Joint European Research Infrastructure network for Coastal Observatories

Rationale and definitions for a common strategy D-1.2

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2. Executive Summary

The objectives of JERICO are to address the challenge of observing the complexity and high variability of coastal areas at Pan-european level, in the framework established by European Directives (WFD, MSFD) and the operational marine services (GMES) by:

- setting up an European Research Infrastructure for coastal observations based on existing systems in European coastal and shelf seas.
- supporting standardization of methodologies for the benefit of data quality, data availability and cost efficiency.
- promoting the cost-effective use of the facilities.
- stimulating the development of new automated systems for the operational monitoring of the coastal marine, environment, with focus on the biochemical, compartment.

To reach these objectives the JERICO consortium has the ambition to elaborate guidelines, quality label and the so-called Common Strategy for the future. Thus JERICO requires a consensual vision and share understanding of what the common strategy is to be, as well as an efficient and targeted coordination between the projects elements, organized as workpackages. These necessary clarifications and guidelines are summarized in the present deliverable, which aims at:

- establishing key elements of the JERICO common strategy on European coastal observatories (section 4)
- reviewing on existing best practices for JERICOs observing platforms (Section 5)
- introducing a roadmap, for each workpackage, for gathering the necessary information and knowledge in view of the consolidation of the common strategy, with emphasis on the expectation from each WP and the necessary interaction between WPs (section 6)

As a guideline document this report will drive JERICO activities during the contract duration. In addition it will help to enhance interactions in-between WPs, as an internal support document, and in-between communities related to the 3 different platforms (gliders, fixed platforms and ferryboxes) as a public document. It is a first stage of a general state-of-the-art related to coastal observation systems, from which the consortium will build upon to establish a roadmap for the future.

3. Introduction

In the last decades marine observing systems have been implemented in **coastal and shelf seas** around Europe. They mostly answer local/regional **monitoring** and **oceanographic research demands but heterogeneity and geographical dispersion** are often a limit. Indeed, often driven through short-term research projects, **sustainability of observing systems is not guaranteed.**

One of the main challenges for the European marine research community is now to **increase the consistency** and **the sustainability** of these dispersed infrastructures by addressing their future within a **shared pan-European framework.**

The aim of JERICO, as a network of observatories, is to ensure regular and standardized observations in order to provide long term time-series of high-quality data. This needs to combine operational capabilities, innovation and sustainability for high quality European networking research.

3.1. The JERICO vision:

The JERICO vision is to make a significant contribution to the harmonisation of existing European coastal observatories and to support future strategic developments. JERICO will promote easier access to the infrastructures and data.

JERICO will:

- increase knowledge and understanding of marine systems,
- strengthen the evidence base for environmental assessments,
- provide data and information required to improve predictions of future human and climate-driven environmental changes and strategies to combat them.
- support development of new tools and technologies for the monitoring of key oceanographic parameters in coastal systems.

3.2. Objectives of JERICO

The objectives of JERICO are to address the challenge of observing the complexity and high variability of coastal areas at Pan-european level, in the framework established by European Directives (WFD, MSFD) and the operational marine services (GMES) by:

- setting up an European Research Infrastructure for coastal observations based on existing systems in European coastal and shelf seas.
- supporting standardization of methodologies for the benefit of data quality, data availability and cost efficiency. This implies:
    - harmonizing technological aspects, such as operation and maintenance methods: sensor calibration, antifouling procedures, quality control, systems

control,

  - ensure compatibility between systems to reduce the costs and promote interoperability wherever possible,
  - definition of a JERICO label, which is a set of criteria with regards to infrastructure design, procedures, sensors, measured parameters, sampling frequency, data quality, data delivery.

- promoting the cost-effective use of the facilities.
  - provide **access** to **external users** for their own experiments and testing **(TNA)** and access to data and services **(SA)**
- stimulating the development of new automated systems for the operational monitoring of the coastal marine, environment, with the focus on the biochemical compartment. This implies to enhance the links with sensor providers through a dedicated forum, namely the Forum for Coastal Technology.

3.3. Objectives of this report

It has been recognized that the ambition set by the JERICO consortium on elaborating guidelines, quality label and the so-called Common Strategy requires a consensual vision and share understanding of what the Common strategy is to be, as well as an efficient and targeted coordination between the projects elements, organized as workpackages. These necessary clarification and guidelines are summarized in the present deliverable, which aims at:

- establishing key elements of the JERICO common strategy on European coastal observatories (section 4)
- reviewing existing best practices for JERICOs observing platforms (Section 5)
- introducing a roadmap, for each workpackage, for gathering the necessary information and knowledge in view of the consolidation of the common strategy, with emphasis on the expectation from each WP and the necessary interaction between WPs (section 6)

4. Towards a Common Strategy

All the aforementioned elements are pieces of the mid-term (5 - 7 years) Common Strategy for Operational Coastal Observing System, to be elaborated in the course of JERICO and provided as recommendation to the EU by the end of the project period.

