ICTS SOCIB

Coastal Ocean Research Vessel

Updated Operations and Personnel Costs Report

Board of Trustees

July 6, 2010

Index

1. Overview

A Coastal Ocean R/V represents a major infrastructure investment and is one of the flagships for the Balearic Islands Coastal Observing and Forecasting System, SOCIB. We provide below a brief overview of the proposed vessel, with detailed information regarding needs, current regional platforms and feasibility of construction and costs.

A fast catamaran hull with overall length of approximately 24 m (less than 24 m registered LOA) is proposed as this design maximizes space for both scientific operations (wet and dry laboratories, aft platform etc.) and accommodation (crew and scientists/technicians), whilst offering high speed capabilities and manoeuvrability, essential for flexible and efficient operations in the Balearic Islands environment (4 islands, 1.200 km of coastline) and Mediterranean Seas.

A proposed design solution from Teknikraft Design Ltd, offers a sound design in terms of space, speed, high fuel efficiency, low wake wash energy, excellent sea keeping, stability, 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 operational costs are also kept at a minimum.

This document presents a detailed operations and personnel costs analysis from the above mentioned coastal R/V, as requested by the Executive Commission and the Board of Trustees in their meeting from April 2010, and can be considered an extension to the R/V information contained in the SOCIB Implementation Plan.

An external analysis of the costs is presented and different scenarios of operations are analysed, in the frame of the general SOCIB budget presented to the Board of Trustees on April 7, 2010 that remains unchanged. In this frame, we show that under a "worst case" funding scenario (i.e. no income from external sources at all), existing SOCIB budgets are sufficient to guarantee SOCIB R/V missions at sea and sound maintenance of the vessel in dock.

Figure 1: Example of the type of vessel envisioned (NOAA R/V Manta commissioned in 2009, currently operating in the Gulf of Mexico)

2. 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 a modern 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 Islands[1].

3. 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.

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.

To support interdisciplinary research and monitoring objectives a modern R/V requires sufficient wet/dry lab space for physical, biogeochemical, chemical, biological and geo-science operations. In addition a fully equipped working area aft deck is required, with space sufficient for the placement of storage containers to support equipment storage (e.g. IEO containers[2]) and therefore use by external research organisations. Typical oceanographic operations include:

- CTD casts
- Water sampling with onboard chemical/biological analysis

[1] 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

[2] IEO-COB (Balearic Islands) currently use a 10 foot container to move equipment from vessel to vessel

- Atmospheric and air-sea flux observations
- Glider, AUV and ROV mission support
- Mooring/buoy deployment and recovery
- Moving vessel ADCP
- Diving operations
- Plankton tows
- Continuous Surface Analysis
- Towed vehicles (Side Scan Sonar, Acqua Shuttle, Triaxus)

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 needs.

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

The highest possible stability, high manoeuvring capability and high cruising speed maintaining high fuel efficiency.

Suitable for daily operations to all sectors of the Balearic Sea, with the capability for up to 7 days of continued operations at sea, with accommodation for a minimum of 7 scientists/technicians plus crew.

Spacious wet and dry laboratories and a fully equipped aft deck.

Scientific equipment to support modern oceanographic research and multidisciplinary studies.

Anticipated annual days of operation are 150 in order to maintain low operation costs (since above this limit, two crews would be likely needed based on Spanish maritime regulations).

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.

Projects already identified within the SOCIB Implementation Plan include: detailed sea floor mapping, habitat characterization, bi-monthly glider deployment and recovery missions, quarterly physical oceanography and biogeochemical fluxes monitoring cruises, 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, Water Framework Directive Implementation, etc.

4. 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 10'3) 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.

4.1. International Benchmark

The leading edge international example of this type of research vessel is the NOAA R/V Manta, launched in February 2008 and currently operating in the Flower Garden Banks National Marine Sanctuary, Gulf of Mexico. See Annex 13.8 for details on the specification, layout, equipment and costs of this R/V.

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. 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.

The R/V Manta represents the international state-of-the-art in fast coastal ocean research vessels and is 24 m LOA, with accommodation for a maximum of 14 persons for operations of 1 - 7 days duration, and laboratory space of 23 m2. 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.

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, within one year of operations, a valuable platform for the multidisciplinary scientific research community of the region, 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).

Two short video featuring the R/V Manta are provided in Annex 13.5 and the corresponding links are also provided below:

http://www.youtube.com/watch?v=4Vkj2G1N4hk

http://www.allamericanmarine.com/videos:

(manta/berth, manta/galley, manta/helm, manta/labs)

[3] 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 if fully assured.

4.2 Existing R/V 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 fibreglass coated wood and now more than 30 years old. This R/V is used for daily operations and IEO intend retiring it from service in the near future. On a smaller scale IMEDEA (CSIC-UIB) operates a smaller motor vessel, a Rodman 1120 of 11.25 m LOA, only suitable for daily operations. At the larger scale, IEO operates the R/V Cornide de Saavedra, an open ocean vessel, 66 m LOA and constructed in 1972, that undertakes several annual cruises in the Balearic Sea. Finally in Barcelona there is the CSIC operated R/V García del Cid, 36 m LOA and again more than 30 years old.

In a report published in March 2008 the European Science Foundation highlighted the aging of the European Regional Fleet[4], see Annex 13.6 for full report. Recent communication with the European Regional Vessel Operators (ERVO) has confirmed that this is still an issue for the regional research fleet 'The European regional research vessel fleet is aging fast and the marine science community is in high need of a renewal of the fleet and the delivery of state-of-the-art vessels. For that reason a new regional vessel for the Balearic area would be most welcomed and needed …….I have read with much interest the document on the Balearic Coastal Observatory and must admit that I'm quite impressed about the coastal marine future for the Balearics.' (personal communication, Andre Cattrijsse, ERVO Director, 2010).

