telecommunication System⁴² to serve the ocean and atmosphere forecasting community.

- How will data and products be managed?

The Data will be archived, processed and quality controlled at the Coriolis Centre, following the robust and well established protocols developed by the Argo Data Management Team, that currently manage the fleet of 3300 operating Argo profilers. The additional delayed-mode quality control calibration will be carried out at SOCIB, the delayed mode data process is carried out on a 1 year long record so that sudden jumps in calibration may be distinguished from long term drift or water mass property changes. This imposes a minimum 6 month delay on the availability of delayed mode data. The delayed-mode data is provided to the Coriolis Centre and elaborated data products will be available through the SOCIB website.

4. Products and Services

Real-time vertical profiles, from the surface down to 700 m/2000 m depth of physical data (Temperature, Salinity and Oxygen), will be available through the Argo and SOCIB website, every 5 days from each Argo. Drifter trajectories and measurements of surface velocity will also be available real-time from the Surface Drifters.

⁴² The GTS is the coordinated global system of telecommunication facilities and arrangements for the rapid collection, exchange and distribution of observations and processed information within the framework of the World Weather Watch (WWW). It is implemented and operated by National Meteorological Services of Weather Meteorological Organization.

Infrastructure Investment 05: Mooring Facility

1. Summary of Implementation Strategy

Activity No.	Activity	Phase	Duration (months)	Start	End
1	Purchase mooring equipment/sensors x 3	LP	2	July 2010	Sept 2010
2	Test and calibrate equipment, prepare signal buoy	PDP	1	Nov 2010	Dec 2010
3	Install 1 x coastal buoy (Mahón/Ibiza)	C	1	Dec 2010	Jan 2011
4	Development of QC protocols	IOC	2	Nov 2010	Jan 2011
5	Integration of data streams	IOC	2	Nov 2010	Jan 2011
6	Test and calibrate equipment, prepare and install coastal buoy (site two)	C	2	Jan 2011	Feb 2011
7	Commence operational support 1 x coastal buoy (Bay of Palma)	IOC	1	Jan 2011	Jan 2011
8	Commence operational support 1 x coastal buoy (Cabrera)	IOC	1	Jan 2011	Jan 2011
9	Integrate data stream into Data Centre	FOC	0.5	Feb 2011	

CD - Concept Development

PDP - Planning, Design and Pilots

LP - Legal Procedure/Purchase

C - Construction/Installation

IOC - Achieve Initial Operational Capability

OM - Operation and Maintenance

FOC - Final Operation Capability

2. List of Major Assets

3 instrumented buoys including sensors (1 for repository).

3. Access and Data

- How will data be provided?

Data will be provided real-time through the SOCIB web site and THREEDS for the catalogue.

- How will data and products be managed?

Data will be archived at a central location for processing, quality assurance and analysis. Appropriate QC/QA standards will be applied; in particular in situ calibration for salinity and other parameters may be required.

4. Products and Services

The following parameters will be observed.

Parameter	Depth	Sampling Time
T	SST and every 2 m	10 mins
S (conductivity)	10 m	10 mins
u and v	1 m, 10 m, 20 m (or every 1 m depending on site)	10 mins
Hs	Surface	10 mins
Ts	Surface	10 mins
Chl-a	12 m	10 mins
OBS	10 m	10 mins
Wind velocity	Surface	10 mins
Wind direction	Surface	10 mins
P (air)	Surface	10 mins
Net radiation	Surface	10 mins

Infrastructure Investment 06: Marine/Terrestrial Beach Monitoring Facility

1. Summary of Implementation Strategy

Activity No.	Activity	Phase	Duration (months)	Start	
1	Purchase of scientific and technical equipment	LP	2	June 2010	Aug 2010
2	Hire computer engineer on short term contract (6 MM) to develop system	LP	1	July 2010	Aug 2010
3	Hire technical engineer full-time contract for Beach Monitoring Facility	LP	1	Jan 2011	Feb 2011
4	Installation of Mallorca MOBIN, with video monitoring platform, ADCP deep water data and surveying programme	C	3	March 2011	June 2011
5	Development of QC protocols	IOC	2	Sept 2011	Oct 2011
6	Integration of data streams	IOC	2	Sept 2011	Oct 2011
7	Installation of Menorca MOBIN, with video monitoring platform, ADCP deep water data and surveying programme	C	3	Oct 2011	Jan 2012
8	Installation of Formentera and Ibiza MOBINS, with video monitoring platform, ADCP deep water data and surveying programme	C	6	March 2012	Sept 2012
9	Four data streams integrated	FOC		Sept 2012	---

CD - Concept Development
 PDP - Planning, Design and Pilots
 LP - Legal Procedure/Purchase
 C - Construction/Installation
 IOC - Achieve Initial Operational Capability
 OM - Operation and Maintenance
 FOC - Final Operation Capability

2. List of Major Assets

- 5 SIRENA beach video systems
- Nearshore morphodynamics equipment (1 ADCP, 1 RTK, 1 Echosounder, 1 Laser Granulometer)

3. Access and Data

- How will data be provided?

Freeware

- How will data and products be managed?

The data will be made available within the Data Centre data search and discovery services, in particular through the Ramada repository.

4. Products and Services

- Hourly shoreline position at each site

- Bathymetric data every 24 months
- Wave conditions (height and period) at deep water (25 - 30 m) at each site plus vertical currents
- Annual sediment parameters at each site
- Beach profiles (250 m spaced) at each site (4 profiles per annum).

Infrastructure Investment 07: Modelling and Forecasting Facility

1. Summary of Implementation Strategy

	Activity N°	Activity	2009	2010	2011	2012
Ocean/ Atmosphere circulation hindcast /forecast system	1.1	Regional Ocean Modelling System ROMS (1,5 km) implementation, AEMET forcing	CD/PDP	IOC	FOC	FOC
	1.2	Pre-Operational and Operational ROMS nested to MFS	CD/PDP	CD/PDP	IOC	FOC
	1.3	ROMS coupling with WRF			CD/PDP	IOC
	1.4	Calibration, validation, satellite data, assimilation 4DVAR			CD/PDP	IOC
Ecosystem modelling	2.1	ROMS-NPZD coupled model sub-basin scale		CD/PDP	IOC	IOC
Wave forecasting system	3.1	Wave System Forecasting		CD/PDP	IOC	IOC
	3.2	WAM and SWAN Balearic Sea Wave Model			CD/PDP	IOC
Modelling coupling	4.1	WRF-SWAN-ROMS-NPZD Coupling				CD/PDP
Sediment modelling	5.1	Sediment transport modelling			CD/PDP	IOC
Special applications	6.1	Meteo-tsunamis and long wave		CD/PDP	IOC	IOC
	6.2	Jelly fish warning system:			CD/PDP	IOC
	6.3	Oil spill and Search and Rescue trajectory forecasting system			CD/PDP	IOC
	6.4	Water quality system				CD/PDP

CD - Concept Development

PDP - Planning, Design and Pilots

LP - Legal Procedure

C - Construction/Purchase

IOC - Achieve Initial Operational Capability

OM - Operation and Maintenance

FOC - Final Operation Capability

2. List of Major Assets

- SOCIB datasets, forecasting systems output, archived data
- Datasets from other institutions (under Partnership Agreements and adhering to SOCIB data policy)
- Tools developed for policy makers based on SOCIB data to allow decision making

3. Products and Services

- Currents forecast at sub-basin and local scale
- Wave forecast (nearshore)
- Jelly fish warning system: a hybrid numerical forecasting and observational algorithm.
- Meteo-tsunamis and rissagues warning system
- Oil spill and Search and Rescue trajectory forecasting system
- Beach Safety warning system
- Water quality system

Infrastructure Investment 08: Data Centre Facility

1. Summary of Implementation Strategy

Date	Activity		Responsible
jan-10	eMII visit, implementation plan strategy	A	Data Centre Manager
feb-10	SOCIB General WebSite (Version 1)	D	Computer programmer
jun-10	Contract a new Computer Programmer Designer	A	Data Centre Manager
mar-10	General Development Environment	M	Computer programmer
mar-10	implementation plan	D	Data Centre Manager
apr-10	SOCIB General WebSite (Public version)	M	Data Centre Manager
jun-10	Contract a new Technical Support (30 MM)	A	Data Centre Manager
jun-10	Services setup (THREDDDS, RAMADDA, WIKI, 3D environment, specific Web environment)	M	Computer programmer
aug-10	Initial DataSet tests	A	Data Centre Manager
sep-10	Visit of Unidata RAMADDA developer	A	Data Centre Manager
oct-10	Initial TMOOS incoming datasets setup	A	Data Centre Manager
oct-10	Visit IFREMER	D	Analyst programmer
dec-10	TMOOS Incoming dataset incorporation	D	Data Centre Manager
dec-10	First Version of TMOOS-SOCIB Dataset websites	M	Analyst programmer
jan-11	Review of Implementation plan	D	Data Centre Manager
jan-11	SOCIB dataset operational	M	Data Centre Manager
feb-11	Concept development of stage 2	A	Data Centre Manager
jun-11	Stable version for services of SOCIB Datasets	M	Tech support
jun-11	New version of SOCIB Dataset websites	M	Analyst programmer
jun-11	Strategic plan for implementation of stage 2	D	Data Centre Manager
jun-11	New datasets definitions (other centres, new facilities)	D	Data Centre Manager
dec-11	First Version for Stage 2	M	Analyst programmer
dec-11	New Datasets operational	M	Data Centre Manager
dec-11	SOCIB new Services definition	D	Tech support
jan-12	Review of Implementation plan	D	Data Centre Manager
feb-12	Concept development of stage 3	A	Data Centre Manager
jun-12	Stable version of SOCIB Stage 2	M	Data Centre Manager
jun-12	Dataset WebSites	M	Analyst programmer
jun-12	Stable version of new services	M	Tech support
jun-12	First Version Stage 3	M	Data Centre Manager
dec-12	Stable version of SOCIB Stage 3	M	Analyst programmer
dec-12	SOCIB new Services definition	D	Tech support
dec-12	New Dataset operational	M	Data Centre Manager

D	Deliverable
M	Milestone
A	Activity

2. List of Major Assets

SOCIB datasets, observational and models output, archived data, for long term security and access and Real time data access for rapid response

Datasets from other institutions (under Partnership Agreements and adhering to SOCIB data policy)

Tools developed for policy makers based on SOCIB data to allow decision making

3. Access and Data policy

- How will data be provided?

Timely, free and unrestricted access to all data, associated metadata and products generated under the auspices of ICTS SOCIB will be delivered through systems and processes for data and information management as developed by the SOCIB Data Centre Facility. The access and data policies are detailed in Section 4 Access, Pricing, Products and Services

- How will data and products be managed?

Due to the heterogeneous sources of information and uses it will be necessary to have different data quality control and quality assurance procedures for each dataset, sensor, observed parameter, policies will be defined and undertaken in collaboration with the scientists, and the ICTS SOCIB governance, following common procedures and through consultation with the user groups. Furthermore this will be documented in the Data Providers Guide for each dataset.

4. Products and Services

Five services will be provided:

1. Catalogue Service (THREDDS): This service allows access to the information and the user profile for this product / service in a more scientific way. THREDDS allows the use of this information from many client applications. The data is distributed through OPeNDAP and OGC standards like WMS or WCS.

Catalog <http://dataserver.imedea.uib-csic.es:8080/thredds/catalog.xml>

Dataset	Size
 TMOOS	
 Observational	
 <u>Gliders/</u>	
 <u>Moorings/</u>	
 <u>Satellite/</u>	
 <u>Currentmeter/</u>	
 <u>CTD/</u>	
 <u>XBT/</u>	
 Operational Models	
 Oceanography	
 <u>HOPS/</u>	
 <u>Symphonie/</u>	
 <u>MFS/</u>	
 <u>Eseeo/</u>	

Figure 1: THREDDS

2. Discovery Service (RAMADDA): a suite of comprehensive data management, archiving and repository services that automatically read netCDF files, allowing the discovery, search and download of data and its complementary data (such as figures, instructions, etc), establishing the relation between them.

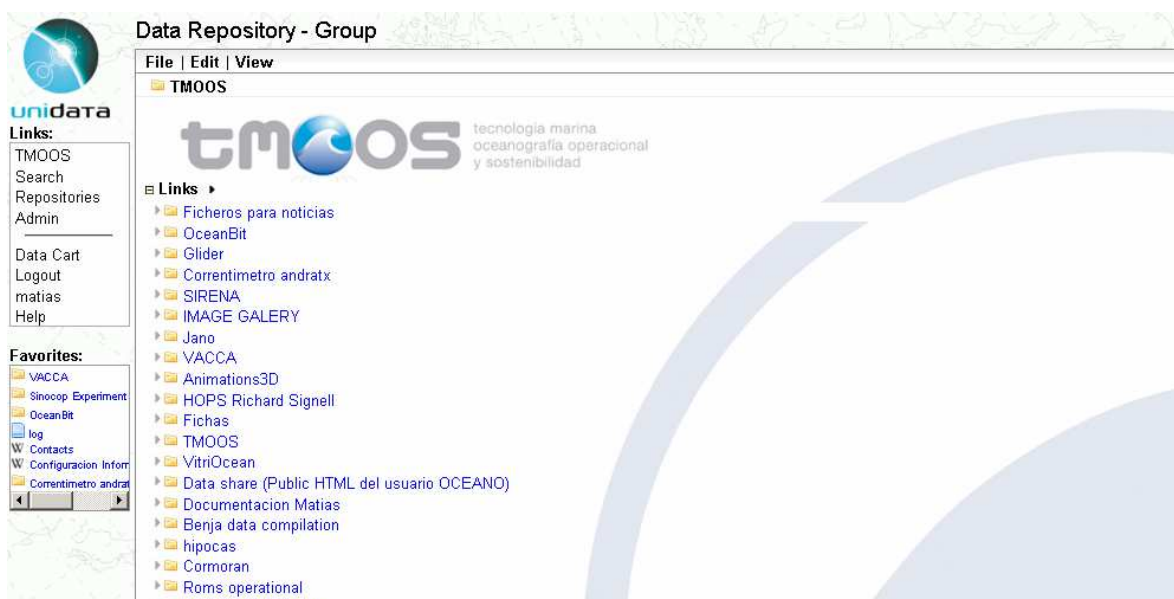


Figure 2: RAMADDA

3. Wiki, data and application: a Wiki is a website that allows the easy creation and editing of any number of interlinked web pages via a web browser using a simplified markup language or a WYSIWYG text editor. Wikis are typically powered by wiki software and are often used to create collaborative websites, to power community websites, for personal note taking, in corporate intranets, and in knowledge management systems. The purpose of this wiki is the documentation of data and the creation of documentation about how to use our data. This wiki will be available for editing by a community of Data Managers and also open to contributions by SOCIB users inside and outside SOCIB. (<http://en.wikipedia.org/wiki/Wiki>)



Figure 3: WIKI example

4. Web Visualization: Web applications developed for each facility enabling real-time tracking and a preliminary analysis of data through its representation in graphs, as well as incorporating descriptive information about the operation of each facility for outreach purposes. A pilot application was established at TMOOS IMEDEA (CSIC UIB) in the context of E.C funded projects such as SESAME or MyOcean.