This section aims at clarifying the terms of reference of the Common Strategy, based on targeted outcomes from each workpackage (WP) individually and from WPs in synergy. The latter is synthesized as a roadmap in section 6.

4.1. Rationale for a common strategy

The rationale behind the collection of observations in our coastal seas is four-fold:

- assessment of environment status
- better understanding of both natural and "anthropogenic" variability in biological, chemical and physical processes.
- short-term to long-term environmental prediction and forecasting
- sustaining development, implementation and control of European policy.

Technologies now exist which allow relevant measurements to be undertaken in autonomous ways from a range of observing platforms. However, integrating and coordinating such observations in an optimal way have not yet been realised. Pre-existing coastal observatories in European waters are composed of platforms such as moored buoys, piles, profiling systems, gliders, "Ferryboxes", and automated systems on board fishing boats. These pre-existing observatories also run data flow procedures and disclose their measurements through various dissemination strategies.

Indeed, around European coastal seas, an increasing number of such observing systems is being implemented for both research and monitoring activities. Moreover, these observing systems require reliable, high-quality and comprehensive observations collected on **automated** systems (both platforms and sensors) operating over long time periods. A key aspiration is that the *in-situ* data, combined with remote sensing and model output, can then be used to detect, understand and forecast physical, biogeochemical and biological processes within the various national/regional marine environments. A recent European wide assessment produced by the EMODNET initiative values the total assets of existing coastal observatories at several million Euros. Furthermore, additional investments are foreseen to upgrade existing networks and develop new systems in the coming years.

To harmonize and standardize European marine observing services, initial steps towards a common reference basis have been taken (e.g., as side targets of the EU-funded projects *ENCORA*, *ECOOP*, *SeaDataNet*, *MyOcean)*. Most of these activities only focus on physical parameters of the global/regional ocean, whereas the coastal seas require knowledge of controls on water quality (and related issues/phenomena, both natural and anthropogenic) which are underpinned by physical, chemical and biological processes.

Global real time knowledge of the state (physical and biological) of the seas has grown dramatically in the last two decades, and expectations are even higher for short-term predictions and environmental assessments with respect to global change. Nevertheless, in this striking evolution, coastal observations can be considered as the weakest link, due to several scaling factors:

- intrinsically, efforts are first initiated over national areas, in limited contexts;
- processes are more complex in coastal than in deep seas (more variables to collect);
- traditionally, deep sea oceanographers formed a better organized community than coastal environmentalists.

This led to the present lack of consistency of the institutional efforts deployed in Europe and as a consequence, the multiplication/replication of single sited apparatus and a divergence of approaches, methods and technology developments among the EU member states.

4.2. Key-elements and definition of a Common Strategy

A number of key environmental challenges and knowledge gaps have been identified, that required improved observation capability at European level:

- Assessment of environmental status
  - Eutrophication and primary production
  - Acidification
- Better understanding of functioning of coastal ecosystems
  - Characterisation of the trophic chain
- Trans-boundary pollution transport
  - concentration and distribution of persistent pollutants
- Control and validation of operational models:
  - Hydrodynamical models
  - Biogeochemical and production models
  - Transport models (sediment, contaminants, radionucleids)

Progress in the observation capability of European coastal waters is also a key element for the successful implementation of both the Water Framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD). It is also a key stone with the implementation of GEOSS and the marine GMES component.

To efficiently address the afore-mentioned rationales, JERICO needs a common strategy (consensual strategy within the JERICO community), covering the following items:

- Integration of existing observing systems into an harmonized pan-European framework.
  - From a sum of single observation for independent platforms towards a synergetic use of co-located and complementary observations from multiple platforms.
- set a framework for future systems for the operational monitoring of the coastal

environment, thanks to common progress initiated on sensors and platforms, on both technological and methodological aspects,

- Optimal designing of future networks.
    - From coverage gaps to a consolidated observation of coastal areas

The common strategy is to encompass the following components, to be elaborated throughout the JERICO project:

1. Present key-environmental parameters measured in European coastal waters (to be provided by WP2)
2. Emerging key-environmental parameters to be measured in European coastal waters (to be provided by WP1 and WP10)
3. sampling requirements in space and time to address efficiently the needs of both the implementation of the EC Directives and its control, and the operational need of in-situ data from the GMES marine services (to be provided by WP2 and WP9)
4. Elements of costs and efficiency of observing systems (to be provided by WP4 and WP10)
5. Standardization, Quality standards (to be provided jointly by WP3, 4 and 5)
6. Data dissemination (technology, channel, time constraint, …). (To be provided by WP 5, 6 and 7)
7. Promoting the use of JERICO infrastructure (WP1 and WP8)

5. Best practices and remaining challenges for OCO Platforms

In this section, a review of best practices is given for each observing platform, addressed in JERICO. Key questions to be answered by JERICO are formulated, and an implementation plan per workpackage is suggested in terms of expected contributions to the Common Strategy.

