Full-Proposal Form

To be submitted by the project coordinator by uploading to the MARTEC server (http://www.martec-era.net/login), in English. A Word or PDF document is required.

MARTEC II
Maritime Technologies II
Trans-national Call for Proposals
Full-proposal to be sent before 30th April 2013 (17:00 Brussels time)

Acronym	CETEX	
Project Title	CETACEANS EXPERIENCES	
MARTEC priority area	Maritime Equipment and Services	
Number of partners in the consortium	2 SMEs 1 RTO (Research and Technology Organisations) Large companies others	
Countries represented in the consortium	☐ Belarus ☐ Germany ☐ Denmark ☒ Spain ☐ Iceland ☐ Finland ☒ France ☐ Lithuania ☐ Norway ☐ Poland ☐ Romania ☒ Turkey ☐ UK ☐ Sweden ☐ Others	
Duration of the project (max. 36 months)	26 months	
Estimated total budget of the project	1.972.311,00 €	
Budget per partner in %	Partner 1 (Coordinator): 64,79% Partner 2: 14,61% Partner 3: 20,60%	Partner 4: % Partner 5: % Partner 6: %

Optional: To avoid conflicts of interest in the evaluation process, you may name the **main direct competitors** to your project:
1) St. Andrews University, Scotland, UK. 2) Brodarski Institut d.o.o., Croatie. 3) Michel Andre, Barcelona, ES 4) Alexandre Gannier, FR 5) Prof. Yvan Simard, Canada (concurrent) 6) Prof. Dawson (New Zeland (concurrent) 7) GIPSA Lab (Gervaise, Iona Cornel, Mars Jerome), Grenoble, FR (concurrent) 8) Centre oceanographique de La Rochelle, France **Note:** The Team CETEX studied and prepared a document for rationale of listing above organizations. This document can be submitted upon request.

Partner 1 = Coordinating the project consortium					
Name of the organisation	Promatek Denizcilik Teknolojileri ve Muhendislik Cozumleri San. ve Tic. Ltd Sti (PROMATECH Maritime Technologies)				
Type	☒ SME ☐ Large company ☐ RTO ☐ Other (Please, specify)				
Branch/Sector	Maritime Industry, Ship Building, Information & Communication Technology				
Country	Turkey	**Postal code**	34469	**Town**	Istanbul
Street name, number	ITU Ayazaga Kampusu KOSGEB Teknoloji Gelistirme Merkezi A BLOK NO 27 Maslak ISTANBUL				
Phone:			**Fax:**		
Contact person	Ms: ☐ Mr: ☒	First name:	Ahmet	Family name:	Bilici
Function:	Managing Director		Phone:	+90 532 420 29 19	
E-Mail:	ahmet.bilici@promatech.com.tr		Fax:	+90 216 361 44 86	

Activity:

Promatech was established in 2010 with an approved R&D project by KOSGEB (Government) in Turkey. Promatech is a research and development (R & D) company that conducts activities for the maritime industry. The company also carry on R & D projects for software technologies and engineering solutions needed by the maritime industry.

• Our Core business:

.Delivery of efficient and effective services and developing software, systems and hardware solutions for maritime and ship building industry.

• Expertise:

. Maritime Technology and Ship Building solutions,

. Systems Engineering solutions for Green & Alternative Energy

. Information & Communication Systems

Date of creation of the company: 11.11.2010

Number of employees	6	Number of employees in R&D	5

Web page: www.promatech.com.tr

Economic/financial data:

Reference year:	2010	2011	2012
Turnover (k€):	0,00	38,71	69,23
Balance sheet (k€):	38,80	87,34	230,16

Share capital(%): 100 National ______ Foreign

______ Public 100 Private

Ownership from a non-SME: ☐ Yes ______ (%) ☒ No

Partner 2 : MS					
Name of the organisation	Marine Signals, Sociedad Limitada				
Branch/ Sector	Marine sector. Telecommunication and Software Technologies				
Country	Spain	**Postal code**	35017	**Town**	Las Palmas de Gran Canarias
Street name, number	Ed Polivalente II del PCyT del Campus de Tafira s/n				
Phone:	+34 928 454 953			**Fax:**	+34 928 457 088
Contact person	Ms: ☐ Mr: ☒	First name:	Francisco	Family name:	Concepción
Function:	CEO		Phone:	+34 628 136 487	
E-Mail:	info@marinesignal.com		Fax:	+34 928 457 088	

Activity:

Science and Technology applied to Innovation in the marine environment.

Design, development, production and marketing of technological products. Software implementation and Hardware integration. Provision of value-added technology services.

Date of creation of the company:

Number of employees	4	Number of employees in R&D	2

Web page: www.marinesignal.com

Economic/financial data:

Reference year:	2010	2011	2012
Turnover (k€):	0,00	0,00	32,61
Balance sheet (k€):	0,01	10,46	53,37

Share capital (%): 100 National ______ Foreign

______ Public 100___ Private

Ownership from a non-SME: ☐ Yes (%) ☒ No

Partner 3 : USTV					
Name of the organisation	Univ. Sub Toulon Var (USTV)				
Organisation type	☒ Public organisation ☐ Private organisation ☐ Part public / private; please specify the % share of public vs. private funds:				
	☒ University / Higher Education ☐ Research Centre ☐ Technical Centre ☐ Private company ☐ Other; please specify: ………				
Name of the research department	Lab. Sciences de I´formation et des Systèmes UMR CNRS 7296				
Country	France	**Postal code**	20132-83957	**Town**	Toulon
Street name, number	avenue de l'université, la Garde				
Phone:	+33 4 94 14 20 00			**Fax:**	+33 4 94 1428 97
Contact person	Ms: ☐ Mr: ☒	First name:	Hervé	Family name:	Glotin
Function:	Professor and research		Phone:	+33 4 94 14 28 24	
E-Mail:	glotin@univ-tln.fr		Fax:		
Activity: Bioacoustics and auditory scene analysis ; multiple sources tracking ; multiple whale tracking ; machine learning for bioacoustics ; computer sciences ; signal processing					
Number of employees / staff in the R&D department			200 in LSIS lab / 16 in the concerned department		
Web page: lsis.org ; of the contact person : http://glotin.univ-tln.fr					

Costs and Financing

Project Estimated Costs in K€	2014	2015	2016	**Total:**	**Funded costs (expected)**	**Own contribution (estimated)**
Partner 1 (Coordinator):	761,88	451,53	64,48	1277,89	958,42	319,47
Partner 2:	101,76	160,70	25,60	288,06	216,05	72,02
Partner 3:	193,48	117,82	95,07	406,36	164,68	241,67
Total project estimated costs:	1057,12	730,04	185,15	1972,31	1399,15	633,16

Project estimated costs per partner: Partner number **1. Promatech**		**Costs have to be listed with or without VAT according to the national/regional funding rules (eligible costs) of your country:** ☒ costs are listed without sales taxes ☐ costs are listed with sales taxes			
		2014	2015	2016	**Total:**
Project estimated costs per partner [1] in K€	Personnel	338,89	338,89	56,48	734,27
	Overheads				
	Travel & subsistence	6,00	12,00	8,00	26,00
	Material & Supply	144,00			144,00
	Equipment	73,00			73,00
	Depreciation and rent, leasing				
	Other costs[2]				
	Subcontracting costs[3] (except R&D)	199,99	100,64		300,63
	Total costs/partner	761,88	451,53	64,48	1.277,89

1 Costs: A more detailed cost breakdown (e.g. list of equipment) may be required by the national/regional funding agency of your country.
2 Other costs: e.g. patent costs
3 Please specify what kind of subcontracting

Project estimated costs per partner: Partner number 2. Marine Signals		Costs have to be listed with or without VAT according to the national/regional funding rules (eligible costs) of your country: ☒ costs are listed without sales taxes ☐ costs are listed with sales taxes			
		2014	2015	2016	**Total:**
Project estimated costs per partner[1] in K€	Personnel	60,70	82,20	12,45	155,35
	Overheads	12,14	16,44	2,49	31,07
	Travel & subsistence	3,60	12,60	5,60	21,80
	Material & Supply	0,60	1,50	0,30	2,40
	Equipment	7,40	8,40		15,80
	Depreciation and rent, leasing	0,42	1,86	0,46	2,74
	Other costs[2]	0,90	2,70	0,30	3,90
	Subcontracting costs[3] (except R&D)	16,00	39,00		55,00
	Total costs/partner	101,76	164,70	21,60	288,06

1 Costs: A more detailed cost breakdown (e.g. list of equipment) may be required by the national/regional funding agency of your country.
2 Other costs: e.g. patent costs
3 Please specify what kind of subcontracting

Project estimated costs per partner: Partner number **3. USTV**		**Costs have to be listed with or without VAT according to the national/regional funding rules (eligible costs) of your country:** ☐ costs are listed without sales taxes ☒ costs are listed with sales taxes			
		2014	2015	2016	**Total:**
Project estimated costs per partner[1] **in K€**	Personnel	131,31	91,35	74,22	296,88
	Overheads	26,26	18,27	14,84	59,38
	Travel & subsistence	8,20	8,20	3,00	19,40
	Material & Supply	7,30	0	0	7,30
	Equipment	20,40	0	0	20,40
	Depreciation and rent, leasing	0	0	0	0
	Other costs[2]	0	0	3,00	3,00
	Subcontracting costs[3] (except R&D)	0	0	0	0
	Total costs/partner	193,48	117,82	95,07	406,36

1 Costs: A more detailed cost breakdown (e.g. list of equipment) may be required by the national/regional funding agency of your country.
2 Other costs: e.g. patent costs
3 Please specify what kind of subcontracting

Project Description

1. Project objectives

1.1. Summary

Whale-watching is a growing sector and currently includes about 20 million users and a global turnover of more than 60 million euros/year. However, the companies working in the sector are subject to high expenditures due to uncertainties related to cetacean distribution and low detectability rates of the animals, leading to high fuel consumption, high crew costs and bad professional reputation due to unsuccessful trips and low-quality sightings. The current systems of operation, in which whale-watching operators follow each other to the same observation place, lead to high pressure of whale-watching companies sharing a single whale-watching area on a single animal or group of animals.

The main goal of CETEX project is producing an innovative system, hereafter will be called CETEX system, which will allow the whale-watching boats to detect and follow cetaceans to minimize the search and maximize the observation times. At the same time CETEX system will help reduce the human impacts on cetaceans and provide a monitoring platform ensuring the long-term sustainability of the whale-watching activities. The core of the CETEX system will be Autonomous Surface Vehicles (ASVs), easily deployable from a whale-watching boat, with an integrated automatic and passive acoustic monitoring system incorporating innovative electronic, software and mechanic solutions.

In Marine Protected Areas (MPAs) this operating system is in contradiction with whale-watching regulations implementation, and globally it is endangering the long-term sustainability of the whale-watching itself due to the impacts of populations of cetaceans which are of whale-watching interest. CETEX system will help reduce the human impacts on cetaceans and provide a monitoring platform ensuring the long-term sustainability of the whale-watching activity. Since the whale-watching industry has high initial investments (boat and skilled crew), the operators are interested to achieve this goal.