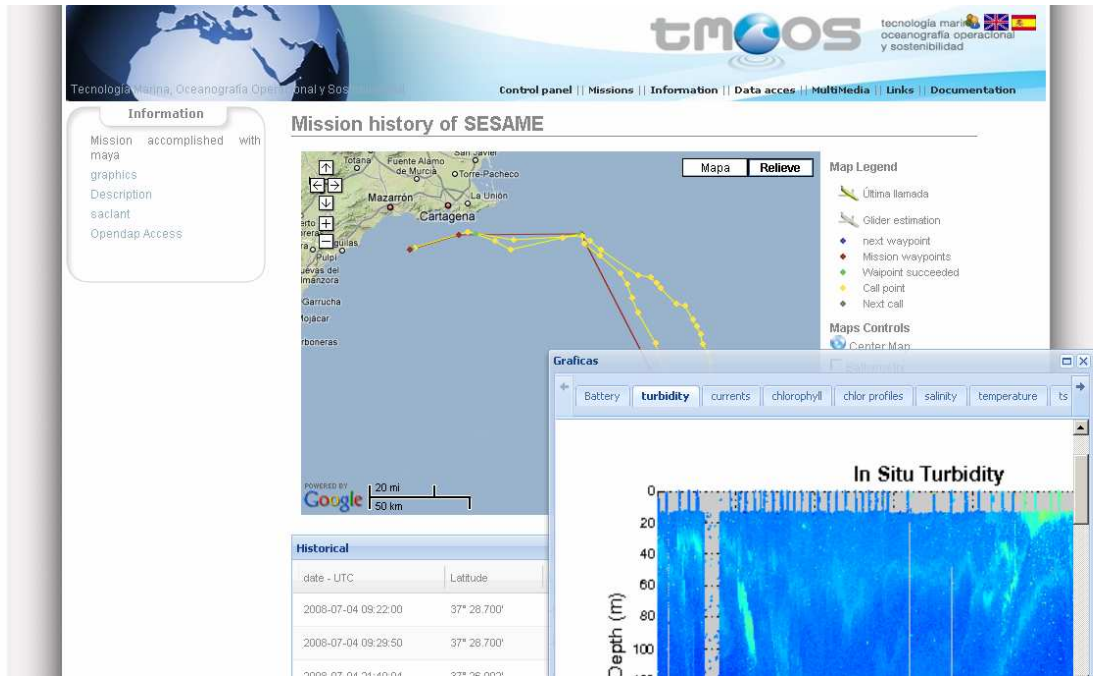


Figure 4: Web Visualization

5. 3D Visualization (IDV): The Integrated Data Viewer (IDV) from Unidata is a Java(TM)-based software framework for analyzing and visualizing geosciences data. The IDV brings together the ability to display and work with satellite imagery, gridded data, surface observations, radar data, trajectories, time series all within a unified interface on a 3D environment. [http://www.unidata.ucar.edu/software/idv/]

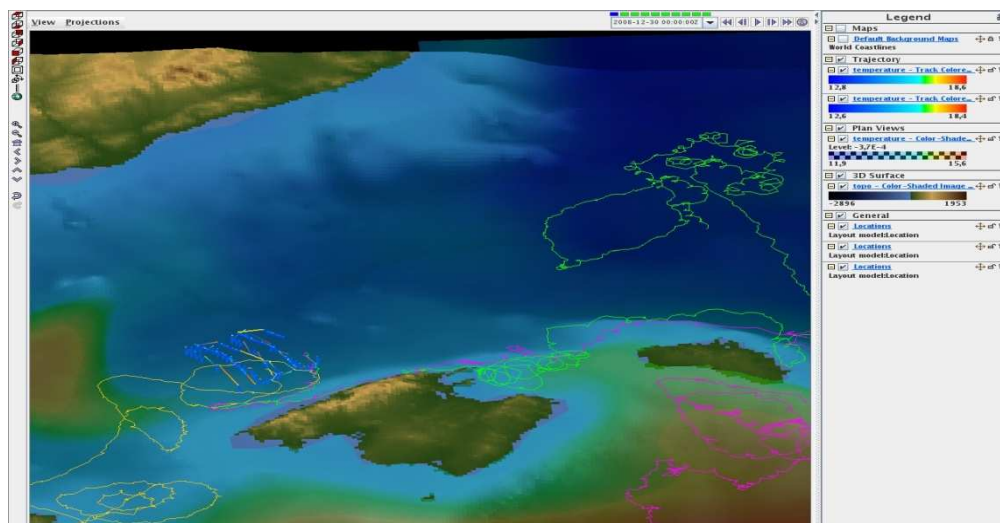


Figure 5: 3D Visualization

Infrastructure Investment 09: Engineering and Technology Development Division

1. Summary of Implementation Strategy

Activity No.	Activity	Phase	Duration (months)	Start	
1	Agreement with IMEDEA (CSIC-UIB) - laboratory and warehouse space	LP	5	Nov 2009	April 2010
2	SOCIB-CSIC General Agreement	LP	6	Jan 2010	June 2010
3	Purchase RECOPECA sensor system	LP	2	April 2010	May 2010
4	Hire 1 st ETD engineer	LP	1	July 2010	July 2010
5	Hire 2 nd ETD Pool Manager (in kind)	LP	1	July 2010	July 2010
6	Hire ETD Manager (in kind)	LP	2	June 2010	July 2010
7	Install RECOPECA sensor system	PDP	1	May 2010	June 2010
8	Set up RECOPECA data QC procedure	PDP	3	May 2010	July 2010
9	Integrate RECOPECA data into Data Centre	PDP	3	May 2010	July 2010
10	Nearshore cable design	PDP	3	Jul 2010	Sep 2010
11	Set up laboratories and warehouse	C	2	Aug 2010	Oct 2010
12	Purchase ETD equipment general	LP	2	Aug 2010	Oct 2010
13	Purchase 10 - 12 m RIB	LP	6	Sep 2010	Feb 2011
14	Purchase nearshore cable	LP	3	Oct 2010	Dec 2010
16	Hire 3 rd ETD Technical support	LP	1	Jan 2011	Jan 2011
17	Purchase 9 additional RECOPECA systems	LP	2	Feb 2011	Mar 2011
18	Install additional RECOPECA sensor systems	C	2	Mar 2011	May 2011
19	Integrate 9 RECOPECA into Data Centre	FOC	1	May 2011	June 2011
18	Purchase AUV	LP	4	June 2011	Oct 2011
20	Purchase ROV	LP	2	June 2011	Aug 2011
21	Install Nearshore Station Pilot System	C	6	June 2011	Dec 2011
22	Test AUV/ROV	PDP	6	June 2011	Dec 2011
23	Set up Nearshore Station data QC procedure	IOC	2	Oct 2011	Dec 2011
24	Integrate Nearshore data into Data Centre	IOC	2	Oct 2011	Dec 2011
25	Purchase Pressure Chamber	LP	2	Oct 2011	Dec 2011
26	Set up AUV/ROV data QC procedure	IOC	2	Jan 2012	Mar 2012
27	Integrate AUV/ROV data into Data Centre	IOC	2	Jan 2012	Mar 2012
28	Integrate ROV/AUV function with Nearshore Station	FOC	4	Mar 2012	June 2012

CD - Concept Development

PDP - Planning, Design and Pilots

LP - Legal Procedure/Purchase

C - Construction/Installation

IOC - Achieve Initial Operational Capability

OM - Operation and Maintenance

FOC - Final Operation Capability

2. List of Major Assets

- 10 - 12 m RIB
- AUV
- ROV
- Pressure Chamber
- Equipment and sensors (various spares/equipment pool)

- Intellectual property for applications and tools developed by this Division

3. Access and Data

- How will data be provided?

Data streams from pilot programmes will be integrated into the Data centre Facility as pilots become operational. In the Pilot phase 2 archives from 1 vessel (CTD downcast and upcast, time of trawl and position) will be uploaded automatically to SOCIB Data Server after daily operations. Anticipated 10 files per week initially, T, S profile and position, thereafter 100 files per week. The data provided from the Nearshore Station will depend on the sensors implemented however will include video data from the AUV and ROV habitat monitoring activities.

- How will data and products be managed?

All data products will be managed under the normal Data Centre Facility operations

4. Products and Services

From the Ships of Opportunity/Fishing Fleet Monitoring Programme specific parameters will include: temperature (T) and salinity (S), depth (P) and location. From the Nearshore Station programme the parameters observed are likely to include temperature (T), salinity (S), turbidity, fluorescence, current velocity (u, v), video of sea floor activity, video from AUV/ROV activity.

Infrastructure Investment 10: Strategic Issues and Applications for Society Division

1. Summary of Implementation Strategy

The table below summarizes the expected timelines of the current and proposed research projects of the group. Additional proposals will be developed in the coming years. Publications, conference attendance and work placement and collaborative activities will be consistent across the years.

Research activity	2010	2011	2012	2013	2014	Funding
Development of SAMPs						ICTS SOCIB/external sources to be identified
KNOWSeas						EC (in kind IMEDEA)/ ICTS SOCIB
LIMCosta Project						Chamber of Commerce/ ICTS SOCIB (since 2009)
Balearic Indicators Project						Government of the Balearic Islands, ICTS SOCIB (since 2009)
Proposal for an ICZM governance structure						ICTS SOCIB

2. List of Major Assets

- Intellectual property for applications and tools developed by this Division

3. Access and Data

- How will data be provided?

Access to papers and associated datasets, publications and application tools developed for internet deployment will be provided through the ICTS SOCIB website and/or on a needs or collaborative basis.

- How will data and products be managed?

Data will be managed by the Data Centre, applications developed will be managed by the SIA Division, with support from the Data Centre in the case of tools developed for internet deployment.

4. Products and Services

The team will generate a series of products and services through the implementation of the research activities, with the primary purpose of sharing and transferring scientific results, tools and data to society and to the scientific community. Specific products will include:

- Academic publications (see listing below for publications to date)
- Presentations at conferences and publications in conference proceedings
- Guidelines, best practices and frameworks to support decision making (e.g. System of Indicators for ICZM in the Balearic Islands, Dictamen CES 05/2007, Special Area Management Plans)
- The joint publication of a book (Chamber of Commerce of Mallorca and SOCIB) of the results of the LIMCosta Mallorca study on Establishing Limits to Growth in the Coastal Zone of Mallorca. The book will present the qualitative and

quantitative results of the study in addition to presenting a Process for the Spatial Management of Limits to Growth in the Coastal Zone.

- The development of a Proposición no de Ley (proposal for a regulatory bill) to support the implementation of the System of Indicators for ICZM in the Balearic Islands (SOCIB in collaboration with IBESTAT and OBSAM (Observatorio Socio-ambiental de Menorca)).
- Decision support tools (linked to ICTS SOCIB Data Centre) targeted at specific risks and issues e.g. oil spill decision support tool based on Environmental Sensitivity Index (US NOAA), explicitly linked to habitat mapping, similar tools for monitoring jelly fish on beaches.

The primary services will be:

- The development of research activities that respond to societal needs. The team is open to receiving requests from local decision makers for collaborative and research actions in areas related to the major research objectives.
- The provision of technical support for indicator measurement and monitoring efforts (e.g. Indicators Pilot Project in Menorca).

Infrastructure Investment 11: Services

Management & Finance

1. Summary of Implementation Strategy

Activity No.	Activity	Phase	Duration (months)	Start	End
1	Increase ParcBit Office Space	C	1	Mar 2010	April 2010
2	Purchase access/alarm system	C	1	April 2010	May 2010
3	Hire additional office support	LP	1	Sept 2010	Oct 2010

CD - Concept Development

PDP - Planning, Design and Pilots

LP - Legal Procedure/Purchase

C - Construction/Installation

IOC - Achieve Initial Operational Capability

OM - Operation and Maintenance

FOC - Final Operation Capability

Annual Reporting activities:

1. Annual accounts and report of activities (Cuentas Anuales, informe de gestion y memoria técnica, memoria annual de actividades) – Jan – March
2. Budget and Plan for Projects and Activities year ahead (Plan Annual de actuaciones y proyectos y aprobación del presupuesto) – Sept – Dec

2. List of Major Assets

Office equipment:

- Printers/copiers
- Furniture
- Telephones

Computing and IT

1. Summary of Implementation Strategy

Activity No.	Activity	Phase	Duration (months)	Start	End
1	Installation of outer communications	C	2	Nov 2009	Jan 2010
2	Installation storage system and general services computers	C	3	Dec 2009	Feb 2010
3	Hire a chief system manager	LP	1	Dec 2009	Jan 2010
4	Installation of first stage backup system	C	1	Jan 2010	Feb 2010
5	Purchase of first stage parallel computing	LP	2	Apr 2010	May 2010
6	Installation of first stage parallel computing	C	2	May 2010	Jul 2010
7	Purchase of serial computing system	LP	1	Jun 2010	Jul 2010
8	Purchase of second stage backup system	LP	3	Jul 2010	Oct 2010
9	Install serial computing system	C	1	Sept 2010	Oct 2010
10	Hire a system manager assistant (6MM)	LP	1	Oct 2010	Nov 2010
11	Install of second stage backup system	OM	2	Nov 2010	Jan 2011
12	Planning and development parallel computing	PDP	3	Feb 2011	April 2011
13	Purchase of storage and backup upgrade	LP	1	May 2011	Jun 2011
14	Purchase of second stage parallel computing	LP	2	May 2011	June 2011
15	Install storage and backup upgrade	FOC	1	July 2011	Aug 2011
16	Install second stage parallel computing	FOC	3	July 2011	Oct 2011

CD - Concept Development
 PDP - Planning, Design and Pilots
 LP - Legal Procedure/Purchase
 C - Construction/Installation
 IOC - Achieve Initial Operational Capability
 OM - Operation and Maintenance
 FOC - Final Operation Capability

2. List of Major Assets

- 1 x rack (located at SOCIB offices) containing:
 - 2 fibre optic switches (GbE)
 - 1 PABX
- 1 x rack (located at SOCIB offices) containing:
 - 3 rack mounted servers
 - 2 switches (GbE)
 - 1 unified storage system (13TB of storage capacity)
- 1 x rack (located at IMEDEA) containing:
 - 1 personal supercomputing machine
 - 1 tape system and 1 virtual tape system
- 1 rack (located at UIB) containing:
 - 1 computer with large memory and computing power
 - 2 blade enclosures
 - 1 infiniband switch

Outreach, Education, Training & Mobility

1. Summary of Implementation Strategy

Activity No.	Activity	Phase	Duration (months)	Start	End
1	Preparation of the SOCIB logo etc.	LP	4	Nov 2009	Mar 2010
2	Hire personnel (part-time)	LP	1	May 2010	June 2010
3	Creation of a professionally designed 'science outreach web portal' as a part of the SOCIB web site	C	9	June 2010	April 2011
4	Creation of social network profiles to disseminate outreach	C	4	Sept 2010	Dec 2011
5	Initial workshop – ICOM Balearic Islands (provisional ideas)	IOC	3	Oct 2011	Dec 2011
6	Press releases and communications regarding SOCIB operations	IOC	1	Dec 2011	Jan 2012
7	Second workshop – New Science in Marine Spatial Planning (provisional ideas)	FOC	3	Mar 2011	May 2012
8	SOCIB R/V Open Days	FOC	1	Sept 2012	Oct 2012
9	Sponsored workshop – ICOM in the Balearic Islands	FOC		Oct 2012	Dec 2012

CD - Concept Development

PDP - Planning, Design and Pilots

LP - Legal Procedure/Purchase

C - Construction/Installation

IOC - Achieve Initial Operational Capability

OM - Operation and Maintenance

FOC - Final Operation Capability

2. List of Major Assets

None

Infrastructure Investment 12: Office of the Director

1. Summary of Implementation Strategy

The Director is required by SOCIB Statutes to undertake the following annual reporting requirements:

Governance Meetings:

Board of Trustees meeting – 2 per year
Executive Commission meetings – 4 per year
Financial Commission meeting – 1 per year

Report preparation and delivery:

Annual Budgets (forthcoming year) - 4th quarter
Plan for activities and projects (forthcoming year) - 4th quarter
Annual Accounts – 2nd quarter
Management Report – 2nd quarter
Technical Report - 2nd quarter
Annual Activities Report - 2nd quarter

Specific short term aims include:

- Establish key Partnership Agreements – CSIC– before July 2010, and later UIB and IEO. Also with international coastal observatories.
- Complete Bluefin Tuna proposal – before June 2010
- Establish EC proposal financial and management capability
- Secure additional European funding

Annex 4: SOCIB Coastal Ocean Research Vessel

1. Mission

The mission is to conduct multidisciplinary coastal ocean research, monitoring, operational oceanography, education and public outreach, and if required scientific/environmental emergency response related operations in the Balearic and northwest Mediterranean Seas.