5.1. Ferrybox

5.1.1. Background

Use of ferries and merchant ships for continuous observations of ocean environmental conditions really kicked off in the late 1990's, as independent efforts from a number of research institutes in Northern Europe. At that time several organizations and companies developed concepts of their own based on national requirements and needs. A major effort for exchanging know-how and harmonizing technologies and practices were realized within the EU funded FerryBox project 2002-2005 (EVK2-2002-00144).

5.1.2. State-of-the-art on best practices

The EU-FerryBox project was focused on ferrybox-system robustness, technical challenges and solutions and further development of the operational observations from ferries. The consortium tackled in details four key parameters, namely temperature, salinity, chlorophyll fluorescence and turbidity/particle concentration (REF EC-FerryBox Contract[1] EVK2-2002-00144 D2.1 and D2.3). Other parameters and related emerging technologies were investigated to a certain degree during the project (D2.4: report on non-standard sensors). One can name oxygen, pH, current (ADCP), light and nutrient analyzer. While progress has been made on a number of key-questions at that time, no "best practice" documents or guidelines were edited within the project.

Since 2006, the FerryBox community previously established through the EU-project has expanding, and progress has been made on harmonization of procedures and best practices. This has been achieved through:

- Annual workshops gathering the Ferrybox community
- Expansion of the initial consortium into a broader international arena, including sensor and technical providers
- Tighter link with the operational oceanography community

Some key-challenges that were discussed and partly solved during that period of time encompass:

- De-bubbling techniques and efficiency

[1] EU Project Ferry Box: From on-line oceanographic observations to environmental informations 2003-2005. Contract Contract EVK2-2002-00144

- Positioning of individual sensor within the flow-through system
- Pump property, speed rate
- Miniaturization of ferrybox systems
- Integration of data flows into display systems
- Techniques for data transmission in real-time and compacted modes
- Plug-and-play system for integration of new sensors
- Calibration of sensors and qualification of integrated observing system
- Quality check and quality control of data
- Relationships between measured parameters and significance of optical measurements (chl-fluorescence especially)
- Operational maintenance of ferrybox systems and self-cleaning technologies
- Etc…

It is therefore timely to synthesise and summarise the available knowledge in order to:

1. Identify the main remaining knowledge, technical and practical gaps
2. Focus on strategic prioriyies
3. Establish best practices and making them available to a broader community through reference documents.

These three points are proposed to the main focus of the NA within JERICO. The implementation of this effort must be implemented through distributing detailed objectives for WPs 2, 3, 4 and 5 (see Implementation plan through WPs section 6), and through an optimal cross-cutting coordination between NA Workpackages (See section 6.2)

5.1.3. Main challenges to be answered

The development of European ferrybox capacity follows nowadays two main streams:

- Purchase of a commercially-available ferrybox system. These systems are generally compact and packed as one measurement units, including data acquisition, data integration, data transmission. The system needs to be plugged to a water inlet, a power supply and a communication interface. It is therefore an easy solution to implement. System providers offer some level of flexibility in terms of:
    - the choice of single component (sensors) to be integrated,
    - the overall design of the water-flow (how sensors are integrated within the data-flow system,
    - the pumping velocity, etc…

Such systems require the availability of a given space in the vessel in order to be installed (e.g. one square-meter on floor and a height of 1.5 meter). This may not suit the configuration of vessels available for carrying the payload.

- Purchase of single components and dedicated design, integration and installation pattern, fitting the boat configuration. Such approach is much more demanding in terms of both know-how, time for integration, and qualification of the system. On the counter-part, one gets a full flexibility on sensors to be integrated, on the flow and data chain within the system, on the positioning of the various measurement systems on the boat, etc…

In term of best practices it is important for JERICO to provide an objective analysis of the pros and cons of such systems, as new comers in the Ferrybox community may be confronted to the dilemna between these two main streams.