In 2010 IEO plan an estimated 2 million € refurbishment of the 31.5 m LOA research vessel the R/V Francisco P. Navarro. Constructed in 1987 this vessel has is a mono hull, constructed of wood but recently assessed to be sound, with 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 and 9 crew[5] and accommodation for 7 scientists. It will be equipped to undertake both oceanographic and fishing related research operations, with wet and dry laboratory space and a large aft deck, although access to the ocean 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

[4] Page 18: Regional Class vessels are in danger their number will dramatically decrease from the current 20 to 12 in 2010, to 8 in 1025 and many fewer (3) until 2025 if renewal and/or major refit are not started now.

[5] Additional crew may be required depending on maritime regulations

- Well equipped, stable platform, suitable for a wide variety of modern oceanographic operations

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.

In addition the design and speed of this vessel can reduce the amount of ship time required for certain monitoring operations. For example taking as a reference some ongoing monitoring operational Programmes in the Alborán and Balearic Seas, it is estimated that the new SOCIB R/V could complete the monitoring in approximately 50% of the time (due to transit speed and 7 days cruise capabilities), reducing therefore from 100 days to 50 days per annum for these monitoring operations.

4.4 Existing monitoring programmes in the Balearic Sea region

It is envisaged that the new SOCIB R/V could fulfil some of the needs of existing permanent monitoring programmes and research projects in the Balearic Sea and adjacent regions from external research institutions such as UIB, CSIC and IEO at lower cost than the current aging fleet. For example IEO currently operate annual cruises in the Balearic and regional seas such as:

- MEDITS, 15 days (May-June), funded by the National Plan for Oceanographic and 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.

In particular, the RADMED, TUNIBAL and MOSAICS cruises have been identified as potential 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. It is important to note that the RADMED and TUNIBAL projects are related to SOCIB priorities for long-term oceanographic monitoring and activities in encompassing MPA monitoring, protection and connectivity.

A formal agreement between SOCIB and IEO is being prepared and will likely enter into force in 2012-2013 when the IEO R/V Odón de Buén will be retired from the IEO fleet.

5. SOCIB Commissioned Design and Feasibility Studies

Two feasibility studies were commissioned by SOCIB in July 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. See Annex 13.9 and 13.10 for the revised version (REV 1).
2. Análisis previo para la Definición de un Buque Oceanográfico para las Islas Baleares - CYPSA Ingenieros Navales, Vigo. See Annex 13.11.

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 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., see Annex 13.14, 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.

5.1 BPMS Study

The BPMS study concluded that a catamaran constructed of aluminium would be the best option to meet SOCIB needs. There are 4 shipyards in Spain identified that would be able to build such a vessel. The report 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

onboard[6], requiring a crew of 5 for daytime operations and 7 for 24 hour operations.

A cost analysis 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 € +IVA, 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 € + IVA [7].

5.2 CYPSA Studies

The initial 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 which would reduce the working space available. Additionally this vessel would be driven by water jet propulsion, with space on the aft platform for a container of 20 m and two winches 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 people[8] 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 that is registered under Spanish maritime regulations with a 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 €+ IVA, with a build time of 12 months.

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. See Annex 13.12 for the design quotation.

[6] 2 cabins with 4 bunks, 5 cabins with 2 bunks and 1 cabin with 1 bunk
[7] 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)
[8] 2 cabins with 3 bunks, 6 cabins with 2 bunks and 1 cabin with 1 bunk

Also important is that Teknikraft Design Ltd has a hydrofoil system that provides a lifting effect for the hull and displaces nearly one third of the vessels weight, while at speed. This design requires less engine power and less fuel consumption to maintain a given speed. See below for a sample sea trial analysis (Annex 13.13 for full details) that shows there is no extra fuel consumption for speeds between 17 and 27 knots, making this design operationally very efficient.

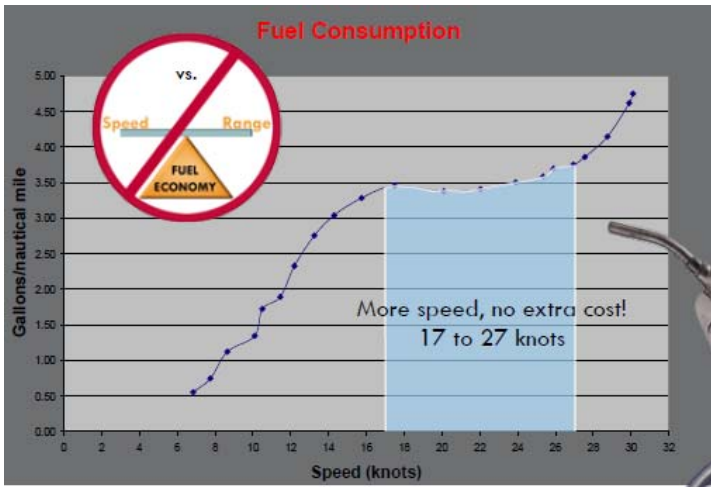

Figure 2: Tecknicraft Ltd design fuel consumption

5.3. Rodman Polyships S.A.U. Proposal

A detailed technical specification[9] for a 24 m 'Manta-type' R/V was requested from Rodman Polyships S.A.U., Vigo[10]. Rodman proposed a specification based on their 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 onboard[11]. 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.

[9] Especificación Técnica para la construcción y subministro de un catamarán para investigación y oceanografía O.T.82 Xh

[10] 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.

[11] 2 cabins with 3 bunks, 4 cabins with 2 bunks

5.4. Discussion of design and feasibility studies

Much progress has been made in terms of assessing the construction, cost of operation 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). Table 1 below summarises the cost and specification of the NOAA R/V Manta and those proposed by CYPSA, BPMS and RODMAN.