The coastal ocean research vessel is envisioned as an advanced technological research vessel, offering advantages in cost and capability that will make it an attractive platform for all organizations conducting coastal ocean marine research and monitoring in the region.

The research vessel is also seen as a flagship facility for SOCIB and an important resource for public outreach in the Balearic Islands⁴³.

2. Needs Identified

With 1.200 km of coastline and located centrally in the Western Mediterranean, the Balearic Islands occupies a strategic location to facilitate ship based research activities to the north, south, east and west of the islands and enabling a fast response to scientific or environmental emergencies. However currently there is no dedicated, fast, modern oceanographic vessel located here. A modern coastal research vessel would facilitate a variety research and monitoring projects that can contribute to increasing our understanding of the ocean response to global change, the variability of the coastal ecosystem, and the sustained monitoring and effective management of Balearic Islands marine resources.

Initial identified projects include: detailed sea floor mapping, habitat characterization, bi-monthly glider deployment and recovery missions, quarterly physical oceanography monitoring cruise (IEO RADMED cruises - 10 days total, 24 hour operations), mooring deployment/data collection, tri-dimensional physical and ecosystem variability monitoring, monitoring of key species (e.g. Blue Fin Tuna, Posidonia Oceanica meadows) and Marine Protected Areas, practical experience for university students and public engagement with marine science.

To support interdisciplinary research and monitoring objectives a modern R/V requires sufficient wet/dry lab space for physical, biogeochemical, chemical, biological and geoscience operations. In addition a fully equipped working area aft deck is required, with space sufficient for the placement of storage containers (10' in size) to support equipment storage and use by external research organisations (e.g. IEO⁴⁴.) Typical oceanographic operations include:

- CTD casts
- Water sampling with onboard chemical/biological analysis
- Atmospheric and air-sea flux observations
- Glider, AUV and ROV mission support
- Mooring/buoy deployment and recovery
- Moving vessel ADCP
- Diving operations

⁴³ As has been found with other modern research vessels e.g. in the UK the NERC operated R/V Callista and in the USA the NOAA operated R/V Manta

⁴⁴ IEO (Balearic Islands) currently use a 10 foot container to move equipment from vessel to vessel

- Plankton tows
- Continuous Surface Analysis
- Towed vehicles (Side Scan Sonar, Acqua Shuttle, Triaxus)

The Balearic Sea is characterized by sudden changes of atmospheric conditions and waves of relatively short wavelength, therefore a high cruising speed, of the order of 25 knots, and a stable aft platform are important considerations for coastal oceanographic operations in this region. In addition a minimal draught of the order of 1.5 m is required for nearshore work and a high manoeuvring capability to aid the accurate deployment/recovery of oceanographic instrumentation.

Most operations from the Balearic Islands location can be carried out as daily cruises in the nearshore and coastal ocean on an 8 - 12 hour basis, however continuous 24 hour operations for cruises of 3 - 7 days duration are also anticipated in response to well defined scientific or technological needs⁴⁵.

In summary the SOCIB R/V should encompass the following characteristics:

- A coastal ocean research vessel with the highest possible stability, high manoeuvring capability and high cruising speed.
- Equipped for multidisciplinary studies, with wet and dry laboratories and a fully equipped aft deck
- Suitable for daily operations to all sectors of the Balearic Sea, however with the capability for up to 7 days of continued operations at sea, with accommodation for a minimum of 7 scientists/technicians plus crew
- Anticipated annual days of operation are 150-210 (depending mostly on the maritime regulations governing crew conditions)
- Scientific equipment to support modern oceanographic research

3. Proposed Design

A fast catamaran hull with overall length of approximately 24 m is proposed as the best compromise, as this design maximizes space, with availability for scientific operations (wet and dry laboratories 23 m² minimum, platform for one or two containers of 10'⁴⁶) and accommodation for crew and scientists/technicians for longer operations, whilst offering speed and manoeuvrability, to fulfil current and planned regional research needs at a minimal operating cost.

A leading edge international example of this type of research vessel is the recently launched (February 2008) NOAA R/V Manta, see below for details. The flexibility of this modern design, in terms of space, speed, stability and layout, gives this vessel the ability to adapt to the goals of different projects making it a valuable tool for the scientific community of the region.

4. International Benchmark

The recently launched (Feb 2008) NOAA R/V Manta (24 m LOA, accommodation for a maximum of 14 persons during a maximum of 7 days, laboratory spaces of 23 m²) represents the international state-of-the-art in fast coastal ocean research vessels. Based in the Flower Garden Banks National Marine Sanctuary (Gulf of Mexico) and with a year of operations the Manta design has a proven ability to adapt to the goals of a variety of different research applications.

⁴⁵ IEO RADMED Cruises

⁴⁶ These types of 10' containers are already available from CSIC and IEO, mostly related to operations onboard R/V such as Odón de Buén, García del Cid, Sarmiento de Gamboa, etc so that compatibility is fully assured.

The Flower Garden Banks are located 100 nm offshore and therefore speed to site and accommodation for 3 – 5 night operations were paramount in the design of the R/V Manta. She has an operational cruise speed 28 knots in 1 – 1.3 m seas, which drops to 15 - 18 knots for seas above 1.3 m, this has significantly reduced average transit times to site to 3 hours in flat seas and 5 hours for 1 – 1.3 m seas. In 2009 the NOAA R/V Manta completed 160 days of operation (of which 59 were at sea) and successfully conducted different types of research operations.

With just one year of operations she is already a favoured platform for the regional marine science community, as evidenced by the inclusion of the R/V Manta in numerous external research proposals for 2010 (personal communication Emma L. Hickerson, Research Coordinator, Flower Garden Banks National Marine Sanctuary). See Section 11 for detailed specification and layout of NOAA R/V Manta.

5. Existing Platforms in the Balearic Sea Region

At present the only coastal ocean research vessel that operates on a regular basis in the Balearic islands coastal zone is the IEO operated R/V Odón de Buén, a vessel of 24 m LOA, constructed in wood (fibreglass coated) and now more than 30 years old. The Odón de Buén is mostly suitable for daily operations and IEO intend withdrawing it from service in the near future. On a smaller scale, and again only suitable for daily operations of 8 hours, there is an IMEDEA (CSIC-UIB) operated motor vessel a Rodman 1120 of 11.25 m LOA. In addition IEO operate the R/V Cornide de Saavedra, a large open ocean vessel, 66 m LOA, constructed in 1972 which undertakes several different annual cruises in the Balearic Sea. Finally in Barcelona there is the R/V García del Cid of 36 m LOA, operated by CSIC, and again more than 20 years old.

In 2010 IEO plan an estimated 2 million € refurbishment of a 31.5 m LOA research vessel the R/V Francisco P. Navarro to operate out of Palma de Mallorca. Constructed in 1987 this vessel has a wooden mono hull, recently assessed to be sound, a cruising speed of 10 knots and a draft of 4 m. Once refurbished the R/V Francisco P. Navarro will have the capacity to support operations of 20+ days with accommodation for 7 scientists and 9 crew⁴⁷. It will be equipped to undertake both oceanographic and fishing research operations, with wet/dry laboratory space and a large aft deck, although access to the ocean from the aft deck may be restricted due to the high freeboard.

A vessel of the type proposed by SOCIB would complement the activities of the existing older vessels and offer the following advantages:

- Fast response time and a reduction in days at sea required to complete operations
- Space for multidisciplinary lab and aft deck operations supported by a small crew
- A well equipped, stable platform, suitable for a wide variety of modern oceanographic operations

The SOCIB R/V could fulfil also some of the needs from existing permanent monitoring programmes and research projects in the Balearic Sea and adjacent regions from different institutions (mostly, UIB, CSIC and IEO). As an example IEO currently operate the following annual cruises in the Balearic and regional seas: MEDITS, 15 days (May-June), funded by the National Plan for Oceanographic and

⁴⁷ Additional crew may be required depending on maritime regulations

Fisheries Data Recovery, with around 16 scientists onboard. ECOMED, 1 month, acoustic monitoring, from Cabo de Creus to the Gibraltar Strait. TUNIBAL, 12 days, Bluefin Tuna larvae monitoring. RADMED, 4 cruises a year of 25 days each, seasonal physical and biogeochemical monitoring along transects at different locations from Barcelona to the Alboran Sea. MOSAICS, 10 days, geological cruises, Balearic region. Marine Protected Areas, 25 days, monitoring Balearic region. The last three listed cruises are already identified as targets for cooperation between IEO and SOCIB, the proposed SOCIB coastal ocean research vessel offering a modern cost effective platform from which to conduct these long term monitoring missions and discussions are underway with IEO in this regard.

A research vessel of this type would be unique in the context of the Spanish oceanographic fleet and will significantly enhance the oceanographic capability of the region.

6. Commissioned Feasibility Studies for SOCIB Coastal Ocean R/V

Two feasibility studies were commissioned by SOCIB in October 2009 to assess the technical specification, crew requirements, operational costs, shipyards and the Spanish maritime regulations for the construction of a 24 m fast catamaran coastal ocean research vessel ('Manta-type' R/V) in Spain.

1. Análisis previo para la definición de un catamarán con fines oceanográficos que operará en las Islas Baleares - Bilbao Plaza Maritima Shipping (BPMS), Bilbao
2. Análisis previo para la Definición de un Buque Oceanográfico para las Islas Baleares - CYPsa Ingenieros Navales, Vigo

Within the feasibility studies the cost and benefits of constructing a 'Manta-type' R/V were compared against those of constructing a vessel of different hull design, construction material and/or up to 30 m in length and recommendations made. In addition the technical specifications for the R/V were outlined and the crew requirements, operational costs and applicable maritime regulations were identified for the anticipated operations and recommended R/V configuration. Potential shipyards for construction of such a R/V in Spain were also identified.

The two feasibility studies conclude that a fast catamaran design similar to the benchmark NOAA R/V Manta represents an optimal configuration, given the requirements for both for speed and space for modern coastal and open ocean oceanographic operations. However the reports differ in their conclusions regarding the optimal LOA and therefore the implications in design and crew requirements.

In addition a technical specification for an off-the-shelf 'Manta-type' R/V was sought from Rodman Polyships S.A.U., a manufacturer of catamaran vessels who already have moulds for 82 ft catamaran vessels constructed in PRFV.

A summary of the reports and proposal are outlined below.

1. BPMS Report

The BPMS study concluded that a catamaran constructed of aluminium would be the best option to meet SOCIB needs and that are 4 shipyards in Spain that would be able to build such a vessel. The report also concluded that the R/V Manta design could not be registered under the Spanish maritime regulations and recommended a catamaran of 31 m LOA with accommodation for 19 persons onboard⁴⁸, requiring a crew of 5 for daytime operations and 7 for 24 hour operations. A cost analysis

⁴⁸ 2 cabins with 4 bunks, 5 cabins with 2 bunks and 1 cabin with 1 bunk

found that reducing the cruising speed of the SOCIB vessel to 23 knots would save 70.00 to 90.00€ in maintenance costs. The BPMS report did not analyse well the options for constructing a vessel in PRFV and the cost of operation of the vessel were lacking in detail, additionally there were no details provided for the cost of construction and no specification developed for a Manta-type R/V of 24 m LOA modified to comply with Spanish Maritime Regulations.

The costs for constructing a vessel of 24 LOA were estimated at 3,400,000 €, with a build time of 12 months, and the costs for constructing the recommended vessel of 31 m LOA were estimated at 4,200,000 €⁴⁹.

2. CYPsa Report

The CYPsa study recommended the construction of a 'Manta-type' R/V of less than 24 m LOA, as for LOA greater than 24 m the Spanish maritime regulations require additional more emergency hatches (escotillas) which would reduce the working space available. Additionally this vessel would be driven by water jets, with space on the aft platform for a container of 20 m and two winches (chigre) for oceanographic operations. The report found aluminium to be the best material for construction (weight and cost) and suggested 3 shipyards capable of constructing such a vessel. The layout proposed by CYPsa includes accommodation for 19 people⁵⁰ onboard, and compared with the R/V Manta shows an increase in space for several of the working areas (laboratories, etc.) however the source of this additional space was not well explained in the text. The conclusions regarding the optimal LOA differ from that found in the BPMS report and there is also a difference between the suggested crew requirements, CYPsa suggest a vessel registered that is registered under Spanish maritime regulations with an LOA of less than 24 m, require a crew of 4 for daytime operations and 7 for 24 hour operations. The report did not fully analyse the option for constructing a vessel in PRFV and the costs of operation of the vessel although more complete than the BPMS report, were lacking in detail.

The costs for constructing such a vessel are estimated by CYPsa at 3,536,200 €, with a build time of 12 months.

In line with the findings of the study, CYPsa additionally secured a quotation from the designers of the R/V Manta, Technicraft Design Ltd, New Zealand, for the supply of a design for the construction of a 25 m research catamaran in accordance with the rules and regulations of the Spanish Maritime Authority. The cost of the design is 187,000 € (inc. IVA) and includes a comprehensive suite of services, including a set of detailed plans and documents for the construction of the vessel (hull, superstructure, machinery, systems etc.), specification, stability book, liaison with builder and suppliers, 3 boatyard visits and submission of the design to Spanish authorities.