Even if some consensus on best practices has been achieved within the ferrybox community, it has not been yet synthesized into a best practices document. Key elements that remain to be fully answered towards best practices, and through WP3, 4 and 5 are:

- Review of alternatives and know-how on the acquisition chain: From the water inlet to data transmission and data quality check
- Progress on plug-and-play technology that could ease integration of new sensors
- Meta-data to be transmitted in order to secure common and harmonized QA/QC procedures, whatever the ferrybox data sources
- Bio-fouling: impact of (self-)cleaning technologies on maintenance and data quality
- Calibration of sensors and qualification of system. The latter item should be a major input to the JERICO label
- Technological bottleneck for integrating of new “hot” sensors (ex: climate change parameters, pollution assessment, litter at sea, etc…) into ferrybox systems
- Quality and robustness.

Furthermore, key-questions to be discussed with technology providers through the FCT need to be agreed upon.

5.2. Gliders

5.2.1. Background

Gliders that are relatively new platforms in oceanography, have great potential for ocean observations. Gliders are used for continuous observations of ocean environmental conditions along vertical sections since the late 1990’s – early 2000’s, and have been designed as efforts from companies and research institutes in North America and in Northern Europe. Since 2005, several groups of European oceanographers from France, Germany, Italy, Norway, Spain and the United Kingdom gathered in an “European Gliding Observatories” (EGO) initiative to promote the use of gliders and develop experiments with international fleets of gliders. More recently, EGO became “Everyone's Gliding Observatories”, while colleagues from Australia, Canada, and USA have joined this initiative.

5.2.2. State-of-the-art on best practices

Effort for exchanging know-how, harmonizing technologies and practices, and to facilitate glider experiments through networking and support are realised within the EGO group. The group shares resources and information about the glider technology with details on both hardware and software and exchanges useful links and references on glider technology, sensors, networks and experiments. If fruitful exchanges exist within the EGO community, no “best practices” documents or guidelines have been edited within the project yet.

Since 2006, the glider community has shared information on harmonization of procedures through :

- Annual EGO Workshops (including “Glider Schools”) to present and discuss scientific and technological issues

- collection of tutorials, technical notes and references,

- glider data collection and dissemination in global databases for a wider community.

Some key-challenges that were discussed and partly solved during that period of time encompass:

- the general organization (hardware and software) of the Glider Fleet Control Panel (GFCP).
- method to transfer files automatically from the GFCP to a dockserver (slocum) or a base-station (seaglider).
- procedure to automatically send the glider real-time data to Coriolis Data Centre
- procedure to add a glider at sea in a Glider Observatory
- procedure to visualize operational simulations of glider trajectory, considering forecasted currents and fields of temperature and density
- integration of different types of batteries and CPUs in Slocum and Spray gliders.
- Etc…

These questions have been mostly only partly answered. It is therefore timely summarise the available knowledge in order to:

- 1. Identifying the main remaining knowledge, technical and practical gaps
- 2. Focus on strategic priorities
- 3. Establish best practices and making them available to a broader community through reference documents.

These three points are proposed to the main focus concerning gliders within JERICO. This effort must be implemented through distributing detailed objectives for WPs 2, 3, 4 and 5 (see Implementation plan through WPs section), and through an optimal cross-cutting coordination between NA Workpackages (See section6.2)

5.2.3. Main challenges to be answered

The main challenge for JERICO is to provide a document in term of best practices for gliders that will be shared by the JERICO partners and community of users. This document will help to transfer the know how from the partners to external users from and outside European countries.

Key questions that remain to be fully answered towards best practices are:

- Automatic piloting taking into account vertical and horizontal velocity computations
- Data processing and transfer through modem RF communications and Iridium
- Development of new batteries for meeting the increase of the electric demand with the integration of multiple sensors
- Development of new tools for the Glider fleet Control Panel
- Design of maintenance tools for gliders and hosted sensors
- Progress on plug-and-play technology that could ease integration of new sensors
- Meta-data to be transmitted in order to secure common and standardise QA/QC procedures,
- Biofouling: self-cleaning technologies vs. data quality
- Calibration of sensors and qualification of system. The latter item should be a major

input to the JERICO label
- Technological bottleneck for integrating of new “hot” sensors (ex: climate change parameters, pollution assessment, litter at sea, etc…) into glider systems
- Quality and robustness…
-

Key-questions and themes that will be discussed with technology providers through the FCT need to be agreed upon.

5.3. Fixed platforms

5.3.1. Background

In JERICO, we define fixed platforms as measuring systems acquiring data wherever in the water column, at the sea surface and/or in the bottom layers, at a given permanent location (contrary to ferrybox and gliders that are moving platforms performing transects).