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, Auxilar del Principado, Aister	Metal Ships and Docks, Nodosa, Auxilar 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 Veritasor 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)

Table 1: Comparison of cost of construction and technical specification for the existing benchmark (R/V Manta) and R/V proposed by CYPSA, BPMS and Rodman

For construction two clear alternatives have emerged, the construction (potentially in Spain) of a 'Manta-type' fast catamaran R/V in aluminium according to the design of Teknicraft Design Ltd and adapted to Spanish Regulations (as proposed by CYPSA) 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, and specification will continue to be analysed. In addition a visit from part of the SOCIB R/V working group to the Flower Garden Banks National Marine Sanctuary is planned for mid 2010 to discuss the practical aspects of the design and operation of the international benchmark, the R/V Manta in detail.

5.5 Positive effects on shipbuilding industry

The recent construction in Spain of the R/V Sarmiento de Gamboa in a Vigo shipyard (70 m LOA, cost of construction 25 million € and 180.000 working hours) is accredited a leading to further work of 2.000.000 hours.

Related commercial contracts are estimated at 300 million €, in the form of a formal contract for a new oceanographic R/V (44 m LOA) by the University of Qatar, a new Discovery R/V (99 m LOA) from NERC UK, an oceanographic R/V (42 m LOA) from Bangladesh, and another oceanographic R/V (73 m LOA) for private company[12].

In other words, this proposal of building a high technology, coastal, oceanographic research ship can also have a very positive impact on the Spanish shipbuilding industry, an area recently prioritized in the European Commission Ocean of Tomorrow 2010 calls, see Annex 13.7. Spain would be therefore ideally positioned to lead the development and construction of coastal research vessels at the European level.

[12] G. Freire, Freire Astilleros, Vigo (personal communication).

6. Operations and Personnel Budget Analysis (additional June 2010)

In this section we present additional information that is complementary to the one presented in SOCIB Implementation Plan Budget (see Annex 13.15, page 165) including specifically further details of operations (including maintenance) and personnel costs of the R/V.

We also analyze the capability of SOCIB to operate the R/V under different funding scenarios always in the general framework of SOCIB budget as described in the Implementation Plan that remains unchanged.

The investment costs[13] were described in the SOCIB Implementation plan (pages 63 onwards, 137 onwards and 169 onwards and remain unchanged) and are therefore not reproduced here.

6.1. External Report on Operations and Personnel Costs (additional June 2010)

Following the request from SOCIB Board of Trustees meeting, April 7th 2010, a further analysis of operations and personnel costs has been undertaken and is presented below.

In order to achieve this, SOCIB wanted an external and independent evaluation of these costs and so commissioned CYPSA Ingenieros Navales to provide a detailed estimate of operations (including maintenance) and personnel costs for the proposed SOCIB R/V. This external report (Costes de Mantenimiento Catamarán Oceanográfico SOCIB REV-A, see Annex 13.1), details both the annual operations and personnel costs for 150 days of oceanographic operations and an estimation of the monthly maintenance cost for a R/V in dock.

The CYPSA annual operations and personnel cost estimates detailed within the report are outlined in Table 2 below and compared with the costs as estimated by SOCIB in the April 2010 Implementation Plan Budget.

The CYPSA estimates were obtained from the following sources, the Autoridad Portuaria de Palma, Astilleros de Mallorca, insurance brokers and 2008/9 crew contracts. The Implementation Plan estimates were obtained from the CYPSA Feasibility Study REV-1 (see Annex 13.10), operational costs obtained from the R/V Manta (see Annex 14.8) and estimates provided by members of the SOCIB R/V Working Group (see Section 10).

[13] Estimated at 4.050.000 €

Components	CYPSA (May 2010)	SOCIB Budget (April 2010)
Port fees	€ 5,931	€ 0
Insurance	€ 23,850	€ 40,500
Crew	€ 89,612	€ 230,000
Fuel	€ 104,500	€ 125,307
Victuals (Fonda)	€ 4,500	€ 21,000
Maintenance of machinery	€ 1,250	€ 38,730
Repairs	€ 4,530	€ 0
TOTAL	€ 234,173	€ 455,537

Table 2: Comparison the estimated operations and personnel cost from the recently commissioned CYPSA Report (May 2010) and those used in the SOCIB Implementation Plan Budget April 2010

As can be seen from Table 2 the total annual operations and personnel cost as estimated by CYPSA reaches a total of 234.173 € which is significantly lower that the annual operations and personnel costs from SOCIB April 2010 Implementation Plan.

There are reductions in almost all areas, in particular in the costs of personnel (crew), which can be explained due to two factors:

- First CYPSA uses a crew of 3 rather than 4, as this is now shown to be the minimum to operate a R/V of less than 24 m LOA under Spanish Maritime Regulations, for operations of less than 12 hours at sea[14].
- Second CYPSA uses crew salary levels specifically adjusted for such a vessel. See table 3 below.

These two factors account for the very significant reduction in personnel costs.

Patrón de altura	1.528	130	443	29.387	31.943
M. Mayor Naval	1.528	130	443	29.387	31.943
Marinero puente y máquinas	1.343	34	200	23.665	25.724
TOTAL					**89.611**

Table 3: CYPSA Crew costs

In addition the CYPSA Report indicates that the costs of fuel, insurance and victuals can be also significantly reduced as compared with the April 2010 SOCIB estimates. The costs for maintenance of machinery and repairs are also very much reduced however in this case the CYPSA estimate is much lower than the real case example of costs obtained from the R/V Manta for the first full year of operations (2009), and as used in the SOCIB Implementation Plan Budget.

[14] When SOCIB implementation Plan was finalised, this was not confirmed, thus the plan was cautious and considered the crew to be 4 as in the first CYPSA feasibility study.