1.2. General objectives

CETEX will result in the development and the production of a prototype of a system able to independently detect cetaceans, localize them and give a prediction on their movement. CETEX will be designed for remote communication of the ASVs with embedded computations and communications, with the use of robust and low electric supply Digital Signal Processing (DSP). In this system, standard Digital Signal Processing (DSP) at a 48 kHz Frequency Sampling (FS) rate and 16 bits resolution will be used. The USTV's ONCET system has already been successfully processed with these parameters (Please find reference and demo at http://glotin.univ-tln.fr/oncet). The ASVs will be able to perform tasks via electronic control system and communications and be able to produce and store its own energy from the environmental energy sources; i.e. wind, solar power, or waves.

The deployment, operation and pick-up system of the product can be adjusted to the needs of the whale-watching operators worldwide, herewith its additional features will enhance its usability across other sectors. Marine protected areas will be able to make use of the whale-watching pressure regulation enabled by the system, and cetacean research groups can use the product as a passive acoustic monitoring system due to the specific acoustic processing and analysis software, developed in this project. Also boat-whale anti-collision project based on visual only like REPCET would be enhanced in CETEX project. Figure 1 provides a concept diagram for the use of the ASVs.

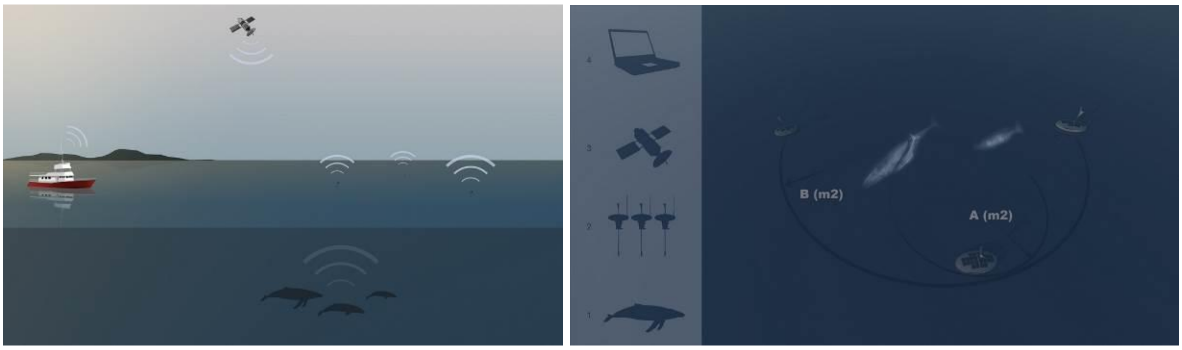

Figure 1: Concept Diagrams for the use of ASVs in Whale Watching Activities.

1.3. Scientific and technological aims of the project

The scientific aims of the project can be summarized as follows: CETEX project is primarily designed for the global whale-watching market, where it can increase the benefits on the short term by reducing costs and the level of customers' satisfaction, and on the long term by making the whale-watching activities more sustainable during prolonged periods of time. The whale-watching operating in the MPAs would be provided with the search and operational mode of the system based on the conservation regulations of the specific area, ensuring the implementation of regulations, a maximum output for the operators, and minimum impact on observed species.

From technological perspective, CETEX ASVs will be designed to be light-weight that allows for carrying and launching by boat personnel and to be shaped ensuring easy deployment and storage on a whale-watching boat, and on the other hand by hydro-dynamic and navigational properties and the mounted instrumentation. An optimum trade-off between the energy expenditure, autonomy and movement possibility will be reflected on the design of the ASV, its thrust system, auxiliary system of energy production, energy storage and energy distribution. The passive acoustic system will be developed, designed in accordance with the desired detection of a wide range of cetacean species from short to medium distances. The accompanying acoustic software will encompass the development of the algorithms for 3D cetacean localization. Software will allow the operators to decide the optimal trip strategy even before the beginning of the trip and allowing advanced trip planning will be developed. Data storage system will allow saving and easy download of acoustic and environmental data. A smartphone application will be developed for the users to receive the information on detected

cetaceans, with navigation directions, operating mode menu and the monitoring information on the state and location of ASVs. The deployment, use and maintenance of systems will be tested in a range of operating conditions and its performances adjusted accordingly.
The obtained prototype will consist of a modular system of ASVs, where 3 vehicles will make 1 operational unit, equipped with a passive acoustic system. This acoustic system will specifically be developed specifically for the needs of this project. The ASV design will incorporate innovative solutions for alternative energy production, mobility and independence. Determining the best hydrophone configuration to better capture the cetacean sounds from an ample range of species and its integration in the vehicles will be object of this project. Furthermore, a software for the analysis of the acoustic signals will be developed. This software will process the sound and detect following: the cetacean species, the cetacean 3D position even with multiple animals and species, give statistics on cetacean presence, an estimation of cetacean behavior, and an estimation for cetacean density.

CETEX will be designed for remote communication of the ASVs with embedded computations, thus will utilize robust and low electric use of DSP. The DSP in CETEX is the BeagleBoard mini PC under robust LINUX system, already used by USTV in DECAV project, with its native audio stereo DSP FS=48Khz. This system can be described as follows: For each of the 3 ASVs, there will be a 'Slave' Hydrophone (SH) integrated into the keel of the ASV, and a 'Master' Hydrophone (MH) connected to a cable to be immerged down to -45 meters. The MH will allow robust detection of the target species because it is under the thermocline. Then recordings from SH (with lower Signal to Noise Ratio than MH because of the boat noise and thermocline) will be processed according to the detections computed from MH. It results in a precise datation of the detection at a precise hydrophone localization (SH has localization is given by the GPS), and a robust 2D localization of each cetacean using ONCET (USTV patent http://glotin.univ-tln.fr/oncet). Eventually, the reflections to the surface recorded by MH, and the distance between SH and MH will be used to estimate the depth of the cetacean, resulting into a 3D localization of each cetacean by ONCET too.

The system for giving information to the boat will involve the development of two software products. The first software product will be used to estimate the optimal distribution of the whale-watching boats in individual sightings in case of multiple boats being in one area, which will allow regulating the whale-watching pressure both in regular whale-watching areas and marine protected areas. The output will be a function of whale distribution, number of boats, and whale-watching regulations valid in the area all this controlled by the given input by the user and the selected operating scenario, which offers a great flexibility to the users. The second software will go beyond giving the actual whale position and will provide an estimation of the position of the individual or a group at a given time, and the closest probable point of encounter with the boat, this by means of predicting the cetaceans' behavior, and position, and monitoring the speed and direction of both the cetaceans and the boat. Any changes in the behavior or speed will be reflected in the outputs in real time, and the user will obtain the GPS coordinates to put into the ships navigation system.

2. State of the art in research and development; own experiences

The goal of the research process is to produce new knowledge or deepen the understanding of specific topics and issues. From the three main existing branches of research methods (exploratory, constructive and empirical), CETEX team will be based mainly on the constructive research method, which tests theories and proposes solutions to problems or questions. Nevertheless, some participants may rely to certain extent on the empirical method, which tests the feasibility of a solution using empirical evidence; or even exploratory method, which helps to identify and define the problems. The constructive method is closer to our needs, since precisely what CETEX team intends is to solve a problem that is patent. In terms of the information search, we face the problems that we intend to cope with through a strict technological surveillance, using several sources of scientific and technological information, in each of the disciplines involved. CETEX team will continue exploiting through the use of scientific and technical search engines such as ISI Web of Knowledge.

2.1 Alternative Solutions:

In this sense, an in-depth research of existing alternatives to the CETEX project revealed only functional alternatives that do not meet the specific needs identified in the whale-watching sector, but no conceptual similarities with our project could be found. We can distinguish between methods that are significantly different from CETEX system in both design and functional outputs.

Alternatives based on different approaches are as follows:

- Visual methods. Traditionally, visual observation methods have been used to find cetaceans since the whaling era, where experienced observers look for cetaceans with or without the aid of binoculars from the high point of the boat or an elevated point on land. However, visual detection is difficult in low visibility conditions which common on the sea, it requires a large effort and the following is disrupted during night hours.
- Visual methods with technological support. Attempts have been made to implement aerial devices supplied with cameras as technological support to visual methods. These solutions are limited by wind speed, the autonomy range of the devices, and relatively small area that can be captured on camera whilst keeping the resolution high enough to detect and identify cetaceans. These are very work-intensive, since the footage must be visually inspected due to the inefficiency of the existing image processing tools.
- Remote sensing. Cetacean distribution can be highly correlated with oceanographic features, such as eddies, in certain areas. Satellite images detecting these features could assign a high probability of cetacean encounter to these areas. The downsides of this method are the uncertainty of the method, limitation to few whale-watching areas, low spatial precision, the question of availability

of updated satellite images and associated costs (http://www.nefsc.noaa.gov/press_release/2012/SciSpot/SS1209/)

- Tagging. Individual tagging devices have been placed on cetaceans enabling their following through satellites in migration and residency research projects. These systems are not suited for whale-watching as the method is intrusive, with direct and indirect risks for the tagged individuals, and due to this requires special permits only given to research projects with application in species conservation. Additionally, the tags are expensive, often drop off the animal after a short time and are lost, specialist team is needed for their deployment and tagged animals might leave the whale-watching area (Please see at http://whale.wheelock.edu/whalenet-stuff/stop.html, and http://www.nwfsc.noaa.gov/research/divisions/cbd/marine_mammal/satellite_tagging.cfm).

Similar alternatives are as follows:

- Network of fixed buoys. A network of fixed position buoys can be set to localize cetaceans on a large scale (each in a certain range). The principal problem is the limitation of the system to shallow areas due to bottom anchoring. Also, in order to cover a wide area, a large number of units are necessary, associated with very high costs (Please see at http://www.listentothedeep.com/acoustics/).
- Towed hydrophones array or addition of hydrophones on to whale-watching boats. This solution presents problems in maneuverability around other boats. Also, possible location ranges are relatively small. Both towed array and hull mounted hydrophones help in tracking cetaceans once on the sea, but cannot be used prior to the trip departure, only cover the area close to the boat itself and are very work-intensive.
- Submerged systems. Many types of Remote Operated Vehicles (ROVs) have been developed, capable of submerging and navigating underwater. However, they are both costly and designed for long range operation between two points and are not suitable for fine small-scale maneuvering, which is needed in whale-watching operations. In addition, they should be pulling a hydrophone array with the same problem as described above. Besides, a solution with several ROVs would imply very high costs.

The Team CETEX developed initial alternative concepts that will be evaluated during the first phase of the project with respect to technical, operational, and environmental requirements generated from the user needs. Figure 2 shows sample of some of this work.