This kind of system, in the JERICO meaning, supplies energy, data storage and possibly data transmission. In addition, for relative long-term deployment in coastal waters, maintenance operations and system protection are closely associated to the system monitoring. Indeed fixed systems are “almost permanently” (by opposition to “episodically”) underwater and are more subject to biofouling, involving for instance macroplankton. In some cases, sensors may need to be specifically configured for fixed platforms deployment.

Considerations on technologies and procedures, such as power supply, building materials, sensors properties, data storage and transmission, maintenance and protection operations and duration of deployment should condition the designing of such fixed systems.

In Europe, but also worldwide, many types of fixed platforms have been deployed in coastal waters but with diverse designs, maintenance and protection procedures, answering requirements from specific scientific programmes. The corresponding know-how and knowledge are usually poorly shared. Moreover developments seldom apply standardized procedures, as discussed hereafter.

5.3.2. State-of-the-art on best practices

Effort for exchanging know-how, harmonizing technologies and practices are realised mainly at regional levels through networking activities such as the Regional Operational Oceanography Systems (ROOS) (Arctic, Baltic, North West Shelf, Biscay-Iberian area, Mediterranean, and Black Sea areas) and at national levels (e.g. Marel network in France, Cosyna in Germany). Different types of fixed platforms (buoys, piers, …) equipped with different type of sensors coexist, including platforms instrumented with tidal gauges, key physical and biogeochemical parameters namely temperature, salinity, chlorophyll fluorescence, dissolved oxygen and turbidity/particle concentration. Best practices for deployment of such fixed platforms are different since sensors need different maintenance and calibration operations. However, no common best practices documents or guidelines have been edited at the European level

Key questions that have to be discussed towards best practices encompass:

- What should be the networking organisation of fixed platforms in Europe ?
- What types of fixed platforms and sensors have to be deployed to answer key questions in operational oceanography ?

5.3.3. *Main challenges to be answered*

The main challenge for JERICO is to provide a document in term of best practices that will be shared by the JERICO partners and community of users. This document will help to transfer the know-how from the partners to external stakeholders from and outside European countries.

Key questions that remain to be fully answered towards best practices are:

- Definition of the mooring components (buoys, chains, wires, clump weights, anchor point, hardware and accessories, …) according to specific scientific objectives and geographical specificities (WP2, WP3)
- How to develop qualified and robust systems (from the anchor to sensors and data transmission)? What criteria to focus on? (WP3, WP4)
- What power supply type to implement? :
  - - development of new batteries for meeting the increase of the electric demand with the integration of multiple sensors and a longer autonomy (WP1/FCT)
  - how to implement solar supply or any other energy source (WP3)
- How to implement remote control and remote maintenance systems for long term deployments? (WP3)
- What are the best sensor solutions?
  - Quality and robustness (WP4)
  - Progress on plug-and-play technology that could ease integration of new sensors and upgrade for future needs (WP1/FCT)
  - Biofouling: self-cleaning technologies vs. data quality (WP4)
  - Calibration of sensors and qualification of system. The latter item should be a major input to the JERICO label (WP4)
  - Technological bottleneck for integrating of new “hot” sensors (ex: climate change parameters, pollution assessment, litter at sea, etc…) into fixed platforms systems (WP10)
- How to manage the data flow from the sensor to the user? (WP5)
  - Data transfer system from the sensor to the land station: through modem communications, GSM, satellites, … (WP3)
  - Data processing (WP5)
  - Harmonized QA/QC procedures, whatever the fixed platforms data sources (WP5)

6. Implementation plan through WPs

In the following sections, expected contributions from each WP to the Common Strategy are clarified. It is planned for the relevant knowledge to be collected through literature review, questionnaires to stakeholders, workshops and forum.

As the existing systems in operational use are different for the different types of platforms in terms of spatial coverage, sensors deployed, available data, It is necessary to identify common elements to all/several platforms and those that are specific to a given platform.

6.1. Expected contributions from WP2

6.1.1. Common contributions for all platforms

The synthetic contributions from WP2 are expected to be:

- The inventory of existing systems in operational use at regional level for the different types of platforms
- The inventory of available data on servers for the different types of platforms
- The Identification of the main gaps between accessible observations and data needs for the different types of platforms
- To propose recommendations on how to fill the gaps at regional level

6.1.2. Specific contributions related to Ferrybox

The specific contributions from WP2 related to Ferrybox are expected to be:

- Review of existing ferrybox systems in operational use (repeated sections) at regional (ROOS) levels.
- Review of on-going and planned observing programmes based on ferrybox data.
- Review of available ferrybox data from non-restricted data servers.
- Recommendations on how to fill the gaps at regional level.

These outcomes serve as inputs to WP3. Timeline for the execution and delivery is therefore to be agreed upon by the concerned WP leaders.