3. Rodman Polyships S.A.U. Proposal

A detailed technical specification⁵¹ for a 24 m 'Manta-type' R/V was requested from Rodman Polyships S.A.U., Vigo⁵². Rodman proposed a specification based on their

⁴⁹ It is important to note that the cost estimations represents an upper boundary, as for a tender a reduction of at least 20 – 30% is expected (BPMS and CYPsa both indicated this was the case)

⁵⁰ 2 cabins with 3 bunks, 6 cabins with 2 bunks and 1 cabin with 1 bunk

⁵¹ Especificación Técnica para la construcción y suministro de un catamarán para investigación y oceanografía O.T.82 Xh

⁵² Rodman have 5 different boatyards and build GRP patrol boats with hulls of up to 30 m, steel boats with hulls of up to 170 m, GRP fishing boats with hulls of over 36 m, regatta boats, and pleasure craft.

existing Rodman 82 design, constructed in PRFV, of 25 m LOA (registered 22.4 m) with a maximum velocity of 28 knots, a cruising speed of 25 knots and accommodation for 14 persons onboard⁵³. They also presented several documents in support of PRFV construction, however it was not made clear within the specification what was the purpose of the original hull design and although they have experience in the construction of patrol boats they do not have experience in the construction of R/V.

The costs for constructing such a vessel are estimated at 2,750,000€ + IVA with 10 months for construction.

Section 14 contains a table summarizing the requirements of the proposed SOCIB R/V as compared with the NOAA R/V Manta and the CYPASA and BPMS proposed vessels.

It is important to note the impact that building a high technology ship with these coastal oceanography characteristics can have on the Spanish shipbuilding industry, prioritized recently by Ocean of Tomorrow European Commission 2010 calls. As an example the recent construction of CSIC R/V Sarmiento de Gamboa (70 m LOA, 25 million € cost of construction and 180.000 working hours) in a Vigo (Spain) shipyard, has led to the formal contract of a new oceanographic R/V (44 m LOA) by University of Qatar, a new Discovery R/V (99 m LOA) by NERC UK, another oceanographic R/V (42 m LOA) by Bangladesh, and another oceanographic R/V (73 m LOA) for private company⁵⁴. This represents a total of 2.000.000 working hours and commercial contracts estimated at 300 million Euros.

7. Budget Overview

A budget overview has been prepared with associated timeline, assumptions and description.

Investment: consists of the design and construction of an advanced technology and high speed coastal catamaran particularly suitable for coastal operations and around 24 m LOA, in line with NOAA R/V Manta (USA) launched in 2008. It is anticipated that a tender will be published during the second semester of 2010 and construction is foreseen during 2011 with sea trials (3 months) in early 2012. With SOCIB monitoring operations estimated to initiate April 2012 or earlier. Scientific equipment is purchased for coastal monitoring and is available onboard, as detailed in Annex 4. The construction cost is based on a quotation from CYPASA, incorporating the New Zealand based Manta design project (see Section 8 - Supporting Documents for details) and representing a middle range cost estimate at 4.050.000 €.

Maintenance and operation: Maintenance and operations is considered from launch in early 2012. The number days available for oceanographic operations is estimated at around 115 days in 2012, thereafter 150 (the maximum under maritime employment law for one crew team). From this 150 days, 60 will be directly related to SOCIB monitoring operations in the Balearic Sea and 90 will be available for external access. Operations costs are estimated from figures obtained from R/V Manta and the CYPASA Estudio De Viabilidad (see Section 8 – Supporting Documents for details). The estimation of costs include, crew, victuals,

⁵³ 2 cabins with 3 bunks, 4 cabins with 2 bunks

⁵⁴ G. Freire, Freire Astilleros, Vigo (personal communication).

maintenance, annual haul out, insurance (estimated at 1%) and fuel (estimated at 1113.84 € per days at sea, personal communication Luis Ansorena, CSIC). Giving an estimated cost per day for the SOCIB R/V of approximately 3.000 €.

It is anticipated that SOCIB monitoring programmes will be undertaken as well as externally funded open access research or commercial projects (e.g. to monitor water quality) in the Balearic region. The IEO operated RADMED cruises (PI. JL Lopez-Jurado, COB-IEO) are undertaken every 3 months in the Balearic and Alboran sea by the IEO R/V Odón de Buén, taking an estimated at 100 days of ship time per year. It is anticipated that the SOCIB R/V would be able to complete the surveys in 50% of the time with continuous operations. In addition there will be a number of weeks per annum available for external operations in the Balearic region for example water quality surveys, seabed mapping, MPA monitoring.

Personnel: The crew will be contracted through a specialised agency, starting from the sea trials anticipated in early 2012. The crew will be adjusted depending on the operations and monitoring programmes (4 for daily 8 hours operation and 7 for 24 hour operations during a maximum of 7 days). For daily operations this would be a Captain, Chief Engineer, Seaman and a Seaman/Cook. The Captain and Chief Engineer are responsible for the safe running of the vessel and the ETD Engineers for the operation and maintenance of the scientific equipment. A naval engineer will be contracted from June 2010 to end 2011 to manage the construction of the SOCIB R/V.

Institutional agreements: The IEO operated RADMED cruises could be part of a Partnership Agreement currently under discussion with IEO. In-kind contributions, in terms of knowledge and expertise, from UTM CSIC and IEO personnel are essential during the construction phase and the possibility of an in-kind contribution to the crew from one or another organization (related to the ceasing of operations of existing old coastal R/V) has also been explored and will be further analysed once the general lines of the SOCIB Implementation Plan are approved.

Income: Externally funded operations of four different types are foreseen for 82 days per year, from 2013 onward, based on existing needs and know how in the Balearic Islands. They could include:

- Routine oceanographic monitoring from research organization (45 days)
- Research projects from different funding agencies (25 days)
- Balearic Islands Government⁵⁵ (10)
- Private Companies⁵⁶ (10)

Will be funded by the organisations undertaking the cruises at a calculated SOCIB R/V daily rate of approximately 3.000 €, to cover fuel, crew and victuals costs with a contribution to maintenance. These costs will be adjusted as operations start and might be modified in particular in relation to external use by private companies.

Budget Overview	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment	24.000	2.065.000	3.025.604	0	0	0	5.114.604
Operations	7.200	12.000	12.000	186.807	225.537	225.537	669.081
Personnel	0	23.322	46.643	230.000	230.000	230.000	759.965
Income	0	0	0	167.030	273.322	273.322	713.675

⁵⁵ Such as: DG Emergencias, DG Pesca, DG Medi Ambient

⁵⁶ Electricity cables, communication cables, pipelines, environmental consulting

Budget Detail	2009	2010	2011	2012	2013	2014	Total (2009-2014)
Investment							
Vessel construction	0	2.025.000	2.025.000	0	0	0	4.050.000
Scientific equipment	0	0	1.000.604	0	0	0	1.000.604
Studies (inc. Manta Visit)	24.000	40.000	0	0	0	0	64.000
Total	24.000	2.065.000	3.025.604	0	0	0	5.114.604
Operations							
Travel	7.200	12.000	12.000	0	0	0	31.200
Fuel	0	0	0	125.307	125.307	125.307	375.921
Maintenance	0	0	0	0	38.730	38.730	77.460
Insurance	0	0	0	40.500	40.500	40.500	121.500
Victuals	0	0	0	21.000	21.000	21.000	63.000
Subtotal	7.200	12.000	12.000	186.807	225.537	225.537	669.081
Personnel							
Captain	0	0	0	80.000	80.000	80.000	240.000
Chief Engineer	0	0	0	80.000	80.000	80.000	240.000
Marinero	0	0	0	70.000	70.000	70.000	210.000
Project engineer	0	23.322	46.643	0	0	0	69.965
Subtotal	0	23.322	46.643	230.000	230.000	230.000	759.965
Income							
External Operations	0	0	0	167.030	273.322	273.322	713.675
Subtotal	0	0	0	167.030	273.322	273.322	713.675

Timeline	2009	2010	2011	2012	2013	2014
	Studies	studies / open call / selection	Build	Sea Trials / Initial Operations	Full Operation	Full Operation
Purchase		0,5	0,5			
Operations (days)						
Days operation available	0	0	0	150	150	150
Sea trials	0	0	0	35	0	0
Permanent SOCIB	0	0	0	60	60	60
External Operations	0	0	0	55	90	90
Subtotal	0	0	0	150	150	150
Days at sea	0	0	0	113	113	113
People (numbers)						
Captain	0,0	0,0	0,0	1,0	1,0	1,0
Chief Engineer	0,0	0,0	0,0	1,0	1,0	1,0
Marinero	0,0	0,0	0,0	2,0	2,0	2,0
Project engineer	0,0	0,5	1,0	0,0	0,0	0,0
Subtotal	0,0	0,5	1,0	4,0	4,0	4,0

8. Coordination

The SOCIB coastal research vessel would be based in Palma and operated by the SOCIB consortium, however strong partnership between institutions (CSIC, IEO, and UIB) is considered a prerequisite for the optimal use and ultimate success of a new modern Balearic based coastal ocean research vessel. The coordination between this ship and other research vessels in the context of the Spanish scientific fleet (mainly IEO and CSIC operated) will also be considered.

9. Timetable

It is anticipated that the tender process will commence during April 2010. The timing of this process is indicated in Table 1, below.

	Months	Accum. Months
Tender Process		
Decision process	1	1
Preparation of tender	1	2
Preparation of public call BOE and DOCE	0,5	2,5
Publication of the call	2	4,5
Opening proposals and review process	0,5	5
Contract signed	1	6
Construction	12	18
Sea Trials	2	20
Delivery	1	21

Table 1: R/V tender process and construction timescales

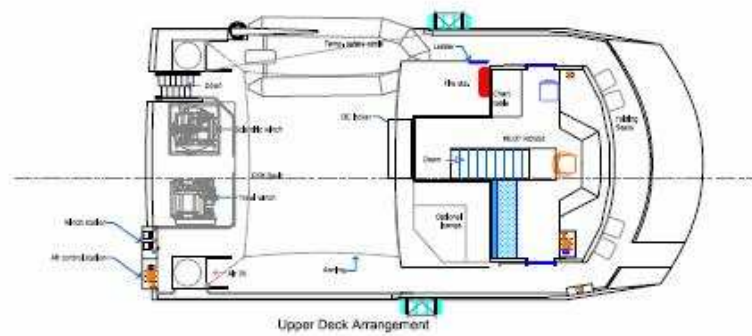
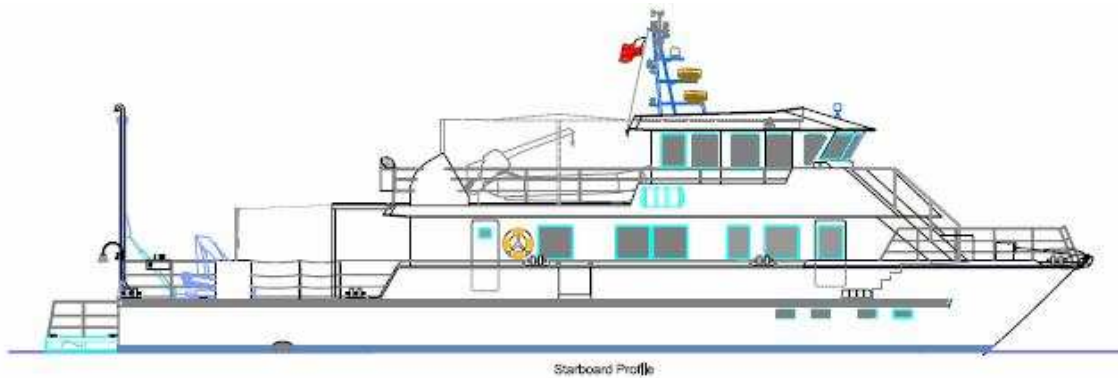
10. Summary

Much progress has been made in terms of assessing the construction and operational costs and advantages of a 'Manta-type' fast catamaran R/V to be based in Mallorca. The optimal length for such a vessel appears to be approximately 25 m (with registered length < 24 m). For construction two clear alternatives have emerged, the construction in Spain of a 'Manta-type' fast catamaran R/V an aluminium according the design of Teknikraft Design Ltd, adapted to Spanish Regulations as proposed by CYPISA, or the construction of a fast catamaran in PRFV using an existing using an existing Rodman 82 design/mould, again in compliance with Spanish maritime law.

The initial costs proposed for theses two options differ and the advantages of each option in terms of cost, delivery, design, specification are being analyzed. A detailed break down of the planning, build costs, equipment costs are being obtained, it is anticipated that this will drive the cost of construction lower, especially given the economic climate. In addition a visit by a SOCIB naval engineer to the to the Flower Garden Banks National Marine Sanctuary is in planning for April 2010 to discuss the practical aspects of the design and operation of the R/V Manta in detail.

Finally discussions with local research institutions, IMEDEA (CSIC-UIB), UIB and in particular IEO, have been undertaken to assess the broader use/contribution of a SOCIB fast catamaran R/V, and an agreement with IEO regarding joint operations is planned as well as agreements with CSIC (research project funded operations) and local government organisations. With regard to ongoing operational costs, the institutions involved in marine and coastal research in the Balearic Islands are being asked to consider the important quantitative input that such a modern coastal ocean research vessel can provide to the regional scientific research capability, technology development and society over the next 20 years and consider the possibility of contributing to the annual operation costs of such a vessel.