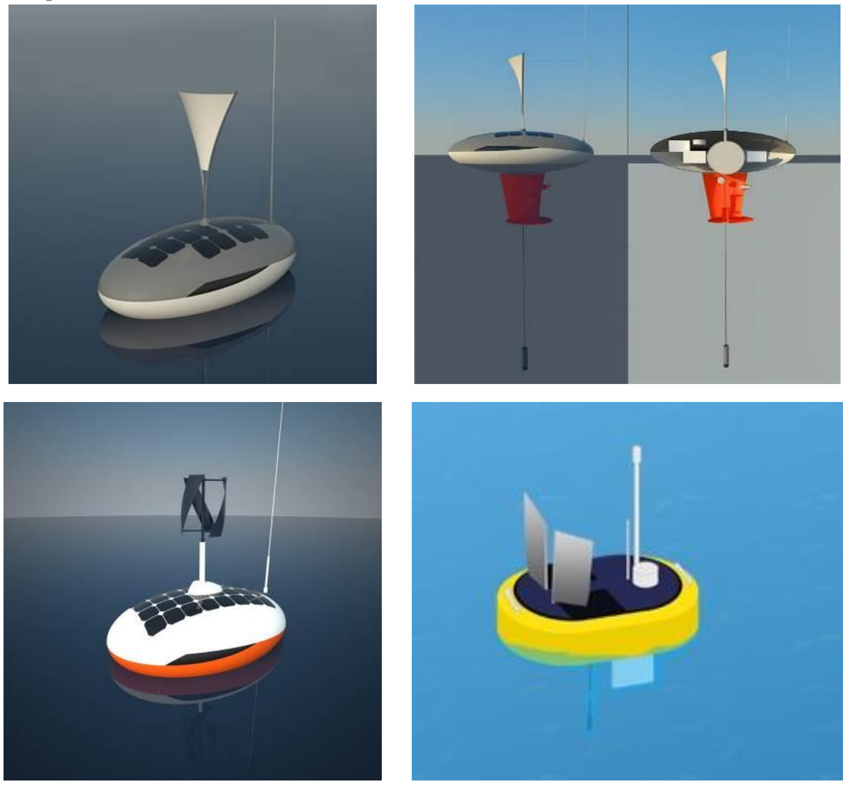

Figure 2: Sample alternative solution studies (Refer to Annex 1 for further details).

In our solution, CETEX system will localize, with their emission range for Wistle (W) or Clicks (C) [Richardson et al.1995 'Marine mammals and noise' Academic Press] (all present in Canaries, *:species also present in PELAGOS Toulon): *Fin whale [0.15,0.75]kHz 150dB re1microPa@1m (W); *Bottlenose Dolphin [0.5,30]kHz 100dB (W); *Spotted Dolphin [4,18]kHz (W); *Common Dolphin [3,50]kHz; *Sperm w. [0.1,30]kHz 220dB (C); *Pilot w. [0.5,8]kHz 180dB (W); Killer w. [5,15]kHz 200dB (W); Humpack w. [0.2,8]kHz 160dB (W); Sei w. [0.5,3]kHz 180dB (W); Bryde's w. [0.15,0.9]kHz 180dB (W); Minke w. [0.1,10]kHz (W); North Atlantic Right w. below 500Hz, sometimes reach 10kHz. Additionally, CETEX will be designed to be extendable with simple USB upgraded DSP to other species like Beluga (artic) emitting aound 100kHz, Porpoise 120kHz, Narwhal 40kHz (artic), *Beaked w. > 25kHz."

2.2 Intellectual property protection rights (IPR)

In order to protect the IPR of participants respect to either background knowledge or previous developments, some of them have been already patented or protected by their original proprietaries. However, the Consortium Agreement to be approved by all Parties will take into account that all individual Background IPR shall remain the property of the Party introducing Background. Each Party shall take responsibility for ensuring that all necessary permissions have been sought to use Background IPR. Each Party will list in an annex in the mentioned Consortium Agreement all its Background IPR.

During the lifetime of the project, each Party granted to the other Party, g free access rights to Background when it is necessary to carry out their work on the project. Such access rights have to be reported to a Steering Group that will be established and whose characteristics will be detailed in the Consortium Agreement.

At the end of the Project access right to Background will not be free and will be negotiated in a specific agreement. The Consortium Agreement does not affect the ownership of any Intellectual Property in any Background or in any other technology, design, work, invention, software, data, technique, know-how, or materials that are not Results.

2.3 Earlier research activities and experience of partners in the proposed field

The project consortium has been formed around a central idea, which was developed by **Marine Signals**, with a continuous and deep relation with whale-watching companies. Another partner is one of the leading groups in bioacoustics and acoustic signal processing in Europe. A leading company in engineering solutions to the marine industry offering innovative solutions in vessel construction and energy production has been also determined as the leader of the project. The global application of the product will be ensured by an active participation of a whale-watching operator, a leading company in its areas of operation with over 20 years of experience. This combination of partners creates a balanced team between the involved European countries (France, Turkey and Spain) and a synergy between the initial idea and the creative inputs to meet final users' needs.

Promatech was established in 2010 with an approved R&D project by KOSGEB (Government) in Turkey. Promatech is a research and development (R & D) company that conducts activities for the maritime and shipbuilding industry. The company also carries on R & D projects for software technologies and engineering solutions needed by the maritime industry. Additionally, Promatech gathered world class personnel to offer state of the art high tech end products in the shipbuilding and maritime industry of EU. Promatech employees developed complex engineering systems in their earlier projects. For example:

Dr. Ismail Cicek, shareholder and Research & Development Manager at Promatech, brings vast of project management experience from his US Air Force experience where he worked as Sr. Systems Integration Engineer for more than 15 years. Dr. Cicek will be the leader of all Promatech's technical activities as well as for the coordination of Team CETEX. Dr. Cicek received MS and PhD diplomas in Mechanical Engineering Department at Texas Tech University, Lubbock, Texas. He worked as a Test Manager and Program Manager for the development of a small tactical unmanned aerial vehicle (UAV) and systems (UAS) at BAE Systems, San Antonio, Texas, USA. He deployed 4 unmanned aerial vehicles and associated systems to US Marine Corps in 2008. This UAV system was delivered to US Marine Corps and used for identification of the "challenging" next generation unmanned vehicle systems. Dr. Cicek's involvement in CETEX Project will be of a great value. Mr. Ahmet Bilici (MSc.), a shareholder and founder of Promatech, has 7 years of expertise in shipbuilding industry. He graduated from Istanbul Technical University (ITU) as Naval Architecture and Marine Engineer and completed his master' degree study. Mr. Bilici is now a PhD. candidate at ITU Maritime Faculty, Tuzla-Istanbul. Mr. Bilici performed research on hull design and he is expert on stability calculations. Promatech has a team of 16 people with various expertise in their areas, including Unmanned Aerial Vehicles (UAV), Remotely Operated Vehicles (ROV), and ASVs. The personnel are from various disciplines, such as Naval Architecture, Industrial, Control Systems, Mechanical, and Manufacturing Engineering. Amongst Promatech's personnel are 2 Ph.D. and 4 MSc graduates. Several of Promatech's employees are current Ph.D. and MSc students. One of whom is Gultekin Avci, who is also the founder of the AUV team of ITU. Promatech employees, including Mr. Avci, currently play a major role in developing AUV for the international 16th RoboSub Competition. A view of the AUV developed by this team is shown below. This vehicle is a completely Autonomous Underwater Vehicle (AUV) carrying an embedded intelligent system that autonomously navigates underwater based on inputs from both image and digital signal processing. This AUV receives input data from its precise sensors like Inertial Measurement Unit, hydrophones and pressure sensor for autonomy. The know-how from AUV development of the Promatech personnel will also of great help for designing an optimized ASV to realize the objectives of the CETEX project.

Figure 3: ITU's AUVTECH Developed for 16th RoboSub Competition. Two of the Current Promatech (Employees are still Team Members; one is Captain and another is System Designer, in this ITU Project)

University of Toulon, has created in department **Laboratoire des Sciences de l'Information et des Systèmes (LSIS)** in 2002 as a multidisciplinary research body. Integration Dynamics and Integration team, which will be the specific partner in this project, is a leading-edge group in the topics of cetacean position detection using acoustic monitoring. Some of its recent large scale projects he leads: SABIOD CNRS interdisciplinary mission to detect, cluster, classify and index bioacoustics big data in various ecosystems http://sabiod.org), and ONCET. The LSIS will use their original approach (patent PCT EUROPE, USA, CANADA, New Zealand n° 2009/01227) to localize the different species. It is based on the time difference of arrival of the sounds to each hydrophone and on efficient combinatronic algebra allowing fast and robust passive acoustic tracking resulting in 3D submarine whale diving observation demonstrated by ONCET (See Figure 4) and Annex 5 for the interest letter.

Figure 4: Whale Observation Demonstrated by ONSET.

This approach is supported by the dir. of the National Parck of Port-Cros and also dir. of the French part of the internat cetacean sanctuary PELAGOS (please see the letter in the Annex). These bioacoustics USTV activities in PELAGOS have been reported on the national French televisions, see http://sabiod.org/tv where is part off the ONCET movie shown in feb. 2013 at Oceanographic Museum of Monaco with 200 invited experts in cetology. USTV LSIS brings also its multiobjective optimisation for the ASV coordination / driving, based on its operational research expertise as demonstrated in their FUI OSEO current SYCIE project for French navy on multiple marine multidrones coordination (http://www.polemerpaca.com/Securite-et-surete-maritime/Maritime-Protection/SYCIE). USTV is also leader in bioacoustics classification, as demonstrated in pilot publications in JASA, ICASSP, ... and its leadership in the first internat. workshop "Machine learning for bioacoustics" at Int. conf. Machine Learning Atlanta 2013, including Cornell & NY univ.: http://sabiod.univ-tln.fr/icml2013/ .

This algorithm explained above, to our current knowledge, is the only one producing relevant tracks even in the case of multiple simultaneous emitting whales. Moreover it allows fast computation. The strategy consists into robustly echoes or multipath artifacts labeling to avoid false alarm (the system does not predict wrong position). It is demonstrated on real recording of a group of 4 sperm whales emitting simultaneously. There is no other publication with similar complete results. LSIS proposes the use of the localization results to estimate the behavior of the cetacean individuals and their potential interactions. Professor H. Glotin (10 man months in CETEX) (http://glotin.univ-tln.fr) at USTV and the Institut Universitaire de France (for high level research, 2% acceptation rate for his project complex acoustic scene) will be the key person in the design and development of thePassive Acoustic System (PAS) of CETEX. He received the Excellence A+ research since 2009 from a national committee in France. He is currently leading in the DYNI team in LSIS USTV on stochastic multimodal information retrieval and bioacoustics since he created it in 2008. This team includes now 6 permanents and 10 non permanents. Dr J. Razik is Associate Professor at UTSV (11 months in CETEX) is expert in acoustic classification and he works on bioacoustics since 2009. Ms P. Giraudet (6 months in CETEX) is permanent teacher at USTV in biocomputing and bioacoustics. She is a co-author of the ONCET patent and has developed advanced process for cetacean acoustic monitoring and localization.