6.1.3. Specific contributions related to Gliders

The main contributions from WP2 to the Common Strategy will be on recommendations for additional new repeated glider sections for the future. This strategic recommendation is to be provided based on the current status of existing glider fleet in operational use (repeated sections) at regional level.

These tasks are input to WP3.

6.1.4. Specific contributions related to Fixed platforms

The specific contributions related to fixed platforms are the:

- Inventory and synthesis of existing fixed platforms in European waters (not exclusively limited to referenced EUROGOOS platforms): localisation, parameters, data accessibility, etc.
- Identification of available fixed platforms data on servers.
- Identification of the main gaps between accessible observations and data needs.
- Design of the moorings (e.g. buoys, chains, wires, clump weights, anchor point, data loggers communication systems) according to specific scientific objectives and geographical specificities (link with WP3).
- Propose recommendations on how to fill the gaps at regional levels.

These tasks are input to WP3.

6.2. Expected contributions from WP3

6.2.1. Common contributions for all platforms

The synthetic expected outputs from WP3 will be:

- To review the existing systems in operation: types of sensors used, types of data transmission, quality control, and data archiving (link with WP5) for the different types of platforms.
- To define best practices for designing systems for the different types of platforms according to specific scientific objectives and geographical specificities (link with WP2).
- To develop qualified and robust systems (from sensors to data transmission)? Consensual view on key aspects to focus upon, and elements of best practices (link with WP4).
- To establish the existing and future needs to develop plug-and-play technology that could ease integration of new sensors and upgrade for future needs (link with FCT)
- To establish the needed improvements on existing technologies (link with WP10 and FCT).

6.2.2. Specific contributions related to ferrybox

The main contributions of WP3 to the Common Strategy concerning ferrybox are:

- Definition of the best practices for designing, operating and maintaining ferrybox systems (flow-through systems including pumping and de-bubbling, sensors, cleaning, cabling, …)
- Best practices on maintenance tools for ferrybox and hosted sensors

6.2.3. Specific contributions related to Gliders

The main contributions of WP3 to the Common Strategy concerning gliders are:

- Definition of the best technical practices for operating a fleet of gliders
- Best practices on maintenance tools for gliders and hosted sensors

These implies to review and elaborate consensus on:

- Current status of existing glider fleet in operational use with types of sensors used, types of data transmission, quality control and data archiving (link with WP5)
- Development of new tools for the Glider Fleet Control Panel
- The best data transfer units (through modem RF communications and Iridium, …)

6.2.4. Specific contributions related to Fixed platforms

The main contributions of WP3 to the Common Strategy concerning fixed platforms are:

- Definition of best practices to design moorings (e.g. buoys, chains, wires, clump weights, anchor point, data loggers communication systems) according to specific scientific objectives and geographical specificities (link with WP2)
- Best practices on implementing solar supply or any other energy source
- Best practices on implementing remote control and remote maintenance systems for long term deployments
- Best practices on data transfer system from the sensor to the land station: through modem communications, GSM, satellites, …

6.3. Expected contributions from WP4

6.3.1. Common contributions for all platforms

The synthetic outputs from WP4 are expected to be:

- The inventory of procedures and calibration methods for the different types of platforms
- The inventory of existing methods against bio-fouling
- To propose solutions to develop qualified and robust systems (from the definition of the constituting elements of the considered platform to sensors and data transmission) and more specifically to propose criteria to focus on (link with WP3)
- The definition of an analytical form from the running costs aiming at minimizing the routine operation costs by improving and exchanging practices.
- Minimization of the routine operation costs by improving and exchanging practices. This requires establishing *a priori* a common model for analysis and comparison of operation costs for the different infrastructures).
- To propose what would be the best sensor solutions in terms of:
    - Quality and robustness
    - Bio-fouling: self-cleaning technologies vs. data quality
- Best practices in all phases of the setup of sensors (choice of sensor type, deployment, housing, calibration,...) to enable an end to end quality assurance of data (link with WP5).
- What are the needed improvements on existing or future technologies for bio-fouling prevention? (link with WP10 and FCT).

- To define the best practices in terms of calibration of sensors and qualification of systems.

The latter item should be a major input to the JERICO label.

6.3.2. *Specific contributions related to Ferrybox*

The specific outcome from WP4 to the Common Strategy is guidelines on best sensor solutions for ferrybox in terms of:

- Quality and robustness
- Bio-fouling: self-cleaning technologies vs. data quality
- Calibration of sensors and qualification of system. The latter item should be a major input to the JERICO label
- Bio-fouling prevention to implement on ferrybox systems with reference to the cost (implementation, maintenance) and adaptability (to different sensors and areas).