Finally, the CYPSA Report estimates the cost per month for periods of inactivity, i.e. when the SOCIB R/V remains in dock and is maintained to a high standard by a limited number of crew, to be 6,074 € per month, of which the crew cost is 2,662 €.

In conclusion the CYPSA Report indicates that the operations and personnel cost of the proposed R/V could be significantly reduced in a number of areas. With regard to personnel/crew costs this appears to be well assessed, however with regard to some other areas e.g. repairs and maintenance costs the report appears too optimistic.

However it is clear that there is potential to significantly reduce the operational cost base of the SOCIB R/V to a figure significantly below the April 2010 Implementation Plan Budget estimate, but slightly above the CYPSA estimate as just described.

Therefore in the next section, both the revised operational cost base from CYPSA and the earlier SOCIB estimated operational cost base are used in the budget analysis in order to provide a 'lower' and 'upper' budget range for the operations and personnel costs of the proposed SOCIB R/V.

6.2. Budget Analysis (additional June 2010)

The SOCIB R/V budgets have been analysed for two scenarios:

- Scenario 1: The SOCIB R/V is operated for 150 days per annum, with SOCIB monitoring and technology development operations for 60 days and external regional research operations for 90 days at a nominal daily rate based on the costs of operation of the vessel. This scenario is as described in the SOCIB Implementation Plan and is considered a realistic scenario given the existing scientific and monitoring needs in the islands (as described before).
- Scenario 2: The SOCIB R/V is utilised for 60 days per annum by SOCIB, without external use or funding of the vessel. This scenario is to be considered a 'worst case funding scenario' and has been prepared to demonstrate, in the general frame of SOCIB budget (as described in Implementation Plan and unchanged), the capacity of SOCIB to operate the proposed R/V during 60 days and adequately maintain it at dock, without the need for additional funding.

6.1.1 Scenario 1: 150 days of operations and external use of the R/V

For operations of greater than 150 days per annum two crew teams would be required, therefore in the SOCIB Implementation Plan, 150 were days were chosen as the initial operational base for the R/V (one crew team) and this has been maintained for the Scenario 1 analysis.

The SOCIB April 2010 budgets have however been amended to reduce the number of crew from 4 to 3, following the CYPSA Report as this has now been confirmed as acceptable under Spanish Maritime Law.

As indicated in 6.1, two budget options are developed:

1a) 150 days & SOCIB Costs (3 crew)

1b) 150 days & CYPSA Costs

As outlined it is anticipated under this scenario that 60 days of the 150 days available would be used by SOCIB with the remaining 90 days available for externally funded oceanographic operations, research or commercial. Externally funded operations of 4 types are foreseen from 2013 onward, based on existing needs in the Balearic and regional seas, including:

- Routine oceanographic monitoring from research organization (45 days)
- Research projects from different funding agencies (25 days)
- Balearic Islands Government[15] (10)
- Private Companies[16] (10)

The actual days at sea are less than the R/V days of operations to take account of repairs, weather and loading/unloading. Therefore of the 150 days, 113 are assumed to be days at sea[17]. Table 4 below shows an example of how the operational activities could break down in terms of users, campaigns and days at sea.

Campaign	Details	No. per annum	Prepare (days)	Cruise length (days)	Seatime (days)	Total Operations (days)
SOCIB Annual Operations						
Moorings	5 (4 coastal, 1 Signal), visited 2 x year	2	0.5	2.5	5	6
Glider Operations	Monitoring/emergency	10	0	1	10	10
ETD Experiments	Various	5	1	1	5	10
ROV Operations	Habitat monitoring	5	1	2	10	15
Bluefin Tuna Programme	Oceanographic campaigns	1	1	8	8	9
Nearshore Station Programme	Installation and maintenance	2	1	2	4	6
Outreach and Education	Explore marine science days	2	0	2	4	4
TOTAL SOCIB		**27**	**4.5**	**19**	**46**	**60**
Examples Regional Operational Oceanographic Campaigns						
RADMED (IEO)	5 transects Alboran Sea	4	1	6	24	28
	5 Transects Balearic Sea	4	1	6	24	28
IMEDEA (CSIC-UIB)	Bahia Palma, Sóller, Cabrera	6	0.5	4	24	27
TOTAL Examples		**14**	**2.5**	**16**	**72**	**83**
Regional Total		**41**	**7**	**34.5**	**118**	**143**

Table 4: Sample of proposed SOCIB and external oceanographic campaigns and operations, does not include repairs or weather contingency

Operation and crew costs are considered from launch in 2012 and include sea trial operations, the crew will be contracted through a specialised agency starting

[15] Such as: DG Emergencias, DG Pesca, DG Medi Ambient

[16] Electricity cables (ENDESA, REE), communication cables (MOVISTAR, ISLALINK), pipelines (EMAYA, Gas Natural), environmental consulting

[17] The CYPSA costs are based on an estimate of 150 days at sea and so have been adjusted to take this into consideration in terms of the fuel costs

from early 2012. 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.

It is anticipated that income will be gained from externally funded operations based on the annual costs divided by the number of operational days to cover fuel, crew, victuals and other maintenance costs.

Budget 1a) 150 days operation & original SOCIB cost estimates (3 crew)

The budgets below are as presented in the SOCIB Implementation Plan, excepting that the number of crew has been reduced from 4 to 3.