Marine Signals S.L, is a technological-based company founded in 2010, spin-off a science and technology park. The principal activities are the design, development and implementation of new generation tools (intelligent tools) for the supervision, advanced control, management and optimization of processes that take place on marine (maritime and harbor) environments. Marine Signals (MS) has innovate activities in the maritime and port areas, aquaculture and fishing industries, and supports services for nautical tourism activities as well as scientific and technical projects.

From the technical point of view, MS has a multidisciplinary team, comprised of two telecommunications engineers, one industrial engineer, one oceanographer and two software development specialists. The shareholders and founders are, Mr. Francisco Concepcion who has over 10 years of experience in the development of ICT projects and integration of control systems, Mr. Oscar Bergasa has an expertise over 6 years in the realization of marine environmental, and Mª Del Pino Arencibia with a trajectory of more than 10 years in the financial management and business administration.

Marine Signals is specialized in development of software products which involve the integration of remote information under different user interfaces (web and smartphone apps), management and programming of automatic decision making.

MS has developed a product called PLAMASI. This project involved the operation and development of web services relating technology systems present in port facilities and scientific environment. These services are provided through a configurable and customizable environment for users that enable the monitoring and management of information from different databases. In the second year, the company has been linked to a research project (TELECAN) publicly funded about remote sensing, specifically the ocean data application for fishing. It’s an international project where MS leads the development of user interface and the satellite data processing. The project includes a tool that supports small-scale fisheries and large pelagic in the location of the fishing areas.

3. Working plan

The working plan is based on the main objectives of the project, so that there have been established ten milestones, is shown in Table 1.

To achieve these general milestones, CETEX project has been structured in 5 Work Packages (**WP**s): (1) Management; (2) Passive Acoustic System; (3) ASVs; (4) Electronic Control System; (5) Software Implementation (Control System and User Interface).

In order to accomplish the correct development of the WPs as well as the necessary synchronization between all participants, there have been established a set of deliverables throughout the entire project development. There will be also a series of meetings planned for the integration of the results of the parties and conducting performance tests. Please refer to Annex 3, WP Flowcharts, for the diagram that reflects the relation between the participants and the milestones.

From the methodological point of view, we have fundamentally used the spiral life cycle model in our project. This choice is justified due to the variety of scientific and technological disciplines involved and the attainment of some prototypes that require several cycles of experimentation and verification of the subsystems. The Spiral methodology is a type of iterative development model which is generally implemented in high risk projects. In this system development method, we combine the features of both waterfall model and prototype model.

Each loop in a spiral represents a development phase. In general terms, each loop has four sections or quadrants: (1) Determining the objectives, alternatives and constraints. We try to understand the product objectives, alternatives in design and constraints imposed because of cost, technology, schedule, etc. (2) Risk analysis and evaluation of alternatives. Here we try to find which other approaches can be implemented in order to fulfill the identified constraints. Risk mitigation will be in focus in this phase. And evaluation of all these factors will determine the future action. (3) Execution of the phase of development. In this phase the system and associated tests will be done. In order to do development, waterfall or incremental approach can be implemented. (4) Planning the next phase. Here we review the progress and judge it considering all parameters. Issues which need to be resolved are identified in this phase and necessary actions are taken.

The milestones specified and the identifiers of the respective deliverables are shown in Table 1. below:

Table 1: General Milestones.
1- Definition of the modus operandi, user needs, operating scenarios, constraints, requirements, state of the art, implementation strategy and limitations
2- Preliminary and prototype design of all subsystems by all participants
3- Integration of parts and consecution of the first prototype
4- Experimentation in controlled conditions. Test of the first prototype
5- Implementation of a system consisting of 4 prototyped units (Operating System)
6- Test of the Operating System (not extreme conditions)
7- Test of the Operating System (extreme conditions)
8- Evaluation of manufacturing processes to obtaining a commercial product
9- Communication planning and marketing plan
10- Conclusions and dissemination of project results

3.1. Work Package 1. MG – Project Management

Leadership and contributions.

Promatech will be responsible for Project Management under WP 1.

Concept and objectives.

The main goal of this WP is to achieve an overall coordination and management of the project, including monitoring and coordination of the activities and communication between partners in accordance with the overall integrated schedule. One of the key role of the project management will be the reviewing the status of the risks, and monitoring to ensure that mitigation techniques are employed to reduce the risk level. Additionally, all deliverables will be monitored and controlled by this WP to ensure the deliverables are met in accordance with the schedule.

WP1a Project coordination:

The initial task will be to organize the kick-off meeting, and subsequent progress meetings and during mid-term meetings. This will involve identifying a venue, arranging accommodation in collaboration with the respective partner where a meeting occurs at that partner's location, setting an agenda, recording minutes and agreed action points. When possible, progress meetings will be coupled with attendance at international (EU) conferences concerned with the project WPs topics, thereby maximizing efficiency and minimizing travel expenditure. PRMTC will also be responsible for the preparation of technical reports and coordinating submission of financial statements in collaboration with the other partners' finance officers.

WP1b Project management:

Day to day management activities will be also the responsibility of PRMTC. An initial activity will be to set up contact databases for the CETEX consortium with full contact details for the individual partners and their research staff, and then to facilitate full interaction between the partners within the various WPs. This will include dissemination of materials and information as well as the gathering of necessary information to prepare the reports. PRMTC will also assist with the arrangement of any necessary *ad-hoc* technical meetings, which might involve two or more partners from the consortium, as needs arises.

WP1c Website design and maintenance:

PRMTC will create a website (**www.cetaceanexperiences.com**, whose domain has been already registered) that has both public accessible areas for non-confidential information concerning the Project CETEX and its findings, along with confidential, password-protected areas for the partners where reports and confidential project findings can be deposited.

WP1d Market Approach and Dissemination

This WP includes activities related to the pre-commercialization and marketing of the prototype. Thus, the main objective of this activity is to disseminate and promote before the completion of the project.

The tasks included in this part of the project are as follows:

1. Market study and marketing needs.
2. - Design of the "Communication and marketing plan".
3. - Feasibility study for the industrial production of the Project outcome.
4. - Options for the certification of the prototype through class societies as well as through governmental or professional agencies.

It is crucial to start the product pre-marketing, which will raise high expectations of part of the larger players in the most popular destinations and herewith come to their attention. The presence of the project in scientific forums help dissemination and further support of the results achieved over time so that it will support the marketing process itself. In this sense also the option to have the prototype certificated will attest its suitability in extreme conditions.

Until the month 18 the team will not have a true and real picture of the prototype. In this time it will be possible to study its industrial production, as it will be solved much of the technical specifications.

Issues related to the marketing and exploitation rights will be treated in the management WP. Thus, the project results or deliverables are expected to be commercially exploited by the SME and industry partners with the strong involvement of the solution-driven academic groups. Due to associated IP and confidentiality issues those outputs that are identified of being capable for commercial or industrial application will be adequately and effectively protected by the owners, and may entail partners undertaking exploitation individually while adhering to the Consortium Agreement. However, because of the myriad of potential applications arising from the materials under development, it is anticipated there will be additional interest of end users and licensing opportunities from outside the consortium and this WP will facilitate and oversee such activities. The management of intellectual property rights (IPRs) will be pursued vigorously over each step of the knowledge acquisition process with patent exploitation being agreed internally between the respective CETEX partners. An Exploitation Committee will be set up consisting of the WP leader and at least one industry related project partner and will engage in an ongoing dialogue with partners to ensure that such activities are compliant with the rules of the Consortium Agreement.

<table>
<tr><th colspan="5">Table 2: WP Management (MG).</th></tr>
<tr><td rowspan="3">1</td><td colspan="4">Kick-off Meeting</td></tr>
<tr><td colspan="4">Related deliverables/milestones: 1) Agenda 2) Meeting Minutes 3) Integrated Project Plan</td></tr>
<tr><td>03.02-04.02.2014</td><td>Duration (days):2</td><td>Person/month:0,3</td><td>Location: Las Palmas de Gran Canary, Spain</td></tr>
<tr><td rowspan="3">2</td><td colspan="4">Critical Design Review Meeting</td></tr>
<tr><td colspan="4">Related deliverables/milestones: 1) Agenda 2) Meeting Minutes 3) System Design Document</td></tr>
<tr><td>07-09.01.2015</td><td>Duration (days):3</td><td>Person/month: 0,8</td><td>Location: Istanbul, Turkey</td></tr>
<tr><td rowspan="3">3</td><td colspan="4">Monthly Status Review (MSR) Meetings – Online/Teleconference</td></tr>
<tr><td colspan="4">Related deliverables/milestones: 1) Agenda 2) Meeting Minutes 3) Integrated Project Plan 4) Alternative Solutions 4) Risks and Contingency Plans</td></tr>
<tr><td>Dates: Monthly</td><td>Duration (days): 26</td><td>Person/month: 2</td><td></td></tr>
<tr><td rowspan="3">4</td><td colspan="4">Project Completion Meeting</td></tr>
<tr><td colspan="4">Related deliverables/milestones: 1) Agenda 2) Meeting Minutes 3) Integrated Project Plan 4) Final Report</td></tr>
<tr><td>21-26.03.2016</td><td>Duration (days): 5</td><td>Person/month: 0,5</td><td>Location: Istanbul, Turkey</td></tr>
<tr><td rowspan="3">5</td><td colspan="4">Technical Interchange Meeting (TIM)– Passive Acoustic System (PAS) & ASV</td></tr>
<tr><td colspan="4">Related deliverables/milestones: 1) Agenda 2) Meeting Minutes 3) PAS Interfaces</td></tr>
<tr><td>01-04.07.2014</td><td>Duration (days): 4</td><td>Person/month: 0,3</td><td>Location: La Garde, France</td></tr>
<tr><td rowspan="3">6</td><td colspan="4">Technical Interchange Meeting (TIM) – Electronic Control System (ECS) & ASV</td></tr>
<tr><td colspan="4">Related deliverables/milestones: 1) Agenda 2) Meeting Minutes 3) ECS Interfaces</td></tr>
<tr><td>07-10.07.2014</td><td>Duration (days): 4</td><td>Person/month: 0,3</td><td>Location: Las Palmas de Gran Canary, Spain</td></tr>
<tr><td rowspan="3">7</td><td colspan="4">Technical Interchange Meeting (TIM) – Human Machine Interface (HMI) & ASV</td></tr>
<tr><td colspan="4">Related deliverables/milestones: 1) Agenda 2) Meeting Minutes 3) HMI Interfaces</td></tr>
<tr><td>08-11.10.2014</td><td>Duration (days): 4</td><td>Person/month: 0,3</td><td>Location: Las Palmas de Gran Canary, Spain</td></tr>
</table>

Table 2: WP Management (MG).				
8	Final Project Report (MARTEC)			
	Related deliverables/milestones: 1) Final Report			
	21.03 – 02.04.2016	Duration (weeks): 1	Person/month: 0,5	
9	Market Approach and Dissemination			
	Related deliverables/milestones: 1) Marketing Plan 2) Cooperation Networking 3) Business Models/Plans			
	01.02 – 02.04 2016	Duration (months): 2	Person/month: 2	

3.2. Work Package (WP) 2. PAS – Passive Acoustic System

Leadership and contributions.