11. NOAA R/V Manta Layout Plan and Specifications



R/V Manta SPECIFICATIONS

NAME OF VESSEL: R/V Manta

Type of vessel: Research Vessel
 In survey to: USCG Subchapter T
 Home port: Galveston, Texas
 Owner: N.O.A.A.
 Owner contact phone: Dana Wilkes (206) 553-1449
 Operator: N.O.A.A.
 Designer: Teknicraft Design, Ltd.
 CAD software:
 Builder: All American Marine, Inc.
 Hull construction material: Aluminum 5383
 Superstructure construction material: Aluminum
 Deck construction material: Aluminum
 Length overall: 82' 8" (25.2 m)
 Length waterline: 73' 8" (22.5 m)
 Length bp.:
 Beam: 30' (9.14 m)
 Draught: 3.5'
 Depth:
 Displacement: 78.5 metric tons (full load)
 Tonnage/s: GRT NRT DWT
 Main engine/s: 2 x Caterpillar C32 ACERT 1600 bhp @ 2300 rpm
 Gearbox/s: 2 x ZF 3050
 Propulsion: 2 x Hamilton Jet HM 571
 Generator/s: 2 x Northern Lights M1064-T2 65 Kw
 Steering system: Hamilton Jet & Jastram
 Maximum speed: 34 knots (lightship)
 Cruising speed: 27 knots (fully laden)
 Range: 623 Nautical Miles (fully laden with reserves)
 Hydraulic equipment: Hydraulic A-frame with 4,500 lbs. SWL
 Electronics supplied by:
 Radar/s: Furuno FR-1833 C NT (NavNet)
 Depth sounder/s: Furuno ETR-6/10N
 Radio/s: Icom M504 VHF
 Sonar:
 Satcom:
 Autopilot: ComNav Commander
 Compass/es: Ritchie HB 740
 Weather fax: Furuno Fax 30
 GMDSS:
 GPS: Furuno BBWGPS WASS/GPS
 Plotters:
 A.I.S. Furuno FA 150
 Audio visual system: Denon
 Other electronics: Speco CCTV
 Winches: Kinematics Marine hydraulic trawl winch
 Markey Machinery Com-7H hydraulic scientific winch
 Capstan/Windlass: Kinematics Marine hydraulic anchor winch

Cranes: Morgan Marine 703M2S articulating knuckle crane
 Deck equipment: A-frame, Davit, Crane, various winches
 Other equipment installed: SeaKeeper's Society Monitoring System
 Alarm system/s:
 Paints/coatings: Interlux – Trilux33 Bottom Paint
 Windows: Diamond Sea/Glaze
 Seating:
 Flooring/Deck surface finishes: Lonseal flooring / Loctite non-skid
 Interior fitout/furnishings:
 Armament/Weapons: n/a
 Safety equipment: standard safety equipment
 Life raft/s: 2 x DBC 16man Solas A life raft
 Lifeboat/s:
 Skiff Work boat/s: Polaris 15.5' Spirit RIB
 Hold capacity:
 Deck cargo capacity:
 Water ballast:
 Fuel capacity: 3600 Gallons
 Fuel consumption:
 Freshwater capacity: 500 Gallons
 Crew: 14
 Passengers: 25 for day trips
 Vehicles:
 Operational area: Flower Garden Banks National Marine Sanctuary
 Homeport: Galveston, Texas
 Date of delivery:
 Remarks:

Other vessels on order: 2 x N.O.A.A. Survey Launch boats,
 65' High-speed tour catamaran
 83' Eco-tour catamaran

For more information contact: Joe Hudspeth
 Company name: All American Marine, Inc.
 Country: USA
 Phone: (360) 647-7602
 Fax: (360) 647-7607
 Email: jhudspeth@allamericanmarine.com
 Web: www.allamericanmarine.com
 Person to contact: Joe Hudspeth

12. Detailed specification and layout of NOAA R/V Manta

The detailed specifications from R/V Manta are provided here as a reference of the type of specifications and layout planned for SOCIB R/V.

R/V Manta is serving the Flower Garden Banks as part of NOAA's National Marine Sanctuary fleet. The vessel design provides enhanced capabilities for on-board scientific data collection and diving operations, plus increased stability and speed needed for research, education, enforcement, and management of the sanctuary and surrounding waters in the north western Gulf of Mexico.

Builder: All American Marine Inc., Bellingham, WA

Design: Teknicraft Aluminum Catamaran

Length: 82'08"

Beam: 30'

Draft: 6'

Freeboard: 5.5'

GRT: 77 tons

Cruising Speed: 25 knots

Maximum Speed: 35 knots

Fuel capacity: 3200 gallons

Fuel endurance: 600 nm (5 days)

Fuel consumption: 175 gallons per hour (5 gallons/nm @ 70% speed)

Berthing: 14 (10 science, 4 crew)

Passengers: Maximum of 25 on day-trips

Deck Equipment

- Markey COM 7H oceanographic winch with 1000m of .322" electro-mechanical cable (on turntable) slip ring assembly
- Trawl Kinematics science winch with 1000m of 7/16" galvanized cable
- A-frame with 4500lb SWL, has block with LCI 90 wire-readout
- Morgan model knuckle-boom crane with max reach of 20 feet (900 #)
- Steelhead Marine small boat davit with reach of 10'06"
- Polaris 15'06" "Mobula": aluminum RHIB with 40hp Yamaha (10 gal. fuel)
- Hydraulic connects on port side for hydraulic tools (e.g. corer)
- Hydraulic lines on starboard side (future install of J-frame)
- Main deck tie-downs with 2' by 2' pattern (.75" SST eye-bolts)
- Moon pool opening approx. 2' x 1.5'
- Pole mount brackets (no pole at this time)
- Observation area with fold down benches forward of the bridge
- 220VAC, 440VAC power hook-up
- Interchangeable main deck space
- Freshwater and saltwater hoses

Laboratory space

- Seakeepers 1000 Automated Observing System. Includes surface CTD, dissolved oxygen, PH, redox, air temp, barometer, wind speed, and direction. Observations are recorded continuously and transmitted every hour.
- HAZMAT storage locker, double stainless steel sinks (FW, SW) in wet lab
- Acid use only sink (Fume hood install in the future)
- Freezer and deep freeze
- Entertainment rack system in dry lab (AV receiver, DVD player, speakers)
- Uni strut tie-down system
- LCI-90 readout (payout speed and distance)

- Trawl winch remote controller
- CCTV with controller (4 cameras)
- UPS power, 120V clean power

Dive Amenities

- Bauer 200 B-Trox nitrox membrane dive compressor (12 cfm) with 4-bottle cascade storage
- Nitrox fill panel with O2 analyzer and 4 fill whips
- Dive master station and extra tank racks
- (2) 6 person dive benches with tank holders, folding tables, hanging racks
- (2) 6' by 8' dive platforms with 6' dive ladders
- Freshwater rinse showers on transom and main deck
- Emergency oxygen and regulator
- Hyperlite recompression chamber

Network and Computers

- Cat 5 network drops throughout vessel, R232 drops in select locations (not wired)
- Dell laptop computer

Bridge Electronics

- Furuno Navnet Plotters (GOM electronic charts)
- Furuno radars and AIS
- (4) Steering stands - Centre console, Port Bridge, starboard bridge wing, and aft control station
- Furuno Autopilot
- (2) ICOM VHF marine band ship radios
- (3) Hand-held VHF radios
- Iridium 9505 satellite phone
- Intercom system with 10 stations, talk-back capable loudhailers(exterior)
- Internal Phone system
- CCTV (4 cameras)

Engine machinery

- Northern Lights Generators, 65kw
- Caterpillar C32 Acert Main Engines, 3200 Horsepower available
- Propelled by Hamilton H571 Waterjets

Tank Capacity

- Water storage of 500 gallons, Water maker up to 800GPD
- MSD Type II sewage treatment system (Headhunter) with 500 gallons storage

Living Spaces

- Sleeping quarters: Main deck- One 4 person and Two 2 person
- Below deck - Two 3 person - Lockers and hooks in all rooms
- Heads: Two interior heads with showers, one outside head and separate shower
- Galley: Stove, microwave, refrigerator, freezer, ice maker, trash compactor
- Mess: Seats 14 people with LCD TV backdrop
- Gear storage: Main deck under dive benches, labs, outside of bridge

13. Images of R/V Manta



Another view of the wet lab area showing the doorway that leads out to the main deck.
Photo credit: FGBNMS



Sleeping quarters on board the R/V Manta. Lockers provide storage for the passengers occupying these quarters.
Photo credit: FGBNMS



The galley of the R/V Manta.
Photo credit: FGBNMS



The mess (eating area) next to the galley. The window on the left looks into the dry lab area.
Photo credit: FGBNMS

14. Cost and specifications comparison - R/V Manta, CYPsa, BPMS and Rodman proposals

A table summarizing the known SOCIB requirements as compared with the known cost and specifications of the NOAA R/V Manta and the proposed CYPsa study proposed vessel, the BPMS study proposed vessel and the RODMAN quotation proposed R/V.

Basic Specifications	R/V Manta	CYPsa	BPMS	Rodman
Construction Cost (€)	2.500.000	3.536.200	4.200.000	2.750.000
Length (m)	25.2	26.1 (23.5)	32 (30.15)	25 (22.4)
Beam (m)	9.14	9	9.4	9.00
Draft (m)	1.07	1.35	1.0	1.10
Displacement	78.5 metric tons	90.000 kg		53 Tons
Range (nm)	600			360
Max speed (knots)	35 knots	28	34	28
Cruise speed (knots)	25 knots	25	27	25
Engines	2 x Catapillar C32 ACERT	2 x	2 x	2 x Catapillar C32 ACERT
Horsepower	2 x 1600 bhp	2 x 1.900 bhp	2 x 2000 bhp	2 x 1600 bhp
Propulsion	2 x Hamilton Jet HM571	2 x water jet		2 x Hamilton Jet HM571
Dynamic Positioning	Y	Y	Y	Y
Fuel tanks	13644 L	2 x 11.000		10,000 L
Water tanks	1895 L	1000		1,000 L
Black/grey water tanks		2 x 1.500		500 L / 500 L
Design	Teknicraft Design	Teknicraft Design	Design to be	Rodman 82
Hull Type	Catamaran	Catamaran	Catamaran	Catamaran
Hull Material	Aluminium	Aluminium	Aluminium	PRFV
Construction	All American Marine	Carinox, Auxiliar del Principado, Aister	Metal Ships and Docks, Nodosa, Auxiliar del	Rodman
Year	2009	2012	2012	2012
Layout/Crew				
Crew 8 hr / 24 hr	4	4/7	5/7	4/7
Berths	14	19	19	14
		2 cabins with 3 bunks, 6 cabins with 2 bunks and 1 cabin with 1 bunk	2 cabins with 4 bunks, 5 cabins with 2 bunks and 1 cabin with 1 bunk	2 cabins with 3 bunks, 4 cabins with 2 bunks
Passengers	25			25
Galley	equipped galley and dining area	equipped galley and dining area	equipped galley and dining area	equipped galley and dining area
Aft deck working space (m ²)	65	69		
Wet and Dry Lab (m ²)	23	22.5	32	
Registration				
Register		Lloyd's Register of Shipping, Bureau Veritas or Det Norske Veritas	Lloyd's Register of Shipping - Special Service Craft	Lloyd's Register of Shipping - Special Service Craft
Code	I (open ocean)	I (open ocean)	I (open ocean)	I (open ocean)

15. Summary and Pricing of Scientific Equipment

Preliminary estimation of equipment costs which will be up dated after April 2010 by a SOCIB R/V working group, composed of researchers and technicians from COB IEO, IMEDEA (CSIC-UIB) and UIB.

Basic Equipment	Cost €
Rosette - CTD	274.813
Continuous Surface Water Analysis	36.166
Salinometer PortaSal	46.191
ADCP	41.200
Towed Undulator Triaxus (CTD, PAR, fluorometer, etc.)	322.000
Multiple opening and closing net - (MOCNESS)	183.836
Laser Optical Plankton Counter (LOPC)	96.398
Total	1.000.604

Annex 5: Bluefin Tuna Project – Advanced Research Programme

1. Overview

The Bluefin Tuna Project is the first project under the Office of the Director - Advanced Research Programme. We present below a first version of the Bluefin Tuna project which is the result of the Bluefin Tuna SOCIB works hosted by SOCIB in October 2009. This initial version is not intended to be completed, but is included here to provide initial indications of the ongoing work between four leading international institutions that will be coordinated in this initiative. Work on the final version is planned upon approval of the Implementation Plan in early April 2010 and final version of Bluefin Tuna Targeted SOCIB Project will be due June 30, 2010.

Bluefin Tuna: Sustainable use of marine living resources: impact of Mediterranean variability on bluefin tuna spawning grounds and population dynamics

2. Introduction

Atlantic bluefin tuna (*Thunnus thynnus*), hereafter referred to as BFT, has been continually exploited in the Mediterranean Sea since the Antiquity. Over the last 30 years, the development of the sushi-sashimi market in Japan has increased demand for high quality fish, and BFT in particular. As a result, prices paid for BFT have significantly augmented. For example, in 2001, a 200 kg bluefin tuna was sold for 174,000 US\$ in the Tokyo fish market. This price stimulated the development of the fishing activity and BFT catches in the East Atlantic and Mediterranean sharply increased. They reached an (official) historical peak exceeding 50,000 tonnes during the mid 1990s. The International Commission for the Conservation of Atlantic Tuna (ICCAT) concluded that such high level of fishing largely exceeded the natural productivity of the stock, which is estimated to be about 25,000 tonnes. Consequently, ICCAT classified, in 1996, the East Atlantic and Mediterranean BFT as being overfished but still established a quota at around 30,000 tonnes starting in 1998. These management regulations were unfortunately not very effective in limiting catches, especially in the Mediterranean Sea where significant misreporting and illegal fishing occurred. Despite a new recovery plan for BFT have been implemented by ICCAT from 2006, including more restrictive technical measures, many experts still believe that if further and stronger measures are not rapidly taken, the BFT stock could collapse within the next few years. However, some positive signs have been observed this year, as the presence around Balearic Islands of important quantities of juvenile BFT schools. This could be a result of improved recruitment success attributable to environmental causes; but also a consequence of the application of some of the aforementioned technical measures, as the prohibition of fishing individuals >30kg, or the reduction in the fishing pressure exerted over the spawning fish in this area, since the fishing activity, formerly focused in this area, is from some years ago concentrated in the Central Mediterranean.

In that context, monitoring of the main known Mediterranean BFT spawning sites is of the utmost importance. Indeed the spawning activity and survival rate of the larvae controls the recruitment rate, one of the most important, if not the most important, natural factor determining fish population dynamics. The processes controlling the BFT recruitment rate must thus be understood and monitored in order to be able to implement appropriate protection measures that shall ensure

stock recovery from the present low levels, and then sustainable exploitation of a hopefully recovered stock.

Defining such measures is not simple as the Mediterranean and Atlantic BFT populations are difficult to monitor and study. BFT is indeed a highly migratory species distributed at, usually, low densities over the whole North Atlantic and adjacent seas. There is thus little or no possibility to evaluate the population using the traditional acoustic or trawling surveys that are routinely carried out for most other exploited fishes. In addition, catch records are often unreliable, as mentioned above. They can thus hardly be exploited for scientific purpose. Consequently, there is a strong need to develop and exploit fisheries-independent techniques that shall allow us to better understand the population dynamics of this extremely valuable species and, in particular, the oceanographic factors controlling recruitment. This knowledge is a determinant step towards the possibility of implementing ecological based fisheries management of this species. This is a main goal of this proposal.

Even if this is not firmly established, BFT tuna is believed to display spawning site fidelity (i.e. adults are believed to come back to spawn in the areas where they were born). Three main spawning grounds have been identified in the Mediterranean sea: offshore the Balearic Islands, in the Sicily-Malta-Gulf of Gabes area and offshore Cyprus. As mentioned above, the Balearic spawning ground has probably been seriously affected by over fishing in the nineties; but at present fishing activity in this area is significantly reduced.

Independently of the variations in fishing pressure, both the BFT spawning activity and recruitment in this area could be highly variable, as a consequence of the important interannual variability in the complex dynamical oceanographic phenomena affecting the Balearic waters.