Scenario 1a)

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	195,000	195,000	195,000	654,965
Income	0	0	0	154,197	252,322	252,322	658,841

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	35,000	35,000	35,000	105,000
Project engineer	0	23,322	46,643	0	0	0	69,965
Subtotal	0	23,322	46,643	195,000	195,000	195,000	654,965
Income							
External Operations	0	0	0	154,197	252,322	252,322	658,841
Subtotal	0	0	0	154,197	252,322	252,322	658,841

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	1.0	1.0	1.0
Project engineer	0.0	0.5	1.0	0.0	0.0	0.0
Subtotal	0.0	0.5	1.0	3.0	3.0	3.0

Summary 1a)

Taking figures from 2013, when full operational capacity is achieved and the cost levels can be assumed to be stable, it can be seen that the annual cost of operations and personnel for 150 days and with the SOCIB cost base is estimated at 420,537 €, which gives a daily cost of operations of 2,804 €.

This represents a small reduction (1 crew less) of approximately 35,000 €/annum.

Budget 1b) 150 days operation & revised CYPSA cost estimates

The budgets below are based on the CYPSA cost estimates.

Scenario 1b)							
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	87,131	92,911	112,505	323,748
Personnel	0	23,322	46,643	89,610	89,610	89,610	338,795
Income	0	0	0	66,924	109,513	109,513	285,950

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	58,781	58,781	78,375	195,938
Maintenance	0	0	0	0	5,780	5,780	11,560
Insurance	0	0	0	23,850	23,850	23,850	71,550
Victuals	0	0	0	4,500	4,500	4,500	13,500
Port Fees	0	0	0	5,931	5,931	5,931	17,793
Subtotal	7,200	12,000	12,000	87,131	92,911	112,505	323,748
Personnel							
Captain	0	0	0	31,943	31,943	31,943	95,829
Chief Engineer	0	0	0	31,943	31,943	31,943	95,829
Marinero	0	0	0	25,724	25,724	25,724	77,172
Project engineer	0	23,322	46,643	0	0	0	69,965
Subtotal	0	23,322	46,643	89,610	89,610	89,610	338,795
Income							
External Operations	0	0	0	66,924	109,513	109,513	285,950
Subtotal	0	0	0	66,924	109,513	109,513	285,950

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	1.0	1.0	1.0
Project engineer	0.0	0.5	1.0	0.0	0.0	0.0
Subtotal	0.0	0.5	1.0	3.0	3.0	3.0

Summary 1b)

Taking figures from 2013, when full operational capacity is achieved and the cost levels can be assumed to be stable, it can be seen that the annual cost of operations and personnel for 150 days and with the CYPSA cost base is estimated at 182,521 €, which gives a daily cost of operations of 1,217 €.

6.2.2 Scenario 2: 60 days of operations plus maintenance in dock

A total of 60 days of operation per annum is considered to be a "worst case" funding scenario. This covers the annual SOCIB requirements and therefore the new SOCIB R/V is used only for SOCIB observing, monitoring and technology development projects without any need for external use or funding. When the vessel is not in use it is maintained by SOCIB to a high standard and remains on the dock.

Two budget options are developed:

2a) 60 days & SOCIB costs (3 crew) and

2b) 60 days & CYPSA costs,

Operation and crew costs are considered from launch in 2012 and include sea trial operations, the crew will therefore be contracted through a specialised agency starting from early 2012. However in Scenario 2 the costs of operation are reduced to reflect the reduced number of days of operation where appropriate, e.g. crew, fuel, victuals etc. While in dock the R/V is maintained by the minimum crew required to ensure that the vessel is maintained to a high standard at all times. The operational and personnel costs of maintaining the SOCIB R/V vessel in dock are taken from the CYPSA Maintenance Cost Report and are 6,074 € a month.

The Captain and Chief Engineer are responsible for the safe running of the vessel during the days of operations 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.

No income is considered in this scenario.

Budget 2a) 60 days operation & original SOCIB cost estimates (3 crew)

The budgets below are as presented in the SOCIB Implementation Plan, excepting that the number of crew has been reduced from 4 to 3 and 60 days of operations at sea with 10 months maintenance in dock.

Scenario 2a)

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	177,483	216,213	216,213	641,108
Personnel	0	23,322	46,643	78,000	78,000	78,000	303,965
Income	0	0	0	0	0	0	0

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	66,830	66,830	66,830	200,491
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	8,400	8,400	8,400	25,200
Maintenance in dock	0	0	0	61,752	61,752	61,752	185,257
Subtotal	7,200	12,000	12,000	177,483	216,213	216,213	641,108
Personnel							
Captain	0	0	0	32,000	32,000	32,000	96,000
Chief Engineer	0	0	0	32,000	32,000	32,000	96,000
Marinero	0	0	0	14,000	14,000	14,000	42,000
Project engineer	0	23,322	46,643	0	0	0	69,965
Subtotal	0	23,322	46,643	78,000	78,000	78,000	303,965
Income							
External Operations	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0

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	60	60	60
Sea trials	0	0	0	35	0	0
Permanent SOCIB	0	0	0	25	60	60
External Operations	0	0	0	0	0	0
Subtotal	0	0	0	60	60	60
Days at sea	0	0	0	60	60	60
Months in dock	0	0	0	10	10	10
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	1.0	1.0	1.0
Project engineer	0.0	0.5	1.0	0.0	0.0	0.0
Subtotal	0.0	0.5	1.0	3.0	3.0	3.0

Summary 2a)

Taking figures from 2013, when full operational capacity is achieved and the cost levels can be assumed to be stable, it can be seen that the annual cost of operations and personnel for 60 days and with the SOCIB cost base is estimated at 294,213 €, of which 61,752 € is for maintenance of the R/V in dock, this gives a daily cost of operations of 4,904 €.

Budget 2b) 60 days operation & revised CYPSA cost estimates

The budgets below are based on the CYPSA cost estimates for 60 days of operations at sea with 10 months maintenance in dock.