In order to elaborate these recommendations, inventories have to be gathered and agreed upon:

- calibration procedures for physical, optical and chemical sensors used in operating ferrybox systems,

- methods used for bio-fouling prevention for physical, optical and chemical sensors used in operating ferrybox systems

6.3.3. *Specific contributions related to Gliders*

The main outcome from WP4 to the Common Strategy is guidelines on best sensor solutions for gliders.

In order to elaborate these recommendations, inventories have to be gathered and agreed upon:

- calibration procedures for physical, optical and chemical sensors used in operating gliders,
- methods used for bio-fouling prevention for physical, optical and chemical sensors used in operating gliders

6.3.4. *Specific contributions related to Fixed platforms*

- Inventory of calibration procedures for physical, optical and chemical sensors used in operating fixed platforms,
- Inventory of methods used for bio-fouling prevention for physical, optical and chemical sensors used in operating fixed platforms
- For bio-fouling prevention to implement on fixed platforms with reference to the cost (implementation, maintenance) and adaptability (to different sensors and areas).

6.4. Expected contributions from WP5

Contributions from WP5 are intended to be common for all platforms, and expected to be:

- Harmonized procedure to manage the data flow from the sensor to the user
- To produce a data management handbook for real-time and delayed mode data
- To propose standardised QA/QC procedures, whatever the platforms data sources
- To define procedures for ascribing overall and component-specific uncertainties to measurements (taking into account precision and accuracy of sensors, instrument drift, …) for selected key parameters (temperature, salinity and chlorophyll) (link with WP3 and WP4)
- To harmonise vocabularies for real-time and delayed mode data formats and meta-databases
- To harmonise real-time and delayed mode data handling practices
- To harmonise data and metadata formats (in compliance with EU INSPIRE Directive) for real-time and delayed mode data
- Real-time data management platform to reinforce MyOcean and EuroGOOS and delayed-mode data management platform to reinforce SEADANET.
- Standard tools for online data access and visualising (link to WP6)

6.5. Expected contributions from WP6

Contributions from WP6 are expected to be:

- JERICO data tool for easy data access in different formats (output from WP5)
- Common Ferrybox screens passenger display
- JERICO Oceanboard for diffusion of on-line informative and educational resources to professionals and general public
- JERICO Summer Schools
- JERICO Community Hub (link to WP1)
- Web-based Yellow pages (link to WP1)

6.6. Expected contributions from WP9

The synthetic outputs from WP9 are expected to be:

- The definition of the sampling requirements in space and time to address efficiently the needs of both the implementation of the EC Directives and the operational need of in-situ data from the GMES marine services.
- Optimisation of observational systems with Observing System Simulation Experiments (link with WP2)
- Optimisation of a 3-D grid of observing systems at European level
- Improvements of future observing networks based on new platforms (profilers, fishing ships, link with WP10)
- Identification of gaps in sampling systems (Link to WP1)

6.7. Expected contributions from WP10

WP 10 intends to give major inputs to the Common Strategy in terms of emerging technologies and sensors that will contribute to future OCO.

The contribution is expected to be knowledgeable recommendations on new sensors maturity and performance, and way towards their full integration in existing OCO.

The synthetic outputs from WP10 are expected to be:

- The identification of the technological bottlenecks for integrating of new "hot" sensors (ex: climate change parameters, pollution assessment, litter at sea, etc…) into the different considered platforms systems. Emphasis is set on contaminant measurements using passive samplers, algal pigments and carbonate system (pH, pCO_2 and alkalinity).
- Identification of new tools (in situ and laboratory video systems) for monitoring of key biological compartments
- Identification of emerging technology (profiling systems, fishing vessels, link with WP9)

7. Coordination between Workpackages

7.1. Synergies between WP2, 3 and 4

Exchanges of information between NA workpackages is crucial for establishing a common roadmap for a future fully integrated European network of coastal observatories. Existing gaps in the spatial coverage of existing coastal observatories for the different types of platforms have to be defined through tight interactions between WP2 and WP3, and with contributions from WP9. Propositions to have a better spatial coverage by deploying new observation systems are addressed for each type of platforms (fixed platforms, ferrybox lines, repeated glider lines).

Existing gaps in the different types of measured parameters and operational technologies deployed on the different platforms have to be defined through dialog between WP2 and WP3. WP10 may contribute to this assessment at a later stage in the project. Once these gaps is established, recommendations for possible harmonization of sensors and technologies between platforms will be proposed in order to contribute to the definition of a JERICO label.

A good and timely interaction and coordination between WP2 and WP3 is crucial for a consensual and ad-hoc definition of the "roadmap for the future".