The leader participant will be the LSIS. However, the other participants will take part but in a much lesser extent.

Concept and objectives.

The main objective of this WP is to obtain the acoustic, electronic and signal processing systems for detecting, identifying and localizing sounds produced by cetaceans in a range of 5 Nm.

Some of the tasks which will be needed to face are: definition of the modus operandi of ASVs (operability required by a system made up of 3 units, running in the different scenarios) and its influence in acoustics, acoustic design, achieving the hardware subsystems, signal processing and computing according to the established requirements, detection of the cetacean species, classification of the cetacean species, multiple simultaneous sources separation to avoid false localization, integration with hardware and software control (ECS-HMI) in order to intercommunicate the acoustic system with the main CPU of the whole system, embedded acoustic system/corrections, test/recordings in situ, online optimization of the 3 ASVs geometry, collaboration in the integration and adaptation of the acoustic system aboard the ASV, localization of lonely emitting cetacean, localization even within multiple emitting cetaceans & species in good conditions and in extreme conditions, statistic on cetacean presence, estimation of the cetacean behavior, estimation of the cetacean.

Table 3: WP Passive Acoustic System (PAS).				
1	Technical Management by USTV in accordance with the other participants and subcontracted companies			
	01/02/2014	104 weeks	6.5 Person/month	
2	Final specifications and agreement: (1) Modus operandi; (2) Limitations and expertise; (3) Strategy; (4) Report and deliverable. (5) Strategy of implementation and identification of limitations in solving the challenges identified (6) Meeting.			
	3/02/2014	8 weeks	2 Person/month	Meeting: Canary Islands
3	Implementation of the hardware PAS: (1) PC Unit alimentation, connection of hydrophone (2) Hydrophone alimentation and cable connection and (3) Electronic noise cancellation			
	07/04/2014	20 weeks	5 Person/month	
4	Software detection for different species on real signals: (1) Detection of whistles, (2) Detection of transients, (3) Classification species			

Table 3: WP Passive Acoustic System (PAS).				
	07/04/2014	20weeks	5 Person/month	
5	Design of the Master/Slave hydrophone system for robust datation/localization: (1) Master detection, (2) Modeling of signals, (3) Collection from the 3			
	Result of operation test			
	07/08/2014	20 weeks	5 Person/month	Meeting: Toulon
6	Multiple simultaneous sources separations: (1) Datation from the 3, (2) Modeling of signals, (3) Collection from the 3.			
	Result of operation test			
	07/07/2014	24 weeks	6 Person/month	
7	Localization of different species at medium SNR: (1) 2D localization – Master hydrophone and (2) 2D localization – Slave hydrophone			
	Result of operation test			
	07/10/2014	24 weeks	6 Person/month	
8	Localization of different species at LOW-SNR, 3D localization using the 3 * (master / slave hydrophones), 3D tracking using the 3 * (master / slave hydrophones)			
	Result of operation test			
	07/10/2015	24 weeks	6 Person/month	Meeting: (1) Istanbul, (2) Toulon and (3)Canary Islands □ place
9	Statistics of cetacean presence: (1) Correlation with Anthropogenic noise, (2) Evidence of the group composition			
	Result of operation test			
	16/10/2015	20 weeks	5 Person/month	
10	Estimation of the cetacean behavior:(1) correlation with anthropogenic noises, (2) evidences on the whale behavior during whale watching			
	Result of operation test			
	16/10/2015	20 weeks	5 Person/month	
11	Valuation of manufacturing process: (1) Locating the most common species (2) Identify some of the main species, (3) Planning development and (4) Report R&D Processes			
	Final report for MARTEC II			
	16/10/2015	16 weeks	4 Person/month	Meeting: Canary Islands
12	Support CETEX team: (1) Collaboration in diffusion of Project result in industrial field			
	Final report for MARTEC II			
	18/01/2016	10 weeks	2.5 Person/month	Meeting: Canary Islands

3.3 Work Package 3. ASV – Autonomous Surface Vehicles

3.3.1 Leadership and contributions.

Promatech will be the leader of this WP, although the collaboration of the rest of participants will be needed for coupling or adapt the other subsystems (acoustics, electronic, communications, software and control).

3.3.2 Concept and objectives.

The main goal of this WP is the design, development and manufacture of the ASVs, as well as the integration of all ASV systems and subsystems. This WP also includes all verification and validation (V&V) activities, including integration tests, towing tank tests, environmental tests, Seakeeping tests, drag tests, wind and resistance tests, vibration/shock tests, and seaworthiness tests. Through complete

V&V activities against the initial requirements list, Promatech aims to ensure the final product is ready for fielding and it meets or exceeds the requirements.

Some of the most important items that will be addressed in WP3-ASV are the following: accommodating all the needed systems, achieving an effective navigation. maintaining a stable position within a delimited area, obtaining a high degree of self-energy sufficiency, having a structure with a minimum drag, providing none or minimum interference into the process of acquiring and processing the acoustic signals, achieving a lightweight ASV using composite materials in the structure, manipulated by people in the deployment and recovery from a ship destined for whale watching, achieving a robust system against adversity in the marine environment, setting of signaling according to international regulations during day and night operations.

Weight vs. autonomy, will be a vital factor in this technical WP. Propulsion system, lightweight, compactness and low cost will be other crucial developments. By analyzing the contradicting requirements, the Team CETEX will ensure the alternate solutions are well-studied and an optimum ASV and systems are developed. New concepts in energy capture and autonomy will be faced.

Promatech is planning to design, develop, and test to produce an intelligent, autonomous and robust vehicle as the main outcome of this project.

<table>
<tr><th colspan="5">Table 4: WP Autonomous Surface Vehicles (ASVs).</th></tr>
<tr><td rowspan="2">1</td><td colspan="4">Technical Management in accordance with the other participants and subcontracted companies: (1) Need Analysis (2) Requirements Document (3) Interface Control Documents (4) Test Plan (5) Test Procedures (6) Integration Tests (7) Test Evaluation</td></tr>
<tr><td>03/02/14-02/04/16</td><td>104 Weeks</td><td>24 Person/month</td><td></td></tr>
<tr><td rowspan="3">2</td><td colspan="4">Final specifications and agreement: (1) Modus operandi; (2) Limitations and expertise; (3) Strategy; (4) Report and deliverables, Requirements Document. (5) Meeting.</td></tr>
<tr><td colspan="4">Strategy of implementation and identification of limitations in solving the challenges identified</td></tr>
<tr><td>03/02/14-05/04/14</td><td>8 Weeks</td><td>8 Person/month</td><td>Meeting: Canary Islands</td></tr>
<tr><td rowspan="3">3</td><td colspan="4">Preliminary Design: (1) Concept design; (2)Alternate solutions; (3) Structural design; (4) Propulsion design; (5) Hull; (6) Energy; (7) Integrated systems; (8) Preliminary design</td></tr>
<tr><td colspan="4">Preliminary Design Review</td></tr>
<tr><td>07/04/14-07/08/14</td><td>16 Weeks</td><td>28 Person/month</td><td></td></tr>
<tr><td rowspan="3">4</td><td colspan="4">Prototype Design: (1) 3D models; (2) Manufacturing drawings; (3) Design document; (4) Design review; (5) Order components</td></tr>
<tr><td colspan="4">Critical Design Review</td></tr>
<tr><td>01/09/14-09/01/15</td><td>16 Weeks</td><td>24 Person/month</td><td></td></tr>
<tr><td rowspan="3">5</td><td colspan="4">Prototype Manufacturing & ASV Towing Tank Tests: (1) Design; (2) Components test; (3)Integration; (4) Energy Integration; (5) Mechatronic system; (6) Structural and prototype integration; (7) Drag Tests; (8) Drag tests results; (9) Seakeeping test; (10) Seakeeping results; (11) Wind Test; (12) Wind test results; (13) Impermeability test; (14) Resistance test; (15) Vibration/shock test; (16) Tank test results</td></tr>
<tr><td colspan="4">Design Review per Towing Tank Test Results</td></tr>
<tr><td>12/01/15-12/05/15</td><td>16 Weeks</td><td>32 Person/month</td><td></td></tr>
</table>

Table 4: WP Autonomous Surface Vehicles (ASVs).				
6	System Tests (Full Scale Seaworthiness Tests): (1) Energy test; (2) Subsystems integration; (3) Operation test; (4) Shipment of first prototype			
	Results of operation test			
	13/05/15-16/06/15	4 Weeks	10 Person/month	Meeting: Istanbul
7	1st Prototype Delivery: (1) Strategy for manufacturing 4 ASV; (2) Technical and economic evaluation; (3) Meeting, operational test			
	Results of operation test and operating instructions			
	17/06/15-23/07/15	5 Weeks	5 Person/month	Meeting: Canary Islands
8	Final Prototype Design and Manufacturing (4uds ASV): (1) Design review; (2) Series production; (3) Final mechanical test; (4) Quality control; (5) Shipment of prototypes; (6) Maintenance Instructions; (7) Meeting			
	Report delivery and operating and maintenance instructions			
	17/08/15-15/12/15	16 Weeks	24 Person/month	Meeting: Canary Islands
9	Valuation of manufacturing process: (1) Serial production international market; (2) Resources, production time and risks (2) Production stage; (3) Manufacturing process			
	Report of manufacturing process			
	16/11/15-16/02/16	8 Weeks	8 Person/month	
10	Support CETEX Team: (1) Diffusion Project results; (2) Final balance and marketing decisions; (3) Final report			
	Final report for MARTEC			
	18/01/16- 02/04/16	10 Weeks	15 Person/month	Meeting: Canary Islands

3.4 Work Package 4. ESC – Electronic Control System

Leadership and contributions.

The leader participant is Marine Signals and in addition to the contribution of PRMT and LSIS, is important to note the contribution of subcontracting Division of Robotics and Computational Oceanography (ROC), which belongs to the Institute of Intelligent Systems and Numerical Applications in Engineering (SIANI) at University of Las Palmas de Gran Canaria.

Concept and objectives.

Designing of hardware architecture and selection electronic devices associated to control, data acquisition, storage, power electronics and energy supplying onboard are the main goals of this work package along with the integration of all electronic subsystems and interconnection with mechanical systems onboard. Some of the most important tasks to be faced are: analysis, evaluation and definition of hardware implementation strategy, definition of the ASVs hardware architecture, designing of control system, subsystems implementation control modules, self-monitoring capabilities (watchdog, power), communication & GPS support and other sensor integration, integration with acoustic processing and incorporation of a navigation control module, designing of control system, adaptation to results of experimentation, improvements and extension of the implementation, development of testing procedures for subsystems on board, experimentation in controlled conditions with first prototype, assembly and adjustment on vessel, verifying an operating condition and performance of hardware in navigation, implementation of the requested improvements, development of maintenance procedures and testing of electronic subsystems.