Scenario 2b)

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	129,202	134,982	134,982	430,367
Personnel	0	23,322	46,643	35,844	35,844	35,844	177,497
Income	0	0	0	0	0	0	0

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	41,800	41,800	41,800	125,400
Maintenance	0	0	0	0	5,780	5,780	11,560
Insurance	0	0	0	23,850	23,850	23,850	71,550
Victuals	0	0	0	1,800	1,800	1,800	5,400
Maintenance in dock	0	0	0	61,752	61,752	61,752	185,257
Port Fees	0	0	0	5,931	5,931	5,931	17,793
Subtotal	7,200	12,000	12,000	129,202	134,982	134,982	430,367
Personnel							
Captain	0	0	0	12,777	12,777	12,777	38,332
Chief Engineer	0	0	0	12,777	12,777	12,777	38,332
Marinero	0	0	0	10,290	10,290	10,290	30,869
Project engineer	0	23,322	46,643	0	0	0	69,965
Subtotal	0	23,322	46,643	35,844	35,844	35,844	177,497
Income							
External Operations	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0

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	60	60	60
Sea trials	0	0	0	35	0	0
Permanent SOCIB	0	0	0	25	60	60
External Operations	0	0	0	0	0	0
Subtotal	0	0	0	60	60	60
Days at sea	0	0	0	60	60	60
Months in dock	0	0	0	10	10	10
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	1.0	1.0	1.0
Project engineer	0.0	0.5	1.0	0.0	0.0	0.0
Subtotal	0.0	0.5	1.0	3.0	3.0	3.0

Summary 2b)

Taking figures from 2013, when full operational capacity is achieved and the cost levels can be assumed to be stable, it can be seen that the annual cost of operations and personnel for 60 days and with the CYPSA cost base is estimated at 170,826 €, of which 61,752 € is for maintenance of the R/V in dock (10 months), the gives a daily cost of operations of 2,847 €.

6.3 Conclusions from Operation and Personnel Cost Analysis

In this section we first present a summary from the different operations and personnel costs scenarios from section 6.2 and second discuss the SOCIB funding capability to cope with the different costs scenarios in the frame of the SOCIB budget framework as described in the Implementation Plan (Annex 13.15).

A summary of the annual costs associated with the scenarios and budgets outlined in, 1a), 1b), 2a) and 2b) is shown below:

Scenarios	Operations	Personnel	Total Maintenance per annum (1)	Cost per days operational days
SOCIB Implementation Plan April 2010	225,537	230,000	455,537	3,037
Scenario 1a) 150 days + SOCIB cost base	225,537	195,000	420,537	2,804
Scenario 2a) 60 days + SOCIB cost base	216,213	78,000	294,213	4,904
Scenario 1b) 150 days + CYPSA revised cost base	92,911	89,610	182,521	1,217
Scenario 2b) 60 days + CYPSA revised cost base	134,982	35,844	170,826	2,847
(1) Figures are from 2013				

Table 5: Comparison of annual maintenance costs based on the two scenarios and the 'upper' (SOCIB) and 'lower' (CYPSA) cost bases

We can see that the annual cost of maintaining the proposed SOCIB R/V has been significantly reduced and under the different scenarios cover a range from 420,537 € to 170,826 €

With regard to SOCIB budget available for vessel operation (operations, maintenance and personnel), as described in the SOCIB Implementation Plan presented to the Board of Trustees on April 7, 2010, there is approximately 182,215 € of SOCIB funds allocated for the operations and personnel of the SOCIB R/V Facility (assuming no income from external operations at all). In addition there is a total of 95,000 € per annum allocated to vessel operations in SOCIB Observing Facilities that require vessel based activities, such as deployments, surveys and maintenance of instruments etc.

SOCIB Implementation Plan April 2010	Per annum (1)
Coastal Ocean R/V Facility Budget	
Operations and Personnel Costs	455,537
Income from external operations (shiptime)	273,322
Net SOCIB funding R/V operations and personnel	182,215
Additional Budget for vessel operations	
Office of the Director - Focused Research Programme (shiptime)	32,000
Glider Facility (fuel)	15,000
Drifter Facility (shiptime)	12,000
Mooring Facility (fuel)	6,000
Beach Monitoring (survey)	30,000
Subtotal additional funding	95,000
Total SOCIB budget available for vessel operations	277,215
(1) Figures are from 2013	

Table 5: Existing SOCIB Funds available for ship operations, as outlined in the SOCIB Implementation Plan, April 2010

Therefore, the SOCIB budget available for vessel operations in support of all SOCIB activities, assuming no income from external sources, is 277,215 €.

This means that even if the 'upper' boundary of vessel operational costs in the "worst case" funding scenario is considered (2a) of 294,213 €, then the funding available for vessel operation, 277,215 €, is within a reasonable amount (approximately 17,000 €) of covering the costs of the 60 days operation. That is to say, and taking into account the likely reduction in costs as indicated by the CYPSA Report, the funds already budgeted for vessel operations will adequately cover the costs of operating the vessel for the 60 days of SOCIB missions and for the vessel to be maintained to a high standard in dock when not in use.

If, as anticipated, costs can be reduced towards the CYPSA cost base then SOCIB can comfortably cover the costs of the "worst case" funding scenario (2b) and should be able to consider funding both its own operations and some external research operations. As under the CYPSA cost base (1b), the funds already budgeted for vessel operations, 277,215 €, cover the costs of running the vessel for 150 days, 182,521 €.

This is a significant conclusion as it suggest that as SOCIB drives the costs of operation down towards the levels suggested in the CYPSA Maintenance Cost Report that it would be able to offer a limited amount of funded 'open access' ship-time to external organizations or offer a reduced operating cost rate for partner organizations.

We have shown that under a "worst case" funding scenario (i.e. no income from external funding at all), existing SOCIB budgets are sufficient to guarantee SOCIB R/V missions at sea and sound maintenance of the vessel in dock.