3. Physical background

The western Mediterranean Sea is characterized by a complex and highly variable (in time and space) basin scale circulation that is the result of the interactions taking place during the adjustment processes between the inflowing through Gibraltar lighter recent Atlantic Water (AW) and the denser Mediterranean Water (MW). Through the different sub-basins, Alboran, Algerian, Balearic among others, these thermohaline adjustments take place and govern the eastward/north-eastward spreading of AW that can reach the north of the Balearic Islands, therefore significantly influencing the north/south heat transport and exchanges that appears to be of key relevance for upper level ecosystem variability and fisheries.

Apart from these adjustment processes between recent AW and MW that characterize the basin scale circulation, the western Mediterranean is also characterized by significant mesoscale activity associated with the frontal dynamics near the slope areas. These mesoscale and sub-mesoscale features are characteristic of different sub-basins, in particular the Balearic sub-basin, where the general basin scale circulation is usually weak (30 cm/s, 1 Sv) and highly variable. Intense mesoscale eddies and filaments have been reported (velocities up to 100 cm/s, with intense surface convergence and/or divergence). These structures have been found to modify, not only the local dynamics and ecosystem (significant vertical motions associated, etc), but also the large scale basin scale circulation.

In other words, the sub-basin scale variability is the result of processes interactions at basin, sub-basin and also local scales and results in dynamically significant modifications of the basin scale variability. The necessity of predictive tools linked to new observing capacities (gliders and altimetry) resolving processes at these scales encompasses an integral view of the ocean system and the use of nested schemes that allow for downscaling from general to local conditions.

All this leads us to several basic questions:

1. What are the favourable environmental conditions for spawning and those enhancing larval survival?
2. How does environmental variability (AW eastward propagation, interactions with MW, fronts dynamics, eddies and convergence areas) determine the location of the most favourable spawning grounds and modulate the arrival of adults to such areas?
3. Is this inter-annual environmental variability linked to larger scale climate cycles and, if so, how climatic changes or trends would affect BFT recruitment success?

In order to set the scientific basis to answer these questions the IEO initiated a large research program in 2001, named TUNIBAL (TUNIBAL, 2001-2003; TUNIBAL II, 2004-2006, Ren 2003-01176), focused on BFT larval ecology in the Balearic Sea. The objectives were characterizing the influence of the environmental conditions on the location of spawning grounds and early larval life history of tuna. Within the framework of such projects a series of hydrographic-planktonic campaigns have been conducted off Balearic archipelago. Furthermore, a new competitive research project named BALEARES (CTM 2008-00478MAR and CTM 2009-07944/MAR), has been recently initiated with the principle goals of developing modelling tools to simulate the distribution and survival of larvae of exploited species related to different environmental scenarios.

The new Coastal Observing and Forecasting System, ICTS SOCIB, in the Balearic Islands provides an excellent opportunity for multidisciplinary approaches (environmental variability and ecosystem response) of particular relevance for a science based integrated and sustainable management of marine resources. SOCIB will be providing new observing, modelling and data centre facilities that will be open to all international researchers to implement new and innovative research activities such as the one here described. The contact among three research teams: Larval Ecology IEO team, IMEDEA (Dept. of TMOOS) and CLS together with SOCIB, has permitted to design this proposal (TUNABIT) with the objective of implementing an operational system able to determine and forecast the location and suitability of BFT spawning grounds in the Balearic sea. The development of the project is based on the combination of historical and new field data, 3D hydrodynamic models, satellite data and biophysical modelling. The new field data will be obtained from research surveys specifically designed to address the questions arising within the TUNABIT framework regarding the temporal evolution of spawning intensity and larval mortality rates, the size of high density larval patches and the larval vertical migrations during the day cycle.

4. Objectives

The main objective of the proposal is the implementation of an operational system able to determine and forecast the location and suitability of BFT spawning grounds in the Balearic Sea. The overall objective can be broken down into four specific objectives:

- Identification of spawning sites location and environmental characterization
- Predicting larval survival
- Forecasting of tuna spawning location (spawning habitat) based on environmental variability
- Forecasting of larval recruitment index based on environmental variability and associated predicted survival rates

The objective on the physical part would be to establish the 3-dimensional upper ocean inter-annual variability in the western Mediterranean at basin and sub-basin scale, concentrating on three major dynamical processes: (1) AW and MW adjustment processes from the Alboran Sea to the north of the Balearic Sea/Southern Gulf of Lyons area and their impact on the basin scale circulation, (2) the interaction between mesoscale and sub-mesoscale structures at the sub-basin scale with the basin scale circulation, resulting in modified patterns of the basin/sub-basin circulation and (3) the 3-dimensional motions (vertical in particular, but also converging patterns, etc) resulting from ageostrophic adjustments of mesoscale eddies that generate favourable conditions in the upper layer with significant interdisciplinary effects.

For this, we will use joint Satellite data (SST, Colour, Altimetry) and model results re-analysis of the inter-annual variability at sub-basin scale in the Western Mediterranean. The model results will be based on ROMS (Regional Ocean Model System) coupled physical-biological model nested to state of the art larger scale coupled models and forced by ECMWF (ERA re-analysis, and/or downscaling from Samuel Somot from MeteoFrance, etc.).

5. Project structure

The above objectives will be achieved by new planned campaigns and the analysis of existing data from finished and ongoing research sources. The project target species is bluefin tuna but can be extended in the future to other related species. The objectives in the project can be divided into specific activities, performed within the following 5 Workpackages (WP):

- WP1. Data acquisition
- WP2. Data processing and management
- WP3. Modelling
- WP4. Selection of operational model strategy
- WP5. Spawning grounds and larval recruitment index forecast

The implementation plan of the project is structured based on the Workpackages as shown in Figure 1. WP1 deals with the compilation of data from different sources: *in-situ* sampling, historical (both in situ and satellite) data from previous years and data from hydrodynamic and mid-trophic models. In WP2 the information is processed applying standard protocols of quality control, using common formats (such as NetCDF) and organized in databases (e.g. Thredds catalogs), in order to make it easily accessible to all project users (through OpenDap). Regarding satellite altimetry data, particular emphasis will be devoted to the implementation of algorithms and corrections specifically developed for coastal applications by IMEDEA and CLS. WP 1 & 2 will interact and provide data and results to the modelling work packages 3 and 4. WP3 applies two modelling frameworks (stochastic models and habitat optimisation) for the identification of favourable environmental conditions for the tuna spawning. This WP includes the application of IBMs to estimate the larval survival in the different identified spawning grounds. The pros and cons of

the modelling techniques from WP3 will be evaluated to design an operational model that allows the best forecast possible in WP4. In WP5 the results from the forecast predictions will be validated with data from *in-situ* sampling resulting in the best operative forecasting tool.

6. Project management

The internal structures within the project include a project coordinator, a management coordinator and the workpackage coordinators.

1. Project Coordinator

The coordinator of the project (Francisco Javier Alemany, IEO Baleares) will be responsible for the internal organisation and supervision of the development of the project and management. The project coordinator will co-ordinate and agree to the publication of results taking in consideration the other researchers. A postdoctoral fellow of high international profile will be contracted.

2. Management Coordinator

The management coordinator, from SOCIB Director's office, will be in charge of searching for economical resources and providing the facilities needed for the successful development of the project.

3. Workpackage coordinators

Each WP leader will co-ordinate the activities of the teams involved in the work package organising the practical work and ensuring the milestones planned in the WP will be achieved in the proposed time. The role of the project coordinator and the WP coordinators will also be to initially define the detailed work-plan. WP coordinators are listed in Table 1.

WP	Activity	Responsible person	Institution
1	Data acquisition	TBD	IEO
2	Data Processing/Data Management	TBD	IEO/SOCIB
3	Modelling	TBD	CLS/SOCIB/TMO OS-IMEDEA
4	Selection of operational model strategy	TBD	IEO
5	Spawning grounds & survival forecast	TBD	SOCIB/TMOOS-IMEDEA

Table 1: Workpackage coordinators

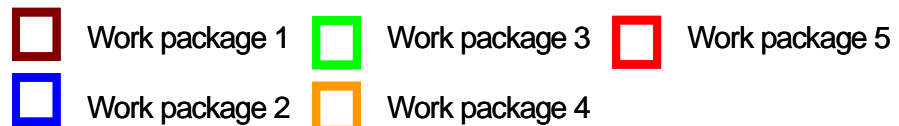
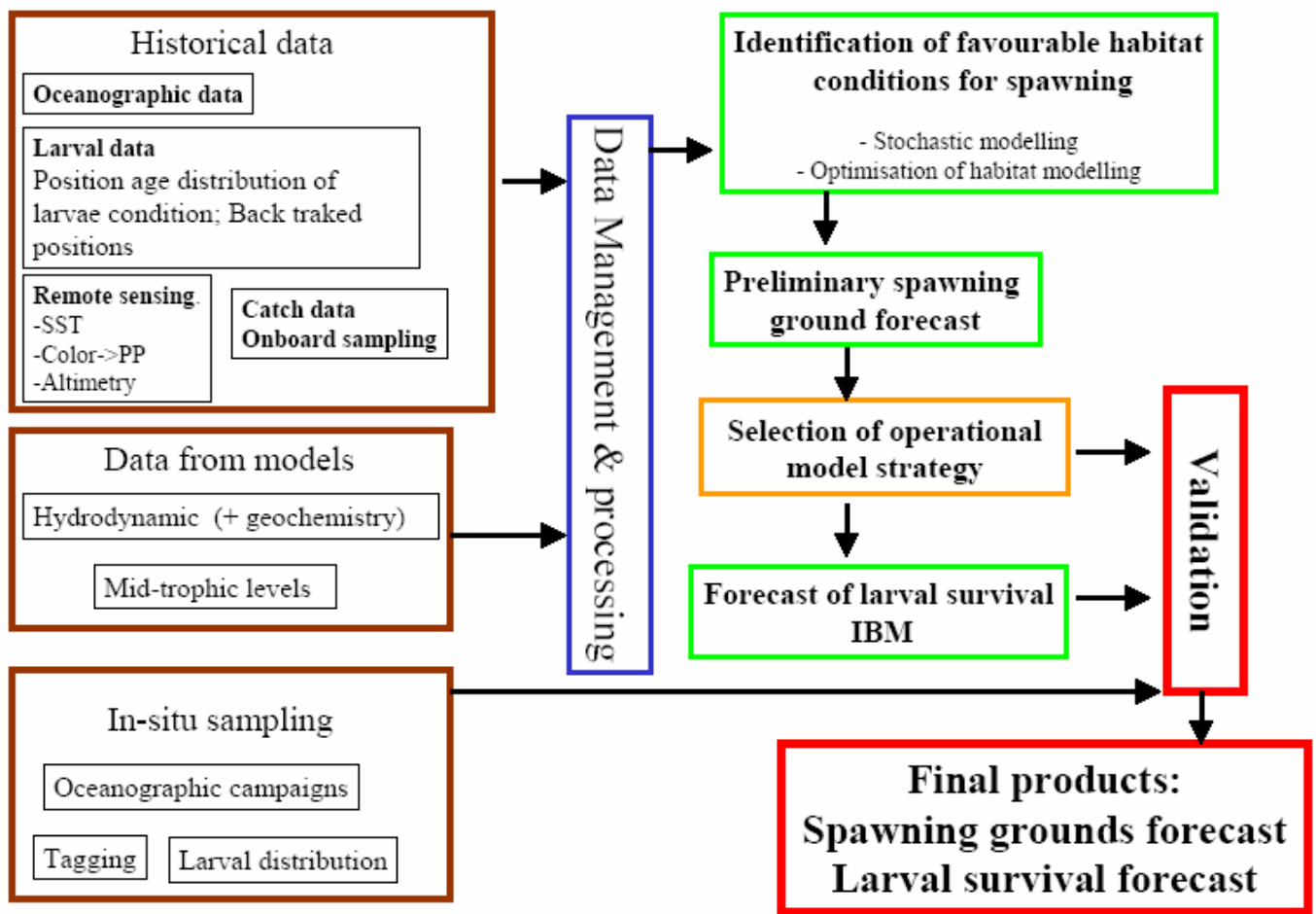


Figure 1: Conceptual structure of the project showing the relationships between workpackages and their relevant contents

Annex 6: ICTS SOCIB Research Lines

The summary of the research lines below is taken from the Memoria científica del proyecto ICTS-SOCIB presented to the SOCIB Board of Trustees on 18/12/2007.

1. Summary

The project raises ambitious but realistic scientific objectives, related to the study of physical and multidisciplinary processes in the coastal ocean (and its interactions) directly related to advances in science and technology for the coastal zone⁵⁷ operational oceanography, through the use of observations and numerical modelling.

These objectives are in line with the established international priorities in operational oceanography, adapted to the specific capacities and interests in the Balearic Islands, and considering the need to progressively address the variability prediction of ecosystems.

The scientific objectives have been focused on a one specific area, **the coastal ocean**, looking to unify and maximize the cooperation possibilities for scientists assigned to SOCIB. It is imperative to be aware of the complexity of the coastal ocean as a system of study, both for its intrinsic multidisciplinary nature, and by the nonlinear interactions (between different scales, the sea floor, the coast and the atmosphere) and its direct influence on major international challenges of the next decade as well as coastal vulnerability or global change. Research in the coastal ocean ("coastal ocean" is a nomenclature which has been internationally adopted to describe the region comprised between the wave break and the external limit of the continental shelf slope) is in fact a specific international priority in the United States, United Kingdom, France, Germany, etc. The scientific objectives will be addressed in a systematic manner by combining the studies of (1) processes (2) with numerical simulations and (3) observations, in line with the research philosophy of IMEDEA's Physical Oceanography Group over the last 15 years. The specific scientific objectives are related to the study of:

2. Hydrodynamics and morphodynamics of the nearshore area, wave-current interactions and sediment transport

The nearshore⁵⁸ marine medium is generally subjected to constant anthropogenic disturbance. The deterioration of the marine medium in these areas will depend on the more or less pernicious nature of the deposited detritus as well as the dispersion capacity of the existing residue in that medium. Therefore, the study and quantification of dispersive processes in this coastal strip is of great relevance for environmental management. Hydrodynamic processes in the coastal zone require the knowledge of the boundary conditions in external waters and the diffusion processes of the receptive waters. From the perspective of the specific study of dispersive processes, the starting hypothesis is that these can be simulated combining the information from high resolution circulation models in shallow waters and wave break areas. The boundary conditions must necessarily come from autonomous system in-situ measurements and nesting in regional oceanographic models. In other words, in the nearshore area, modelling of hydrodynamic processes must be performed by means of 3D circulation and wave models to study

⁵⁷ Including both the studies on the role of the coastal ocean on climate and the impacts of global change (and climate change as a part of global change) on the coastal zone.

⁵⁸ *nearshore*, from the coastline -including the emerged beach zones- until depths shallower than 50 m -generally located at around 500 m from the coast.

the relative importance of each of the processes (waves and currents). In SOCIB, the starting hypothesis is the need to develop a tool that will allow the inclusion, through radiation tensors, and the influence of wave action on coastal hydrodynamics thereby providing a unique tool for prediction that is properly validated by the observations also obtained by SOCIB.