Exploring alternatives for communication systems (protocols and transmission of information techniques) and choice of the most appropriate ahead to achieving an independence of the system respect to the coverage offered by any mobile phone company. Selection of electronic devices associated to communications. It will be also be faced the integration of communication subsystems with electronic hardware and mechanical systems onboard.

Table 5: WP Electronic Control System (ECS).				
1	Technical Management by Marine Signals in accordance with the other participants and subcontracted companies			
	03/02/14-02/04/16	104 weeks	13 person/month	
2	Final specifications and agreement: (1) Modus operandi; (2) Limitations and expertise; (3) Hardware strategy; (4) Software strategy; (5) Meeting			
	Report with the strategy of implementation and identification of limitations in solving the challenges identified			
	03/02/14-05/04/14	8 weeks	2 person/month	Meeting: Canary Islands
3	Design and acquisition Electronic Control System: (1) Analyze, evaluation and selection of hardware; (2) Definition hardware architecture; (3) Definition software architecture; (4) Design of control system; (5) Verification hardware performance			
	Results of software and hardware design, and electronic control system acquisition			
	07/04/14-08/07/14	12 weeks	3.75 person/month	
4	[A] Integration of hardware modules into core of control system: self-monitoring capabilities (watchdog, power), communication modules & GPS support and other sensor. [B]: Development of subsystem´s management procedures: (1) Self-monitoring capabilities; (2) Communication support; (3) GPS Support; (4) Acquisition signal system; (5) Interface of acoustic system.			
	Results of integration and development subsystems			
	01/09/14- 29/11/14	12 weeks	3.75 person/month	
5	[A] Integration with acoustic processing: (1) Meeting; (2) Hardware and Software Test; (3) Information Interchange Procedures; [B] Integration of power system and interface with mechatronic module: (1) Design and selection of hardware for power electronic system; (2) Development software of module control; (3) Verification of hardware and assembly; (4) Test of operation in laboratory, evaluation of performance. [C] Operating evaluation of electronic and communication system, previous integration into mechanical prototype: (1) Evaluation of performance, consumption and management procedure; (2) Test of the functionality using a smartphone as a user interface.			
	Results of operation test			
	01/12/14- 18/05/15	26 weeks	10 person/month	Meeting: Toulon
6	Integration of Electronic-Communication and Passive Acoustic systems: (1) Meeting; (2) Assembling ECS (vessel) and connection with mechatronic hardware; (3) Adjusting and calibration of electric and electronic devices; (4) Testing integrated electronic and communication subsystems on board; (5) Testing of simple operation in controlled conditions by smartphone user interface; (6) Improvement the electronic control system based on experience obtained with the first prototype ASV			
	Results of operation test			

Table 5: WP Electronic Control System (ECS).				
	18/05/15-20/06/15	4 weeks	2 person/month	Meeting: Istanbul
7	Starting up 1st Prototype. Experimentation in real undemanding condition: (1) Meeting; (2) Inspection of received ASV. Assembly of electronic devices and electrical connections; (3) testing of all functionality: acoustic subsystem			
	No deliverable related			
	22/06/15-25/07/15	4 weeks	1.5 person/month	Meeting: Toulon
8	Starting up 1st Prototype. Experimentation in real undemanding condition (navigation, hydrophone deployment and communication): (1) Meeting; (2) Checking status of electronic devices after experimentation. Running maintenance and calibration procedures.			
	Results of operation test			
	27/07/15-09/08/15	2 weeks	0.75 person/month	Meeting: Canary Islands
9	Development of decision-making capabilities and integration with the user interface on board: (1) Testing in controlled real conditions. Evaluation of improvements to be made in subsystems and overall prototype; (2) Developing software module: Communication between ASV and synchronization decision; (3) Developing software module: Assessment and decision making in different operating scenarios; (4) Integration of the system control of 1st Prototype with advanced mobile user interface.			
	Test results of operation			
	31/09/15-05/12/15	14 weeks	4 person/month	
10	Starting up 4 ASVs. Experimentation in real condition (no and demanding): (1) Planning of the tests to be performed in different operating scenarios; (2) Inspection of received ASV. Assembly of electronic devices and electrical connections; (3) Laboratory testing of all functionality: acoustic subsystem, communication subsystem, mechatronic subsystem; (4) Meeting; (5) Checking status of electronic devices after experimentation. Running maintenance and calibration procedures; (7) Elaboration the final procedures for maintenance and testing of electronic subsystems; (8) Developing and starting improvements of control software; (9) Operational testing of 3 ASV prototype in demanding conditions at sea: navigation, hydrophone deployment and communication; (10) Checking status of electronic devices after experimentation. Running maintenance and calibration procedures; (11) Repeat steps from 8 to 10 for a triple cycle.			
	Final report of control software development			
	07/12/15-19/03/16	16 weeks	4 person/month	Meeting: Canary Islands
11	Support CETEX Team: (1) Evaluation technological and market costs for the baking of a serial production; (2) Meeting			
	Final report for MARTEC			
	18/01/16-15/02/16	4 weeks	1 person/month	

3.5 Work Package 5. HMI – Human Machine Interface (HMI)

Leadership and contributions.

The leader participant is Marine Signals and in addition to the contribution of PRMT and LSIS, is important to note the contribution of subcontracting Dolphin & Whales. This WW Operator will participate in the process of completing final testing of the system formed by 3 ASVs and evaluation thereof.

Concept and objectives.

The main objective in this WP is to achieve a great usability user interface and suitable for different operating scenarios both for Smartphones and website (UI). Designing and implementing of contents in Data Base (DBMS) and using of hardware subsystems to controlling communications and navigation as well as supervising the correct global system operation (Control System) are other important goals. The most relevant tasks include several test-improvement cycles.

The WP for Human Machine Interface (HMI) is the mean by which people interact with CETEX system. From the point of view of the supports on which applications run, we can distinguish between mobile devices and the web. If we attend to the applications themselves, there are also two distinct aspects, yet loosely related, although in different software applications: (1) Smartphone App-control, with which operators staff can interact in a direct and detailed way with ASVs, and they can control some parameters (i.e. moving from one position to another, collecting the hydrophone submerged, monitoring sensor information or the state of the batteries). In this item is also included the Smartphone App-organizer which will find the optimal way of distributing the whale-watching boats in individual sightings in the case of multiple boats in one area, which will allow regulating the whale-watching pressure both in regular whale-watching areas and marine protected areas. The output this algorithm will be the place of the boats in the sighting detected area. This software will take into account the whale-watching regulations valid in the area and input by the user and the chosen operating scenario, offering a great flexibility for the users. As a third point in the Smartphone-App, and as a background contribution offered by Marine Signals we can add the application Whale to Take Home (WTTH), which is an application designed to record sightings relying on specific content and geo-location provided by the device itself. (2) Website. The web user interface is implemented to allow supervision of ASV system, in different operating scenarios, allocating technical exploitation of these resources. But also for the End-Users, WW operators and entities who are exploiting Ports.

In this case End-Users area of Website will be specifically designed to allow monitoring of viewing areas according to the information provided by the ASV periodically.

<table>
<tr><th colspan="5">Table 6: WP - Human Machine Interface (HMI).</th></tr>
<tr><td rowspan="2">0</td><td colspan="4">Technical Management by Marine Signals in accordance with the other participants and subcontracted companies</td></tr>
<tr><td>03/02/14-02/04/16</td><td>104 weeks</td><td colspan="2">11 Person/month</td></tr>
<tr><td rowspan="3">1</td><td colspan="4">Final specifications and agreement: (1) Modus operandi; (2) Limitations and expertise; (3) Hardware strategy; (4) Software strategy; (5) Meeting</td></tr>
<tr><td colspan="4">Report with the strategy of implementation and identification of limitations in solving the challenges identified.</td></tr>
<tr><td>03/02/14-05/04/14</td><td>8 weeks</td><td>2 Person/month</td><td>Meeting: Canary Islands</td></tr>
<tr><td rowspan="3">2</td><td colspan="4">Prototype of HMI based on mobile device (smartphone): (1) Definition; (2) Prototyping; (3) Design; (4) Software architecture; (5) Implementation.</td></tr>
<tr><td colspan="4">Results of design and implementation software</td></tr>
<tr><td>07/04/2014 – 26/07/2014</td><td>16 weeks</td><td>6 Person/month</td><td></td></tr>
<tr><td>3</td><td colspan="4">Software implementation of HMI and testing with ECS, PAS and ASV: (1) Extension functionalities; (2) Testing with ECS; (3) Design and development; (4) Testing with PAS; (5) Improvements for Smartphone; (6) Design and development; (7) Testing with ECS.</td></tr>
</table>

Table 6: WP - Human Machine Interface (HMI).

	Results of design and implementation software			
	01/09/2014 – 28/03/2014	25 weeks	7,5 Person/month	Meeting: Toulon
4	Design and implementation of database (BD) on cloud computing for operation with ASV and WW operators: (1) Normalization and protection; (2) Design Entity-Relationship diagram; (3) Implementation scripts; (4) Implementation communication; (5) Testing.			
	Results of BD design and implementation			
	01/12/2014 – 31/01/2015	9 weeks	2,5 Person/month	
5	Prototype of HMI based on Web site: (1) Studying requirements; (2) Developing methodology; (3) Prototyping; (4) Implementation Web platform.			
	Report of Web site design and implementation			
	02/02/2015 – 15/05/2015	16 weeks	6 Person/month	
6	Integration HMI - ASV (1st Prototype): (1) testing with ASV; (2) Improvements Smartphone; (3) Improvements web site; (4) Results; (5) Testing Toulon; (6) 2º Cycle of software improvements; (7) Testing Canary Island; (8) 3º Cycle of software improvements; (9) Testing Canary Island; (10) 4º Cycle of software improvements; (11) Testing Canary Islands in demanding condition; (12) 5º Cycle of software improvements;			
	Report of testing and introduced improvements.			
	18/05/2015 – 09/08/2015	19 weeks	6 Person/month	Meeting: Istanbul / Toulon / Canary Islands
7	Starting of HMI based on Web site: (1) Web area for ww company; (2) Updating the structure; (3) Implementation Web platform; (4) Testing.			
	Report of Web site design and implementation and testing			
	10/10/2015 – 30/01/2016	16 weeks	4 Person/month	
8	Starting HMI (smartphone and Web Apps) whit ASV System composed by 3 units: (1) Configuration Web site; (2) Testing with ASV; (3) Cycle of software; (4) Testing with ASV; (5) Cycle of software improvements.			
	Final report of control software development			
	03/12/2015 – 16/01/2015	8 weeks	1,5 Person/month	Canary Islands
9	Support CETEX Team: (1) Evaluation technological and market costs for the baking of a serial production; (2) Meeting			
	Final report for MARTEC			
	18/01/16-15/02/16	4 weeks	1 person/month	

Respect to subcontractors, on one hand, Marine Signals will subcontract the company Dolphin&Whales, which is specialized in whale-watching tourism. The company began to operate in 1989 with a sailing catamaran when nobody was offering this activity in Gran Canary and there were no information about the presence of such great variety of cetaceans present in these waters.