7. Implementation Timetable (updated June 2010)

It is anticipated that the tender process will commence during July 2010 and will take 7 months, as outlined below. Construction is foreseen as commencing in February 2011 with sea trials of 3 months in early 2012, with the new SOCIB R/V commissioned and monitoring operations to initiating in April/May 2012.

	Months	Accum. Months
Tender Process		
Decision process	1	1
Preparation of tender	2	3
Preperation of public call BOE and DOCE	0.5	3.5
Publication of the call	0.5	4
Opening proposals and review process	2	6
Contract signed	1	7
Construction	12	19
Sea Trials	2	21
Delivery	1	22

Table 7: R/V tender process and construction timescales

8. Navigation in the Mediterranean (additional June 2010)

A study by CYPSA of sea conditions across all months of the year in the Mediterranean Sea, using data from buoys, indicates that the proposed R/V Manta-type design is adequate and sufficient in terms of safety and stability to cope with navigation in the Mediterranean under all conditions.

The study indicated that there are no months in the year when the significant wave height could induce a resonance in pitch and roll of the modern catamaran design that would near the critical value ($\mu/L = 1.4$) when the safety and stability of the vessel would be compromised. See Annex 13.2 for the detailed report.

This fast, modern Catamaran design (Technicraft Design Ltd) is therefore safe for navigation in the Mediterranean Sea.

9. The R/V Management Model (additional June 2010)

The proposed SOCIB coastal ocean research vessel can be seen as part of the much needed European wide initiative towards systematic and long-term monitoring of the global ocean (GMES), an issue that is of particular importance in the Mediterranean and Black sea basins where intense development and exploitation resulted in significant changes to fragile natural resources. See Annex 13.7 an EC 2011 call 'The Ocean of Tomorrow – joining research forces to meet challenges in ocean management', Topic 3 relevant for the operation of regional research vessels (OCEAN.2011-3).

A recent European Science Foundation Report (Position Paper 10: European Ocean Research Fleets, March 2007, see Annex 13.6) outlines how regional and ocean research vessel ship-time could be integrated at a European level. It is worth noting from this document that there is an envisaged shortage of regional research vessels due to aging of the existing fleet and that the elements of coordination proposed by SOCIB are in line with those proposed within the report, for example use of the SOCIB research vessel as a regional tool for advanced operational oceanography, cross-compatibility of equipment and publishing of availability of ship time for outside projects etc.

The coordination between this ship and other research vessels within the framework of the Spanish scientific fleet (mainly IEO and CSIC operated) is also important, and SOCIB is mentioned in the recent MICINN analysis of the management of the coastal ocean research vessel fleet, see Annex 13.3.

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 this a new modern coastal ocean research vessel.

Further work has been undertaken to define the needs of additional regional institutes with oceanographic research operations within Balearic Sea, see Annex 13.4 responses from regional institutes with details of the needs and types of operation that they are interested in conducting using the a modern SOCIB catamaran coastal ocean research vessel. A scientific and technical working group will be launched once decision is taken, to tailor equipments distributions, labs setups, etc. in response to these needs.

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 (related retirement from operations of existing old fleet) have also been explored and can be discussed further once the general lines of the SOCIB R/V are approved.

10. SOCIB R/V Working Group (additional June 2010)

- Joaquín Tintoré, Director ICTS SOCIB.
- Mario Manriquez Landoff, Director Técnico, Unidad de Tecnología Marina, UTM. CSIC. SOCIB R/V Project Manager.
- Luis Ansorena, UTM. Technical coordinator CSIC
- José I. Díaz, Coordinador Equipamiento Científico, IEO Santander. Technical coordinator.
- Benjamín Casas Pérez, Técnico Superior, Instrumentación Oceanográfica, IMEDEA. CSIC

In addition to the team above, a Naval Engineer will be appointed from Sept 2010 for 1.5 years, to oversee and manage the tender, contract, construction and sea trials of the SOCIB R/V full-time, reporting to the Project Management Team.

11. Risk Analysis (additional June 2010)

The identification of an advanced coastal ocean R/V, that is as flexible as possible for the type of navigation and varied operations carried out in the Balearic Sea region, both now and into the future, is a challenge, the construction, commissioning and operation of such a vessel also carries risk.

In Table 8 below a summary of specific risks associated with the SOCIB coastal ocean research vessel are assessed and mitigation strategies outlined. The risks are identified as

1) short-term risks associated with the Design and Construction phase and

2) longer-term risks associate with Operational phase.

Risk	Likelihood Rating	Impact Rating	Net Risk Assessed	Mitigation of Risk
Design and Construction phase:				
Delays in construction	Possible	Moderate	Low	Payment is tied to meeting construction deadlines, with penalties incurred for delays.
Construction quality not as expected	Possible	Low	Low	The shipyards will be assessed before contracts are awarded and construction overseen throughout by a specific marine engineer contracted by SOCIB for this purpose, in addition the SOCIB R/V working group has previous experience in research vessel construction.
Price changes in equipment	Highly likely	Low	Low	Effort has been made to secure accurate pricing, however over the course of construction some prices will rise and some will fall. The contract will contemplate the contingency.
Ship yard does not complete task due to insolvency or similar	Low	Low	Low	The choice of shipyard important in this respect, a contract that indicates the contingency in such a case

Risk	Likelihood Rating	Impact Rating	Net Risk Assessed	Mitigation of Risk
Operational phase:				
Equipment failure	Highly likely	Low	Low	Wear and tear, general management of contingencies
R/V under utilized as a regional tool for oceanographic research	Unlikely	High	Moderate	Pre-specification discussions with oceanographic research institutions to ensure compatibility with current operations, SOCIB aims to enter into agreements regarding ship-time with identified regular users. Finally if ship-time remains available then there are other commercial and government applications foreseen.
Accident at sea	Possible	High	Moderate	Adequate insurance
Changing needs and priorities of the marine community	Likely	Moderate	Moderate	This is addressed through scientific steering committee and ongoing dialogues with regional research institutes, the Spanish Oceanographic Fleet management and awareness of European priorities.
Changing needs and priorities of society	Unlikely	Low	Low	This is addressed through SOCIB in the work of the Office of the Director
Continuity of funding for SOCIB operations	Unlikely	High	Moderate	The current economic uncertainties mean that a temporary reduction in SOCIB operational funding could be possible. This would impact the SOCIB operation of the vessel. If all operations are affected the monthly cost of mooring and maintaining the R/V for a temporary period are low and can be considered within the general SOCIB operational costs.