The lines of research needed to address the observational and numerical development of a new numerical tool in the coastal zone are consistent with the international scientific challenges posed by the scientific community in this area, and are structured in **four main action axes**:

Coastal zone hydrodynamics

- a. Wave propagation from deep waters to the coast:** knowledge of the wave action in the shallow zone is essential to tackle any study on coastal morphodynamics and hydrodynamics. This requires propagation models that allow studying the different processes experienced by the waves (refraction, diffraction, reflection and shoaling) as they travel from deep waters towards shallow waters. With the moored instrumentation in the SOCIB framework, the necessary information will be available to initialize and validate these models.
- b. Modelling of currents in the coastal zone:** coastal circulation models make up one of the main challenges in modern oceanography. The energy variations at the coast occur in a much-reduced scale than in the open ocean. To this must be added the complexity of the bathymetry, irregular coastline and the energetic inputs from both the open ocean and the continental zone. In addition, the task of obtaining an operational is difficult since they currently do not exist for large areas of the coastline.
- c. Wave-current interactions:** the non-linear interaction between waves and currents is at the moment one of the hottest research topics in coastal oceanography and is still not fully understood. The wind induced circulation or density gradients modify waves as they travel towards the coast and these, at the same time, provide momentum to the currents. The pursuit of a model to study and predict this interaction is one of the challenges for the scientific community in the next years and is one of the objectives of SOCIB.
- d. Spill impact numerical models.** Coastal vulnerability against potential spills will be studied through the development of a mathematical model of advection and dispersion of pollutants from which the models described above will study and analyze the spill trajectories to take appropriate measures with a reasonable response time.

Sediment transport and boundary layer

- a. Current-flux interactions:** sediment transport is the result of complex interactions that occur in the bottom boundary layer and the sediments found there. Waves provide this process with enough energy to re-suspend the sediment while the current causes its redistribution. One of the SOCIB objectives in this context is the study of these processes at the boundary layer level in order to achieve a mathematical model for their study. This requires addressing the fundamental mechanics studies by installing a set of Doppler current meters (ADV) in the shallow zone (surf zone).
- b. Energy dissipation by the sea floor.** Posidonia seabeds play an important role in marine hydrodynamics that is still not fully understood. The study through intensive monitoring of these areas at the core of SOCIB will generate the necessary information to be able to formulate the appropriate mathematical models to study these effects.

Beach morphodynamics

- a. **Tilting / erosion of beaches and variability.** Beach erosion on all coastlines of the planet is a matter of great importance in the context of climate change. Completely understanding the sand inputs during “calm” periods where the submerged sand bar feeds, the loss of sand during storms, the tilting of beaches and the passing through different morphodynamic characteristics along different periods (reflective, dissipative or intermediate) is of great importance in order to take the appropriate measures for a proper management of them. This section involves fieldwork in which periodic measurements must be taken of topo-bathymetric data, sediment granulometry and the characteristics of maritime climate, which will provide the instruments for the platform in real time.
- b. **Rip currents and security.** Rip currents are one of the phenomena which cause more deaths on beaches around the world. These highly variable currents are a consequence of many factors, amongst which we find the position of the submerged sand bars, infragravitatory waves or the interactions between the incident waves and the wind-generated current. The study of these factors and subsequent modelling will allow the collection of risk indices and safety profiles for the areas likely to have such currents.

Slope / coastal zone coupling

- a. **Two-way nesting of the coastal zone ($h < 50\text{m}$) and slope.** The two-way coupling between the slope (next objective) and the coastal zone with waters shallower than 50 meters is fundamental for the diagnostic and prognostic system that is being proposed. At the moment in these areas, the nesting between models occurs only in one direction (from deep to shallow areas) and it is assumed that forcing happens in only one direction. However, for a more complete analysis of this complex area, information must be transferred simultaneously between both models. Within the SOCIB framework we intend to obtain the necessary data to validate the physical and mathematical approximations that will be developed.

3. Oceanography in the coastal zone, shelf/slope and marine resource sustainability.

The marine areas of our country, including both the continental shelves as well as their interaction with the coast (estuaries, bays, etc) or the open ocean (beyond the continental shelf slope) represent areas of great scientific, technological and socio-economic interest. These are areas that contain some of the greatest assets in terms of biodiversity, are characterized by ecosystems of great importance and variability, and also play a crucial role in large-scale ocean and climate processes. The sustainable management, protection and preservation of these areas require sound advances in the knowledge of processes and their interactions, to be able to understand and be able to predict both the natural variability (initially in the physical environment but gradually in a multidisciplinary way) as well as the response and variability in response to changes due to human activity and due to climate change.

In this context, we present **three main lines of action** that could be addressed through the new observational, prediction and data management systems available through SOCIB and therefore with multidisciplinary research focused on:

Coastal ocean variability and advances in operational oceanography at a regional and local level

- a. **Characterization and monitoring of the variability of the coastal zone of the Balearic Islands:** the variability of the coastal zone of the islands is not well known, nor in many cases the processes and interactions that lead to this variability, an essential element to understand the natural or

anthropogenic variability of the ecosystems, even more in a global change context taking into account the geo-strategic location of the Balearic Islands in the Mediterranean. It is also essential to incorporate the generated knowledge into the new regional and local operational oceanography systems of SOCIB, which, nested in larger scale⁵⁹ systems, will allow both the study of this variability and associated processes (also in a second phase), to predict their response to different types of forcing.

- b. **Coastal zone satellite oceanography: one of** the great global challenges in the coming years lies in evaluating and improving the performance of satellite⁶⁰ sensors, in particular in coastal zones. In particular, priority will be given to the study and improvement of the current limitations of altimetry in the coastal zone, as well as the introduction of these improvements and results into the SOCIB operational oceanography systems through real-time data assimilation into the implemented numerical models. It will also be considered significant to perform re-analyses of historical time series mainly of SST, with the goal of establishing and defining the possible circulation states in the Western Mediterranean.
- c. **Regional Operational Oceanography System: real-time spatial and temporal variability:** the achievement of the two previous objectives evolves naturally into the third; to establish and operate a system, which in real-time, will provide the variability of the system (and the ecosystem in a second phase) and also add a retro-feedback, allowing the study of specific processes and their impact on the obtained results, thus enabling an effective and continuous monitoring of progress.

Mesoscale and front dynamics: processes, interactions, observations and modelling

- a. **Characterization of the Balearic Front, its variability and role in the North-South exchanges in the Mediterranean:** the slope front located over the SW-NE Balearic coastal shelf is a key oceanographic element in the physical aspects related to the local currents and the blocking of the general circulation as well as of the Island's ecosystem variability and living marine resources. Here there is evidence of its relation with the fisheries (for example, pelagic -red tuna- and demersal - hake and prawn-) and the proliferation of species such as jellyfish. The Ibiza and Mallorca channels are areas of special importance within this objective and therefore observational efforts will be increased in these areas.
- b. **Characterization and variability of shelf/open ocean exchanges:** the coastal zone over the continental shelf represents (from a theoretical perspective) a domain isolated from the open ocean. It is well known however, that exchange processes exist between these two areas, processes that for example give rise to water, larvae and residue exchanges, and which are necessarily induced by the instabilities of a slope front, or wind-associated transitory phenomena, etc. Both the mentioned oceanographic conditions occur in the Islands, the Balearic (SW-NE) slope front, the slope and the shelf areas to the S and NE of Mallorca where, despite a steep slope there is no permanent slope front with a dynamical signature (significant density gradient). It is essential to understand these exchanges, the phenomena which cause them and their effects on the marine ecosystem and its living resources. It is of special interest to maintain and expand, in space and time, the monitoring conducted by the COB (IEO) of the areas

⁵⁹ For example, through MOON and MERCATOR with whom a stable and lasting relationship is maintained

⁶⁰ Allow to obtain quasi-synoptic, in large coastal areas, variables such as temperature, salinity (soon with SMOS although at low resolution), colour, altimetry, etc.

South of Mallorca in the Radiales Project framework. Furthermore, particular emphasis will be placed on exchanges in the deep canyon areas with the goal of advancing towards a sustainable management of the exploited deep ecosystem resources.

Protected Marine Areas and Global Change

- a. Design and management of new protected marine areas based on connectivity studies:** the more than 1,100 km of coastline of the Balearic Islands requires a new method of design and management of new protected marine areas, which in line with the scientific advances of the last years, can allow a biomass recovery over the next 50 years. Particularly, studies of the connectivity between the coastal marine populations in the Caribbean have shown that their distribution depends both on the characteristics of the larval phases and the coastal currents that determine their distribution. Amongst these larval characteristics it is essential to know where they are located (far away or close to the coast), when (autumn-winter, spring-summer), and how for long the planktonic phase lasts. This is because the effects of the currents can change depending on those larval characteristics, conditioning the real dispersion capacity of each species. The detailed knowledge of these aspects, together with the comprehensive study of the population's genetic structure will allow the definition of the connectivity scale or exchange between populations, as well as their degree of vulnerability. Furthermore, it will help to determine the necessary improvements for the existent reserve network, both with respect to their size, their number and geographical location. The intention is to conduct a detailed study of the mean trajectories of the different types of larvae in relation to their lifespan, etc. to create an optimized map of the "mean free paths" of the larvae and the location and types of new protected marine areas. It is also important to know the demersal ecosystems in these areas.
- b. Global change in the coastal areas of the Balearic Islands:** the protected areas constitute ideal zones for the characterization of oceanic variability and also for changes at the deep oceanic levels, as for example those found a few miles south of the Cabrera National Park reaching over 2,000 meters in depth. Therefore, special emphasis will be placed on the study of the variability in these areas and observational efforts will be concentrated with the aim of having a new time series (which must be reliable, sustained over time and available in real-time for researchers and citizens) that allows an adequate response to this objective.

4. Impacts of climate and climate variability (natural or anthropogenic) on the Mediterranean Sea, variability of the regional circulation (sub-basin) and variability of the ecosystem.

The third scientific axis of SOCIB aims at concentrating the knowledge obtained over the last 20 years into a topic of maximum scientific and socio-economic interest containing issues such as the impact of climate and climatic variability on the Balearic Islands and its surrounding areas. In this context, two main aims are set, which are also of international scientific interest.

Determination of global change scenarios on the Mediterranean circulation and their impact of the interannual variability of the ecosystems using high-resolution observations (including underwater gliders) and models.

- a. Scenarios or states of the Western Mediterranean circulation:** identification of the past (from a reanalysis of the circulation over the last 40 years - maximum reliably obtainable) and future scenarios (based of IPCC scenario predictions), and assess (understand, resolve and potentially

parameterize) the interactions resulting from the convergence between recent incoming Atlantic water, less dense ($S < 36$), and the denser ($S > 37$) resident Mediterranean water in the western Alboran Sea, the resulting instabilities and their relation with the north/south heat transport and exchanges in the western Mediterranean. All this is of key relevance to the ecosystem and fisheries variability.

- b. **Scenarios and ecosystem variability:** analysis of the ecosystem changes in specific coastal areas through their short term integration, focusing on specific problems such as the proliferation of jellyfish and algal blooms (HABs), assessing in both cases, the coastal inputs and exchanges with the open ocean. All of this in the context of global change.

Mesoscale and submesoscale processes and their contribution to the 3D interannual variability of the surface layer in the Mediterranean.

Specifically considering the relevance of the vertical movements caused by eddies and the ocean-coast exchange processes, using process, observations and modelling studies.

- a. **Mesoscale variability and scales of variability,** determination or parameterization, for every identified scenario, characterizing the mesoscale variability and establishing the importance of mesoscale and submesoscale eddies on the surface layers of the ocean.

Annex 7: Space Planning and Analysis

The following analysis has been prepared (March 2010) to envision and identify the space requirements for SOCIB in ParcBit, Mallorca, from 2012/2013 onwards, in the general frame of a well coordinated centre of excellence for operational oceanography (UIB, IEO and CSIC). The TMOOS department at IMEDEA spaces directly related to SOCIB ETD activities are provided as a reference.

1. Marine Technologies & Operations Labs (MTO)

Objective. The main objective of this department is to operate marine instrumentation.

MTO LABS in SOCIB framework. This department will provide systems operation and technological support for survey and data acquisition activities in Operational Oceanography from SOCIB.

TASKS
System operation of general ocean instrumentation (CTDs, current meters, etc.)
Testing, calibration and maintenance of general ocean instrumentation
Specific system operation, calibration and maintenance of Gliders and AUVs

HUMAN RESOURCES	Skills	TMOOS	SOCIB
Technician	AUV, Glider and Oceanographic instrumentation operation and maintenance	1	2
Instrumentation Engineer	AUV, Glider and Oceanographic instrumentation testing, calibration and programming.	1	3

MAIN EQUIPMENT	Operation	TMOOS	SOCIB
Water Tank 4x2x1m	Instrument calibration and testing	1	1
Fresh water and drain installation	Instrument cleaning and rinse operations	1	1
Rotary crane 500kgx4m	Heavy loads moving	1	1
Gliders	Ocean data sampling	4	6
AUVs	Ocean data sampling	0	3
Argo Floats	Ocean data sampling	4	4

Weather Station	Ocean data sampling	1	1
Sea level and wave rec.	Ocean data sampling	5	5
Thermistor string	Ocean data sampling	1	1
Currentmeter	Ocean data sampling	2	2
ADCP profiler	Ocean data sampling	5	5
CTD Profiler	Ocean data sampling	1	1
HADP Profiler	Ocean data sampling	1	1
Nortek ADV currentmeter	Ocean data sampling	8	8
ROV	Ocean data sampling	1	1
Optical Backscatter	Ocean data sampling	4	4

LAB/DEPT SPACE NEEDS

L1: Reception Area	
Area [m ²]:	100
Tasks:	<p>This laboratory will house equipment that will be installed in a campaign or permanent positions, trying to reproduce the far as possible the conditions of operation.</p> <p>Storing all tools and materials necessary for installation.</p> <p>Will also receive all equipment back to the laboratories, either because it has finished its business or for maintenance. There will be cleaning and drying them.</p>
Equipment:	<p>Workbenches</p> <p>Small tool panel</p> <p>Large capacity sink</p> <p>Floor drain</p> <p>System for hanging things from the ceiling to simulate vertical mooring lines</p>
Human resources:	F 1-5 pool technicians may work temporarily at this Lab

L2: Sea water tank	
Area [m ²]:	50
Tasks:	In this area of work is carried out in immersion tests, ballasting gliders and AUVs. The tank will also serve to test different

	oceanographic instruments.
Equipment:	Sea water tank (3m X 2m X 1.8m) Fresh water / hose Large capacity sink Floor drain Crane
Human resources:	1-2 pool technicians + 1 glider technician may work temporarily at this area

L3: Lab. Instruments & sensors	
Area [m ²]:	50
Tasks:	In this lab are receive new instruments, it performed its tuning and pre-installation configuration It is possible to make minor repairs to instruments. Additional sensors will be installed to the instruments. Changes batteries and testing to ensure viability.
Equipment:	Workbenches Mobile workbench Tool panel Sink Some computer to communicate with instruments Storage of spare Storage of field material (wire, shackle, tape, etc)
Human resources:	1 oceanographic instrumentation technician 1 electronic engineer

L4: Lab. Calibration & testing	
Area [m ²]:	25
Tasks:	It will perform the calibration and validation of sensors of the instruments.
Equipment:	Workbenches Thermostatic bath Salinometer
Human resources:	1 technician 1 engineer

L5: Lab. AUV's + gliders	
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Area [m ²]:	100
Tasks:	<p>The AUV's and gliders, for his great wingspan, multiple sensors and peculiarities of their functioning have their place in this laboratory.</p> <p>Some parts of the ballasting will be make here, and the complete configuration of the equipment prior to the commencement of the missions.</p> <p>It will carry out maintenance on completion of missions.</p> <p>It will install and test new sensors</p>
Equipment:	<p>Workbenches</p> <p>Tool panel</p> <p>Scale</p> <p>Centralised vacuum system</p> <p>Crane</p> <p>Computer to communicate with AUV's and gliders.</p> <p>System antennas for wireless communication with gliders and AUV's (VHF, wifi, etc)</p> <p>It is necessary that this lab will be near to sea water tank</p>
Human resources:	<p>1 glider technician</p> <p>2 pool technician</p> <p>2 engineer</p>

L6: Nearshore lab.	
Area [m ²]:	100
Tasks:	<p>Here will be processed the samples collected during beaches field works .</p> <p>There will be processing the data collected bathymetric campaigns</p>
Equipment:	<p>Workbenches</p> <p>Small tool panel</p> <p>Sink</p> <p>Stove</p> <p>Sifting sand system</p> <p>Precision scale</p>
Human resources:	2 pool technician

Summary	TMOOS Area [m2]	SOCIB		
		Units	Area	Total
L1: Reception Area.	6,25	1	100	100
L2: Sea water tank	25	1	50	50
L3: Lab. Instrument & sensors	35	1	50	50
L4: Lab. Calibration & testing	0	1	25	25
L5: Lab AUV + glider	25	1	100	100
L6: Nearshore lab	25	1	100	100
Total	116,25			425

2. Marine Engineering Labs (ME)

Objective. The main objective of this department is to develop new instrumentation and assist scientists and technicians in specific marine technology.