In 2004 the company experienced a steady growth in the number of tourists. The company grew offering different timetables and trips. That year the company built a new boat, especially designed for sea conditions and whale watching in the Canaries. The company is the first operator and is distinguished by its contribution to knowledge and dissemination of natural values linked to marine tourism itself. Further information about the company can be found at http://www.dolphinwhale.co.uk/. In the experimentation and test phases, the participation of Dolphin&Whales in the project will be crucial. From a tangible standpoint, they will give the necessary support with their vessels and skilled personnel for proper experimentation, both with the prototype in a first phase and with the 4 ASVs which constitute an operating system at the final tests.

From a know-how point of view, the contribution of Dolphin&Whales will be based on the validation of the results based on the extensive experience they have in the field and his deep understanding of the users' needs. On the other hand, Marine Signals will also subcontract to the Division of Robotics and Computational Oceanography (ROC), which belongs to the Institute of Intelligent Systems and Numerical Applications in Engineering (SIANI) at University of Las Palmas de Gran Canaria. This group of PhD researchers and engineers is specialized in the design and prototype development of robotic systems, in robotic mobile, that is, the known AUVs.

The group of engineers and researchers work on the integration of instrumentation (video camera, satellite communication systems/radio, sonar image, altimeter, etc.) and on the development of market-oriented applications.

ROC has also an extensive experience in planning gliders surveys. This division in conjunction with Rutgers University (New Jersey, USA), have achieved the first overseas trip in the history of oceanography. They have participated in the project of small underwater unmanned automatic navigation, dubbed Slocum Glider or RU-27, from the U.S. west coast to Bayonne (Galicia), traveling more than 7,000 kilometers. Other relevant projects related to CETEX concepts are the following: "*Desarrollo de un robot autónomo submarino para aplicaciones oceanográficas y de control medioambiental en Canarias*", FEDER (Ref: PI 2007/039); "*Planificación y Navegación de Vehículos Autónomos Submarinos: Asimilación y Validación de Modelos Oceánicos en 3D de Escala Regional en Aguas del Archipiélago Canario*", FEDER (Ref: PI 2010/0062); "*Migradores y Flujo Activo en el Océano Atlántico*", CICYT (Ref: CTM2012-39587-C04-01). Further information about these and other projects as well as many other documentations such as publication lists, events, personnel profiles, etc., can be found at http://berlioz.dis.ulpgc.es/roc-siani/publicaciones-principal

4. Exploitation plan

4.1. Economic advantage/expectations and potential of the project:

The product that will be developed in CETEX project will mainly be marketed to whale-watching companies in the world. Although recent data suggest that in 2013 we are already above the 400 whale-watching areas in more than 120 countries, with almost 30 million visitors a year, we will only contemplate the data which is sufficiently verified, dating from 2008. In this year, whale-watching industry had strongly grown respect to ten year earlier, expanding across much more countries and territories, and continuing to develop in those countries with long established industries. In 2008, 13 million people participated in whale-watching in 119 countries and territories, generating total expenditure of $ 2.1 billion.

Furthermore, it is estimated that 3,300 operators offer whale-watching trips around the world. The whale-watching operators are fundamentally concentrated on the 278 ports that have a significant whale-watching activity. The operators employ an estimated 13,200 people. Across the globe, the whale-watching industry has grown at an average rate of 3.7% per year, comparing well against global tourism growth of 4.2% per year over the same period.

The current whale-watching industry provides a new model for using natural resources - an industry that relies on whales in a non-extractive way. That, when well-managed, can be truly sustainable and provide a sharp contrast to the days when whales were seen solely as a resource to be hunted. It is needed the sector's ability to offer a high quality service that results in a model of long-term sustainable market.

The ports with a relevant whale-watching industry concentrate a great number of operators, whose activity is normally developed in more than one sighting area. Therefore, ports are an ideal platform in which CETEX could expand in a more efficient way so they become in a clear market target.

It makes sense that our first market targets should focus on Europe, but CETEX intends to result in a product that addresses all whale-watching regions in the world. In this regard, due to the global vision that is pursued, we estimate to reach markets in North America, Central America and Oceania (which are the most interesting markets outside of EU) in a period of two years after the end of the project. From that point on, we aim to finish the product internationalization through all existing whale-watching areas, paying particular attention to emerging markets.

There are four main factors that determine the end customer’s end profile:

1- Interest from operators to innovate and provide quality service with individual added value.
2- Whale-watching areas subjected to high environmental pressure due to the intense activity of the operators.
3- Protected areas in which the activity of whale-watching is regulated.
4- Areas near the coast where there are frequent collisions between ships and whales.

As an important part included in the actual development of the project (in accordance with the scheduled milestones of the project), and based on our market study conducted on the potential market sectors and users, we have developed a market approach as part of the management WP. The highlights of this market approach are summed as follows:

- A dedicated website will be the main platform for the project presentation in an international scope. As mentioned, the website domain has already been acquired, and it will give the background on the project, the participants and whale-watching operators will be regularly updated with news related to the project progress.

- Media used to make the project visible will be social networks which can be used to reach a large audience, and the target outreach group will be the potential whale-watchers, whale watching companies and marine scientists.
- An evaluation of the marketing approach will enable identifying its strengths and weaknesses so it can be adjusted for optimum results by identifying potential customers and creating a database of related sectors and stakeholders, and further therefore further to define the marketing strategy.
- It will planned to launch to market, where the communication channels and the strategy in the dissemination campaign will be identified, as envisaged in the planned milestones.
- The project innovative idea and development stages will get press coverage, both in national and international magazines. The focus will be on nature tourism and innovations and popular science press. Additionally, other media cover: radio and TV reports on this innovative product are expected as the partners have a good collaboration with the media, which regularly cover their R&D efforts.
- From a specific time, and having the product in an advanced stage, we will start publishing of the results. This will be done in specialized congresses for each sub-part of the CETEX system as a first step, followed by the presentation of the product as a whole. The events in the focus due to their outreach capacity and the participant profile are: The International Whaling Commission Meeting, held annually with representatives of governmental bodies managing cetaceans from most of countries of the world, top-level cetacean scientist and whale watching companies representatives, where the product can be presented to all the target user groups. Furthermore, European Cetacean Society Conference and the Biannual Marine Mammals Biology Conference will be the entry points for the presentation of the first scientific results of the product to the wide cetacean scientists' community, as well as additional entry to the whale-watching market. The project website will stay a continuous resource on the results of the project and the effectiveness of the system in field, tests and real operation conditions.
- From the end of the project execution onwards, an intensive advertising effort will be implemented. This implies presenting the product in local and global tourist fairs, in particular the ones focused on nature tourism or specifically whale-watching, large and small scale meetings related to marine and coastal management, and marine protected areas (MPA). Large-scale media cover will be timed to coincide with the formal exit of the product to the market.

As already mentioned, the ideal profile of the end consumers would be related to environmental awareness. However, the savings in time and money for operators that may arise from CETEX would make that most of the operators would be interested in the results of this project, so that the searched environmental impact would be even more generalized. To this we may add that the use of CETEX system means a high added value respect to the satisfaction due to much better service quality.

Other promotional activities will be also carried out to facilitate the introduction to the market. For example, the expected spin-off companies created, which will conduct the commercialization, would offer favorable agreements with the first customers.

Another necessary step will be to protect the IPR in order to achieve a secure commercialization. This protection will be established in the Consortium Agreement that will be approved by all partners. Although a final agreement has not yet been achieved, all the participants have reached starting point accordance where the most important ideas respect to the IPR issues will be the followings:

- Each Party is the owner of his Foreground IPR.
- When several Parties have jointly carried out work generating Foreground and when their respective share of work cannot be ascertained, they shall have joint ownership of such Foreground. The share of each of the Parties to the development of the joint Foreground shall be defined proportionally to the contribution that each Party has made to the development of the joint Foreground.
- . The co owning Parties shall establish in writing a joint ownership agreement that specifies the applicable arrangements in case of the extension of rights as well as those applicable to the allocation and assumption of expenses in connection with the necessary protection.

Finally, respect to IPR warranties:

- Each Party shall obtain the necessary assignments of IPR or licenses from all staff, agents, or sub-contractors involved in the development and production of the Foreground on its behalf. Each Party warrants to the other Parties that it is the owner of the IPR in the Foreground, or that it is duly licensed to use the Foreground, and that the use of the content of the Foreground as contemplated in this Agreement does not infringe any IPR or other proprietary or rights of any natural or legal person.

4.2. Scientific and/or technical expectations:

The obtained prototype will consist of a modular system of ASVs, where 3 vehicles will make one operational unit, equipped with a passive acoustic system. The ASVs design will incorporate innovative solutions for alternative energy production, mobility and independence. Determining the best hydrophone configuration to better capture the cetacean sounds from an ample range of species will be and its integration in the platforms will be object of this project. Furthermore, a software for the analysis of the acoustic signals will be developed, which will process the sound signals and: (1) detect the cetacean species and localize the cetacean even with multiple animals and species, (2) give statistics on cetacean presence, estimation of cetacean behavior, and estimation for cetacean density.

In this purpose, CETEX will consists of 3 ASVs, each equipped with 2 complementary hydrophones. One of which (SlaveH) will be fixed in a hydrodynamic cage under the ASV (hence having a GPS positioning), while the other 'Master' hydrophone will be deployed up to 45 m below the sea level. The MasterH will drive the cetacean acoustic detection on the SlaveH recordings that will be noised by the thermocline and surface effect. The less precise positioning of the MasterH will be balanced by the GPS positioning of the SlaveH. A specialized software will be developed to order optimize boat positions according to acoustic observability for localization, and boat radio transmission.

The technical expectations of the project are creating a new innovative system in multiple areas. The prototype will consist of a modular system of ASVs, where 3 vehicles will make one operational unit, equipped with a passive acoustic system developed specifically for the needs of this project. For example, Team CETEX will evaluate and the use of the advanced technologies in the development of the ASV structure. Another example is the reduction of final weight of the structure by the use of composites. We expect to have the system man carried to and from the boat as well as that it is deployed from the boat by the boat personnel. Another aspect is the autonomous renewable energy management. The ASV system will not use any carbon fuels; it will rather collect and store the energy from environmental energy sources; i.e. solar, wind, and wave, which will all be considered in the design of the ASV power generation.

4.3. Scientific and economic continuation:

The first point is the Whale Watching market impact. There is no similar products available in the market; therefore, we expect to grow quickly helped by the new spin-off companies. For the companies that form the consortium, CETEX represents a future opportunity for growth and diversification, competitiveness and job creation. These companies will be providing to the spin-off R&D services, needed to maintain market leadership.

European directives related with the species protection and habitats seek to maintain a minimum quality potential to ensure the ecosystem services which are the bases of our well-being, environmentally, socially and economically.