Table 8: Risk analysis and mitigation strategy

The above table outlines the risks of implementing the SOCIB R/V Project, however there are also risks associated with not implementing the project, these are briefly outlined below:

1. Regional oceanographic science, technology development and strategic applications will be more limited and more costly: a modern coastal ocean research vessel is required in the region as none currently exists and there is a need to maintain long-term oceanographic monitoring (IEO until now only, and from now on, also SOCIB) and to facilitate advanced operational oceanographic research and technology development.
2. Loss of opportunity to support Spanish shipbuilding industry: it has been shown that commissions of advanced vessels acts as an impetus to further projects from outside sources.
3. Spain could fall behind other European nations who are investing in such modern, advanced and more economic research vessels, e.g. NERC in the UK, Ocean of Tomorrow Calls EU, etc.
4. Failure to take profit of the opportunity to create a collaborative platform for the various research organizations of the region (UIB, IEO and CSIC mostly) entails loss of coordination, efficient use of public finds and cross fertilization of ideas that this type of project entails.

12. Summary (updated June 2010)

A Coastal Ocean R/V represents a major infrastructure investment and is one of the flagships for the Balearic Islands Coastal Observing and Forecasting System, SOCIB.

A fast catamaran hull with overall length of approximately 24 m (less than 24 m registered LOA) is proposed as this design maximizes space for both scientific operations (wet and dry laboratories, aft platform etc.) and accommodation (crew and scientists/technicians), whilst offering high speed capabilities and manoeuvrability, essential for flexible and efficient operations in the Balearic Islands environment (4 islands, 1.200 km of coastline) and Mediterranean Seas.

A proposed design solution from Teknikraft Design Ltd, offers a sound design in terms of space, speed, high fuel efficiency, low wake wash energy, excellent sea keeping, stability. The 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 and fuel efficiency due to hull shape mean operational costs are also kept at a minimum.

An external analysis of the costs has been presented and different scenarios of operations have been analysed, in the frame of the general SOCIB budget presented to the Board of Trustees on April 7, 2010 that remains unchanged. In this frame, we have shown that under a worst case funding scenario (i.e. no income from external funding at all), existing SOCIB budgets are sufficient to guarantee SOCIB R/V missions at sea for 60 days and sound maintenance of the vessel in dock.

Institutions involved in marine and coastal research in the Balearic Islands and adjacent regional seas 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 coming years and thus far a high level of interest and support is indicated, suggesting that the proposed new SOCIB Research Catamaran has the potential to make a significant contribution to regional oceanographic research.

13. Annexes:

(Available at SOCIB data repository, http://repository.socib.es)

New Reports (June 2010)

13.1 External Report on Operations and Maintenance Costs, 7 pp.

Title: Costes de Mantenimiento Catamarán Oceanográfico SOCIB REV-A.

13.2 External Report on Navigation in the Mediterranean Sea, 3 pp.

Title: Navegabilidad en el Mediterráneo Catamarán Oceanográfico SOCIB.

13.3 Management Strategy of the coastal oceanographic fleet: MICINN, 11pp.

Title: Análisis para un Modelo de Gestión de la Flota Costera.

13.4 Letters of support for SOCIB R/V, 6pp.

Title: Letters of support

13.5 Video presentation of R/V Manta Ships Design

Title: http://www.youtube.com/watch?v=4Vkj2G1N4hk

Title: http://www.allamericanmarine.com/videos/

13.6 ESF Report on European Research Vessel Fleets, 64 pp.

Title: European Ocean Research Fleets. March 2007. Towards a Common Strategy and Enhanced Use.

13.7 EU Coastal Ocean Ship Design priority: "The Ocean of Tomorrow" Call, 2010, 7pp.

Title: EC 2010 Calls/Topic 3, "The Ocean of Tomorrow" Call - Joining research forces to meet challenges in ocean management.

Technical Reports (April 2010)

13.8 NOAA R/V Manta Technical Specification and Contacts, 7pp.

Title: NOAA R/V technical specifications and contacts.

13.9 Feasibility Report 1: CYPSA Ingenieros Navales, 101 pp.

Title: Análisis previo para la Definición de un Buque Oceanográfico para las Islas Baleares - CYPSA Ingenieros Navales, Vigo.

13.10 Feasibility Report 2: CYPSA Ingenieros Navales, 48 pp.

Title: Estudio de Viabilidad Catamarán Oceanográfico SOCIB, REV 1 (26/03/2010).

13.11 Feasibility Report 3: Bilbao Plaza Maritima Shipping (BPMS), 96 pp.

Title: Análisis previo para la definición de un catamarán con fines oceanográficos que operará en las Islas Baleares - Bilbao Plaza Maritima Shipping (BPMS).

13.12 Teknicraft (NZ) Design Quotation, 12pp.

Title: Design Quotation.

13.13 Teknicraft (NZ) Fuel Efficiency and Performance Comparison, 2pp.

Title: Teknicraft Design.

13.14 Rodman Polyships S.A.U Quotation, 52pp.

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

SOCIB Implementation Plan (April, 2010)

13.15 SOCIB Implementation Plan, 204 pp.

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