ME LABS in SOCIB framework. This department will provide technological and maintenance support to the R+D activities in Operational Oceanography from SOCIB.

TASKS
Design and manufacturing of modifications, supports and fixtures for marine instruments
Marine instrument reparation
New marine instrument and technology development
Testing of devices and modifications

HUMAN RESOURCES	Skills	TMOOS	SOCIB
Electronics Engineer	Electronic schematics and PCB design, manufacture and testing. Software programming.	1	1
Mechanical Engineer	CAD-CAM mechanical design. General engineering and marine technology knowledge.		1
Workshop Technician	General electronic knowledge. Specific mechanical manufacturing knowledge.		2

MAIN EQUIPMENT	Operation	TMOOS	SOCIB
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Pressure chamber	Pressure testing 10bar	1	1
Pressure chamber	Pressure testing 200bar		1
Lathe	Component machining	1	1
CNC machining centre	Component machining	1	1
3D printer	Prototyping	1	1
Vacuum casting system	Manufacturing	1	1
MIG Welding	Component welding	1	1
Compressed air supply		1	1
PCB CNC mill	Electronics PCB manufacturing	1	1
Pick and place equipment	Electronics PCB manufacturing	1	1
Reflux oven	Electronics PCB manufacturing	1	1
Oscilloscopes and Power supplies	Electronics PCB manufacturing	1	1

LAB/DEPT SPACE NEEDS

L7: Pressure testing chamber	
Area [m ²]:	25
Tasks:	Pressure testing of instruments and equipment
Equipment:	Fresh water and drain installation Pressure chamber 20bar 2xd0,5m Pressure chamber 100bar 2xd0,5m
Human resources:	No permanent human resources are required, but two pool technicians may work temporarily at this Lab

L8: Mechanics & Manufacturing Lab	
Area [m ²]:	125
Tasks:	General instrument reparation Connector and cable moulding Manufacturing of modifications, supports and fixtures Manufacturing of new equipment Rapid Prototyping
Equipment:	Workbenches Tool panels

	Portable tool trolley Open shelves and closed cabinets Bandsaw, mill, drill, and small portable equipment
Human resources:	One mechanics workshop technician. Four pool technicians may work temporarily at this Lab

L9: Electronics Lab	
Area [m ²]:	50
Tasks:	PCB mounting and soldering PCB and equipment testing Cable and connector soldering and mounting
Equipment:	Workbenches Tool panels Open shelves and closed cabinets Welding-soldering stations and small portable equipment
Human resources:	One electronics workshop technician. Three pool technicians may work temporarily at this Lab

L10: Engineering & Design Lab	
Area [m ²]:	50
Tasks:	CAD mechanical design of components, modifications and new equipment CAD electronics design of schematics and PCB layout Electronics Microprocessors and software programming
Equipment:	Computers with CAD software Microprocessor programmers
Human resources:	One Mechanical Engineer and one Electronics Engineer.

Summary	TMOOS	SOCIB		
	Area [m2]	Units	Area	Total
L7: Pressure testing chamber	3	1	25	25
L8: Mechanics & Manufacturing Lab	50	1	125	125
L9: Electronics Lab	25	1	50	50
L10: Engineering & Design Lab	25	1	50	50
Total	103			250

3. Computing, Information Technology and Data Centre (CITDC)

Objective. The main objective of this department is to design, implement and operate the computing and IT infrastructure, to cope with three needs: information storage, computation and communications

CITDC in SOCIB framework. This department will provide the major infrastructure to support data centre and modelling facilities, and also staff and administrative functions from SOCIB.

TASKS
Design of the computing and information technology infrastructure.
Implementation of the whole infrastructure
Operation and maintenance of the different services
Monitoring, performance evaluation and tuning

HUMAN RESOURCES	Skills	TMOOS	SOCIB
Computer Engineer (M.Sc.)	System design and operation of general services (HTTP, FTP, SSH, LDAP), DataBase and Backup management. Performance analysis and resources optimization	1	1
Computer Engineer (B.Sc.)	System management support and help desk, Windows, GNU/Linux and Mac Operating Systems	0	1

MAIN EQUIPMENT	Operation	TMOOS	SOCIB
video wall	Collaborative visualization of data	1	1
fibre optic switch (GbE)	Main communications from offices to outside	0	2
rack mounted server	General services and data server	1	3
unified storage system	Data sharing	0	1
personal supercomputing machine	Support for the modelling facility.	1	1
global supercomputing machine	Support for the modelling facility.	0	1
tape system	Backup for archive data	0	1
virtual tape system	Backup for fast recovery	1	1

computer with large memory and computing power	Serial computing	1	1
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LAB/DEPT SPACE NEEDS

CITDC_1: Operational Data Center, COOL room	
Area [m ²]:	100
Tasks:	Engineers working area
Equipment:	Videowall
Human resources:	Five computer engineers. There is space for sixteen workplaces in this room

CITDC_2: Computers room	
Area [m ²]:	50
Tasks:	Equipment housing Operation of storage system Operation of servers Operation of communications
Equipment:	1 rack with: 2 fibre optic switches (GbE) 1 PABX 1 rack with: 3 rack mounted servers 2 switches (GbE) 1 unified storage system (13TB of storage capacity) 1 rack with: 1 personal supercomputing machine 1 tape system 1 virtual tape system 1 rack with: 1 computer with large memory and computing power 2 blade enclosures 1 infiniband switch
Human resources:	No permanent human resources are required, but two computer engineers may work temporarily in this space

Summary	TMOOS Area [m2]	SOCIB		
		Units	Area	Total
CITDC_1 Operational Data Center, COOL room	16	1	100	100
CITDC_2 Computers room	20	1	50	50
Total	36			150

4. Garage and Warehouse (GW)

Objective. The main objective of these facilities is to store instrumentation and vehicles.

GW in SOCIB framework. These facilities will provide storing for the Operational Oceanography instruments and vehicles from SOCIB.

TASKS
Post-mission instrument rinse and cleaning, Pre-store instrument and equipment check
New instruments reception, warehouse control of goods
Diving Air bottle charging
Instrument storing
Vehicle storing

HUMAN RESOURCES	Skills	TMOOS	SOCIB
Technician	Driving licence.		1

MAIN EQUIPMENT	Operation	TMOOS	SOCIB
Fresh water hose and drain installation	Rinse and cleaning	1	1
Soundproof charging station (open air inlet)	Diving bottle charging		1
Closed cage	Bonded Warehouse (depósito franco)	1	1

LAB/DEPT SPACE NEEDS

A1: Dry warehouse	
Area [m ²]:	1000
Tasks:	Diving Air bottle charging

	Bonded warehouse Instrument storing Warehouse control of goods
Equipment:	One computer for instrument control
Human resources:	No permanent human resources are required, but four pool technicians or engineers may work temporarily at this Lab

A2: Wet warehouse	
Area [m ²]:	200
Tasks:	Post-mission instrument and wetsuit rinse and cleaning
Equipment:	
Human resources:	No permanent human resources are required, but two pool technicians or engineers may work temporarily at this Lab

A3: Garage	
Area [m ²]:	800
Tasks:	Vehicle storing
Equipment:	
Human resources:	No permanent human resources are required, but four pool technicians or engineers may work temporarily at this Lab

Summary	TMOOS	SOCIB		
	Area [m2]	Units	Area	Total
A1. Dry warehouse	220	1	500	500
A2. Wet warehouse	50	1	200	200
A3 Garage	150	1	800	800
Total	420			1.500

5. General Space

Objective. The main objective is to provide working space to those activities related to general services to all the components of SOCIB

TASKS
This department involves many different tasks, divided into logical units

HUMAN RESOURCES	Skills	TMOOS	SOCIB
Director			1
Vice-Director			1
Assistant Director			1
Manager			1
Administrative			3

MAIN EQUIPMENT	Operation	TMOOS	SOCIB

LAB/DEPT SPACE NEEDS

GS_1: Administration, Management and General Services	
Area [m ²]:	200
Tasks:	
Equipment:	
Human resources:	1 Director, 1 Vice Director, 1 Assistant to the Director, 1 Manager and 3 administrative personnel

GS_2: Meeting room	
Area [m ²]:	60
Tasks:	
Equipment:	
Human resources:	Occasionally 1 administrative

GS_3: Seminar room	
Area [m ²]:	120
Tasks:	
Equipment:	
Human resources:	Occasionally 1 administrative

GS_4: Dining room and lounge	
Area [m ²]:	100
Tasks:	
Equipment:	

Human resources:	Occasionally 1 administrative
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GS_5: Library and common room	
Area [m ²]:	60
Tasks:	
Equipment:	
Human resources:	Occasionally 1 administrative

GS_6: General spaces and maps and charts room	
Area [m ²]:	50
Tasks:	
Equipment:	
Human resources:	Occasionally 1 administrative

GS_5: Reprographics	
Area [m ²]:	30
Tasks:	
Equipment:	
Human resources:	Occasionally 1 administrative

Summary	TMOOS Area [m2]	SOCIB		
		Units	Area	Total
GS_1: Administration, Management and General Services		1	200	200
GS_2: Meeting room		2	30	60
GS_3: Seminar room		1	120	120
GS_4: Dining room and lounge		2	50	100
GS_5: Library and common room		1	60	60
GS_6: General spaces and maps and charts room		1	50	50
GS_5: Reprographics		1	30	30
Total				620

6. Offices

Objective. The main objective of this department is to provide space for scientists, group leaders, visiting scientists, and heads of departments. Also, common spaces for technicians.

TASKS
The tasks and activities that will be done in the OFFICE Department are those related to research and office work

HUMAN RESOURCES	Skills	TMOOS	SOCIB
Administrative assistant	Able to administrate speaces and basic requirements of personnel		1

MAIN EQUIPMENT	Operation	TMOOS	SOCIB

LAB/DEPT SPACE NEEDS

OFFICES_1: Individual offices	
Area [m ²]:	225 (15 units x 15 m2 each)
Tasks:	Offices for Senior Scientists and Heads of Departments
Equipment:	
Human resources:	15 Scientists

OFFICES_2: Double offices	
Area [m ²]:	200 (10 units x 15m2 each)
Tasks:	Offices for Posdocs (RC, JC), Technicians and Engineers
Equipment:	
Human resources:	20 posdocs technicians and engineers

OFFICES_3: Large rooms	
Area [m ²]:	200 (7 m2/person: 2 units x 100 m2 each)
Tasks:	Offices for phd students, technicians, assistants
Equipment:	

Human resources:	28-30 persons
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OFFICES_4: Visiting staff	
Area [m ²]:	40 (2 units x 20 m2 each)
Tasks:	Offices for visitors from the Visiting Programme
Equipment:	
Human resources:	4 scientists at a time

Summary	TMOOS	SOCIB		
	Area [m2]	Units	Area	Total
OFFICES_1: Individual offices		15	15	225
OFFICES_2: Double offices		10	15	150
OFFICES_3: Large rooms		2	20	40
OFFICES_4: Visiting staff				
Total				415

7. Space for Spin Off Companies

Objective. The main objective of this department is to provide working space to spin offs companies already existing (AMT) or that may arise from activities being done in SOCIB.

TASKS
Provide space and resources for new ideas

HUMAN RESOURCES	Skills	TMOOS	SOCIB

MAIN EQUIPMENT	Operation	TMOOS	SOCIB

LAB/DEPT SPACE NEEDS

SPACE FOR SPINN OFF COMPANIES

Area [m ²]:	1.500 (10 units x 150 m2 each)
Tasks:	Marine companies from new ideas
Equipment:	
Human resources:	

Summary	TMOOS Area [m2]	SOCIB		
		Units	Area	Total
CITDC_1 Operational Data Center, COOL room		5	100	500
Total				500

Annex 8: List of Supporting Documents

Note: the supporting documents listed below are provided separately in a digital format.

A8.1 Original SOCIB Proposal (2006)

Memoria científica del proyecto ICTS-SOCIB (2006) in Spanish and English translation.

A8.2 Presentation to Executive Commission Meeting (06/11/2009)

A8.3 R/V Feasibility Report Bilbao Plaza Maritima Shipping

Análisis previo para la definición de un catamarán con fines oceanográficos que operará en las Islas Baleares - Bilbao Plaza Maritima Shipping (BPMS), Bilbao

A8.4 R/V Feasibility Report CYPsa Ingenieros Navales

Análisis previo para la Definición de un Buque Oceanográfico para las Islas Baleares - CYPsa Ingenieros Navales, Vigo

A8.5 R/V Feasibility Report CYPsa REV.1

Estudio de Viabilidad Catamarán Oceanográfico SOCIB, REV 1 (26/03/2010)

A8.6 Quotation Rodman Polyships S.A.U

Especificación Técnica para la construcción y suministro de un catamarán para investigación y oceanografía O.T.82 Xh

A8.7 Design Quotation Teknicraft Design Ltd, New Zealand