CETEX project is closely linked to the whale watching sector that is steadily growing. This growth could affect negatively or it could have an environmental negative impact. Thus, the approach that was decided from the beginning was to get a system that could serve for a dual purpose, a geo-location service for operators and secondly, a system to support the sustainability and environmental protection aims that we find behind European directives.

4.4. Impact for the companies:

PRMT and MS will demonstrate their expertise in their domain, and reinforce them. USTV will for the first time have the opportunity to demonstrate a complete system that uses the power of its ONCET algorithm only such complementary consortium allows this demonstration. Researchers and engineers will be employed during the ERANET schedule of CETEX, and after in order to produce ASV and enhanced DSP system for other species or specific cold / iced polar waters where whale observations are also needed.

Although Promatech team has proven to be expert in the systems engineering for developing AUVs and UAVs in their past work, the product developed in CETEX project will be one of the key systems engineering outcome of Promatech to demonstrate the capabilities of providing challenging systems engineering solutions and turning them into top level and high quality end product.

4.5. Compatibility with norms, standards and regulation:

CETEX ASVs will be silent and doesn't injure cetacean: no risk of collision / mechanical injuries to cetacean because ASV will be designed to avoid this, with lightweight design and slow location change. Therefore and additionally, CETEX ASVs will not be source of any type of pollutions.

The design of the ASVs shall also be compatible with the maritime norms and standards. According to International Whaling Commission (IWC), whale watching is a globally recognized use of cetacean resources, and since 1955 has been an activity of growing economic importance. The International Whaling Commission (IWC) has considered the issue since 1975. Arrangements should be made to allow independent inspection of cetacean watching activities to ensure compliance with guidelines. In order to minimize potential impacts on whales and dolphins, vessels should comply with the approach distances and operating procedures outlined in these guidelines. Some important guidelines are certain vessels are prohibited for use in whale and dolphin watching. These include all personal motorized watercraft (e.g. jet skis and underwater scooters), parasails, remotely operated craft, wing-in-ground effect craft, and hovercraft. Also, prohibited vessels should not approach closer than 300m to any whale or dolphin[12]. If a prohibited vessel incidentally moves to within this distance it should slow down and avoid the whale or dolphin, moving away from the animal at a no-wake speed to at least 300m. Figure 5 from IWC shows the approach distances for whales. All of these norms, standards and regulations will be considered for the design of the ASVs and in the operating scenarios and activities.

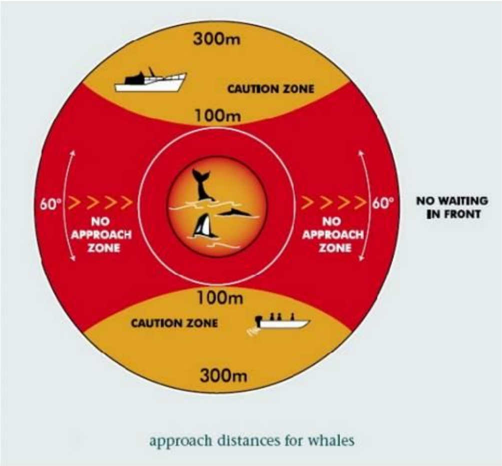

Figure 5: Approach Rules for Whale Watching.

Additionally, the team will build the ASV structure and perform all required tests in accordance with the Lloyd rules and regulations.

4.6. Sustainability including social and environmental impact

This project has a high positive impact on the environment. The whale-watching activity grows at a steady rate for more than a decade in most destinations. CETEX system will greatly help to regulate

[1] Australian National Guidelines for Whale and Dolphin Watching, National Standards for Vessels, (TIER 1), 2005.

[2] Carlson, Carole; "A Review of Whale Watch Guidelines and Regulations around the World, Version 2012." Retrieved from http://iwc.int/cache/downloads/4mc4x7y9nlicc8g0wwg00cg0c/WWREGS%202012.pdf on 29 April 2013.

whale watching activities. The growth of this activity and its sustainability will be reflected in employment generation and even high-skilled employment, which are goals that are consistent with the European innovation strategy.

The economic sustainability will be based on product marketing at international level. We foresee two major phases in the marketing approach. The first period would be based on the support of a spin-off specialized in marketing, that would reach the most important market targets. Spin-off will sell directly to the end customers and the final customers will be carefully selected. This step involves the outsourcing of technical service support by a regional partner that could carry out supplying, running and maintaining the system. In a second phase, having achieved a broader positioning in the market, national partners in the respective countries will support the spin-off new company. In this situation, it would be desirable to have a second spin-off company who will be responsible for technical support, training, and maintenance, but also for the continuous incorporation of improvements.

In summary, it is necessary to focus on specific markets in areas where the final consumer could find a middle ground between the costs of the system and the advantages from the efficiency and innovation point of view.

5. European added value in carrying the work at European Level

There are currently about 300 whale-watching operators in Europe, whose activity is done in more than 60 ports in a total of 23 countries. Whale-watching companies share two common characteristics. Firstly, they have high initial investment for starting up a company due to the expenses for buying a boat which is suitable for whale-watching and is matching all the legal requirements regarding vessel and passenger safety and costs related to skilled crew. This is why it is necessary to have a long-term business, where the initial investments can be returned. In the second place, the high expenditures of each trip are mainly due to the fuel expenses. Used fuel per trip is directly related to the time spent searching for cetaceans. Whale-watching companies need a system to regulate the whale-watching pressure on cetaceans, which can drive the populations out of the whale-watching area and even affect population status, to ensure the long-term sustainability. They also need an effective way to reduce fuel costs – this can be done by planning the shortest route possible before and during the trip by having the information on exact location of the cetaceans that are not visible on the surface.

MPAs enable us to ensure that the species and habitats detected can thrive and are not threatened or damaged. At the same time, The Marine Strategy Framework Directive (2008/56/EC) requires Member States to put measures in place to achieve or maintain good environmental status in their waters by 2020. To meet these objectives and to achieve the requirements forced by the directive, CETEX system could be an optimal solution for monitoring these areas (in Europe, more than 200000 km^2). Besides implementing the current regulations, there is a recurrent need of information on cetacean populations' status as it is usually only small regions being monitored. Visual monitoring has limitations in workload, sea state, visibility, time of day and costs; therefore passive acoustics is a more effective monitoring method. CETEX solutions offer the possibility of a large scale passive acoustic monitoring in cetacean hotspots worldwide at a relatively low cost to the market, and through a cooperation between the whale-watching companies and the research groups, gives the scientific community extremely valuable deliverables (such as exact localizations of vocalizing animals). Implementation of rules of conduct and regulations of whale-watching activities in protected areas is difficult to monitor due to large areas, long operating hours and the difficulties in reporting and charging fines as local economy could be based on the existence of these companies. There is a need for a system which will regulate the approach of the boats to the cetaceans in an alternative way, such as giving the information on cetacean position conditional on the regulations in the area.

There is also a growing concern in the port sector (public and private) that points to a more effective management of the whale-watching activity in marinas and its surroundings. This offering a different experience which would be of higher quality and integration of additional services to attract guests, and making the experience less demanding, by reducing the trip length, which would make the whale-watching product acceptable and appealing for customers, which is currently under-represented.

6. Necessity for funding and risk

CETEX is a major systems engineering project, with highly complex and various technical and scientific disciplines taking place. Many aspects of the system are based on high technology that requires specialized, trained, and experienced personnel. These factors greatly hinder the task of finding financial organizations. In addition, the whale-watching industry is currently involved in a process of exponential growth worldwide that can lead to the development of ideas like CETEX by competitors in other continents (mainly in North America and Oceania). For these reasons, it is remarkable that CETEX team was gathered from three technological SMEs which need an external support to develop this R&D project.

If funding is not achieved, the project will be of in great difficulty for developing this highly complex CETEX product with their own total funding. Finding private investors would be extremely complex before the consecution of a prototype, which is aggravated due to the international features, and in any case, this could result in substantial changes in the approach and business plan that is intended.

From the technical risks aspect, there are two main groups of risks. The first is directly related to the main technical objectives in CETEX, which is the selection of systems/components and their integration in order to achieve the desired level of autonomy. Performance imply a development process that will be not exempt of challenges. Among them, one of the main difficulties will be the design of a small, low-cost, self-positioning ASV, which can reach the project constraints. The second group of risks has to do with the final users. Whale-watching companies will have to adapt their daily on-board routines to use the proposed system. It may be argued that usability might not be considered as a technological risk. However, there is an abundance of examples that show how good technological developments failed because they did not meet usability and acceptance criteria of final users. This conception explains why in CETEX we consider this issue a technological risk and deserve a very special attention to it as a key factor in the final success of the project. Table 7 provides some of the identified risks and preventive actions. Refer to Annex 4 for more detailed study of the identified technical risks and mitigation techniques that will be carefully managed in CETEX project. Team CETEX will develop a risk management matrix in the beginning of the project and will utilize risk based management approach in project management (refer to Section 3.1, WP 1 Project Management).

Table 7: General Risks and Preventive Actions.

Risks	Preventive actions
(1) Not being able to achievement of the location of cetaceans in the desired ranges and conditions through passive acoustics	The participant in charge is one of the most specialized teams in this topic in the world, with a Patent to this regard (PCT Europe, USA, Canada, New Zealand n° 2009/01227)
(2) No adequacy of ASV design for required operation: energy-navigation autonomy in harsh conditions. ASV deployment and retrieve, as well as ASV subsystems.	Spiral development method: Feedback and improvement in development phases. Test plans/tests and Experimentations.
(3) Mis-achievement of a correct electronic integration and a perfect coupling between the subsystems	Excellent coordination between all groups. Scheduled meetings.
(4) Mis-achievement of desired operating procedure in deployment of the ASVs.	Constant communication with Whale Watching operators and staff training

7. Planning aids (Gantt-Diagram, Roadmap, Resources)

Refer to Annex 2 for Gantt-Diagram and other additional information related to the CETEX project. Table 8 shows the breakdown of the cost for project partners.

Table 8: Resources / Cost Breakdown for Project Partners.

RESOURCES	PROJECT PARTNERS			Sum (€)
	PROMATECH MT	Marine Signals SL	USTV LSIS	
Personnel (man month x €)	189 x 3885	94,75 x 1,639.58	52 x 5,709.27	-
Personnel (costs)	734,265.00	155,350.00	296,882.00	1,186,497.00
Overheads	0.00	31,070.00	59,375.00	90,445.00
Travel & subsistence	26,000.00	18,800.00	19,400.00	64,200.00
Material & Supply	144,000.00	2,400.00	7,300.00	153,700.00
Equipment	73,000.00	15,800.00	20,400.00	109,200.00
Depreciation and rent, leasing	0.00	2,740.00	0.00	2,740.00
Other costs2	0.00	6,900.00	3,000.00	9,900.00
Subcontracting costs3 (except R&D)	300,629.00	55,000.00	0.00	355,629.00
Sum (€)	1,277,894.00	288,060.00	406,357.00	1,972,311.00
Budget per Partner	64.79%	14.61%	20.60%	100.00%

Date: 2013-04-30