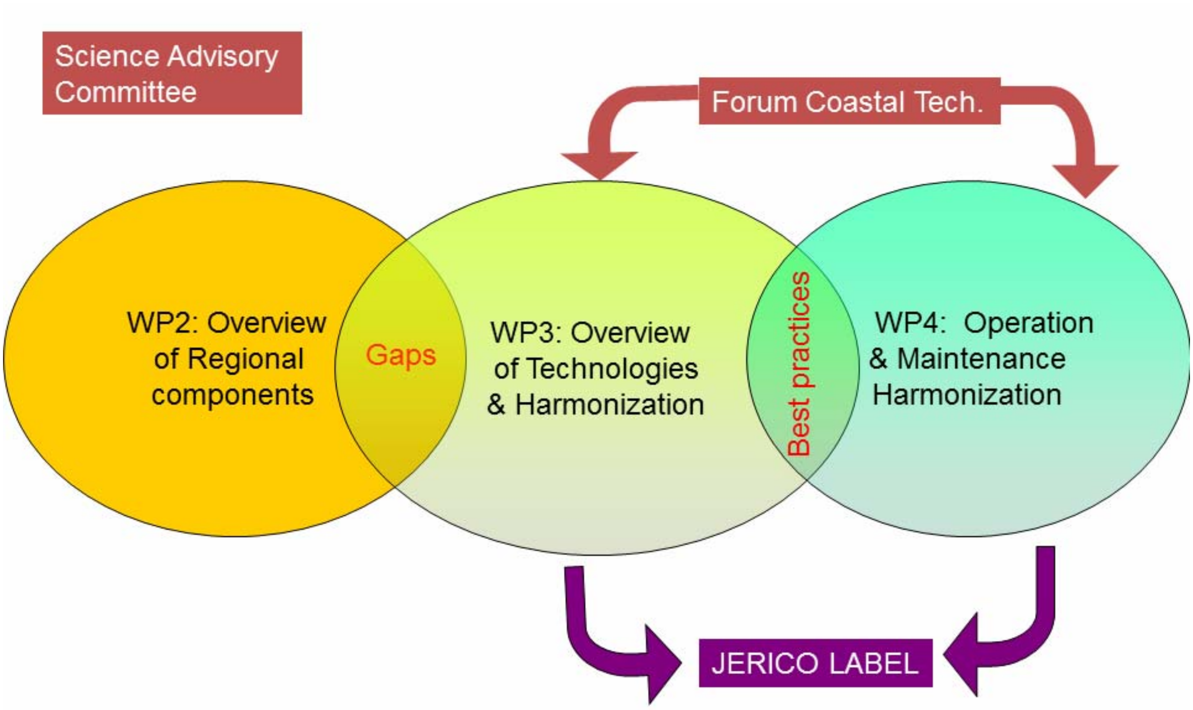

Figure 1. Interactions between workpackages and NA activities in JERICO – WP 2 – 4.

Likewise, existing technologies and operation/maintenance procedures used for the different platforms have to be established through tight interactions between WP3 and WP4. These exchanges will help to define relevant common best practices on the harmonization of deployed sensors and technologies, and on their maintenance. These harmonized common best practices will also contribute to the definition of the JERICO label.

Dialog between JERICO and sensor providers through the Forum of Coastal Technologies should lead to a common vision on requirements for new technological developments for existing or future sensors, and for improved maintenance procedures for the different types of sensors and platforms.

7.2. Overall synergies within JERICO

As an I3 project, JERICO encompasses three major types of activities dedicated respectively to networking, joint research and trans-national access to infrastructures and data.

Within JERICO, Networking Activities (NA) aim at building a consensual vision on required R&D related to operational coastal observing systems, at harmonizing methods, practices and procedures towards an improved pan-European quality of coastal data, and at identifying the most important technological and methodological gaps for existing OCO to optimally answer the demand for environmental information in the European coastal zones.

The expected new knowledge will lead to concrete and targeted recommendations on strategic investment to be realised at European level in the years to come.

Through the joint research activities (JRA), JERICO is testing upcoming technologies and methodologies towards recommendations on the next steps to take in OCOs.

Transnational access activities give a unique framework for promoting European know-how, and for testing new technologies and methodologies within the time frame of JERICO.

There are clear synergies between NA, JRA and TNA that is important to exploit in order to speed up the implementation of a numbers of premature technologies, and to generate adding-values within the project and towards the industry.

As examples of such synergy is the importance of accounting of new knowledge and harmonized views in terms of gaps, and methods, that are being generated in the NA, for the implementation of JRA and of TNA (especially TOP).

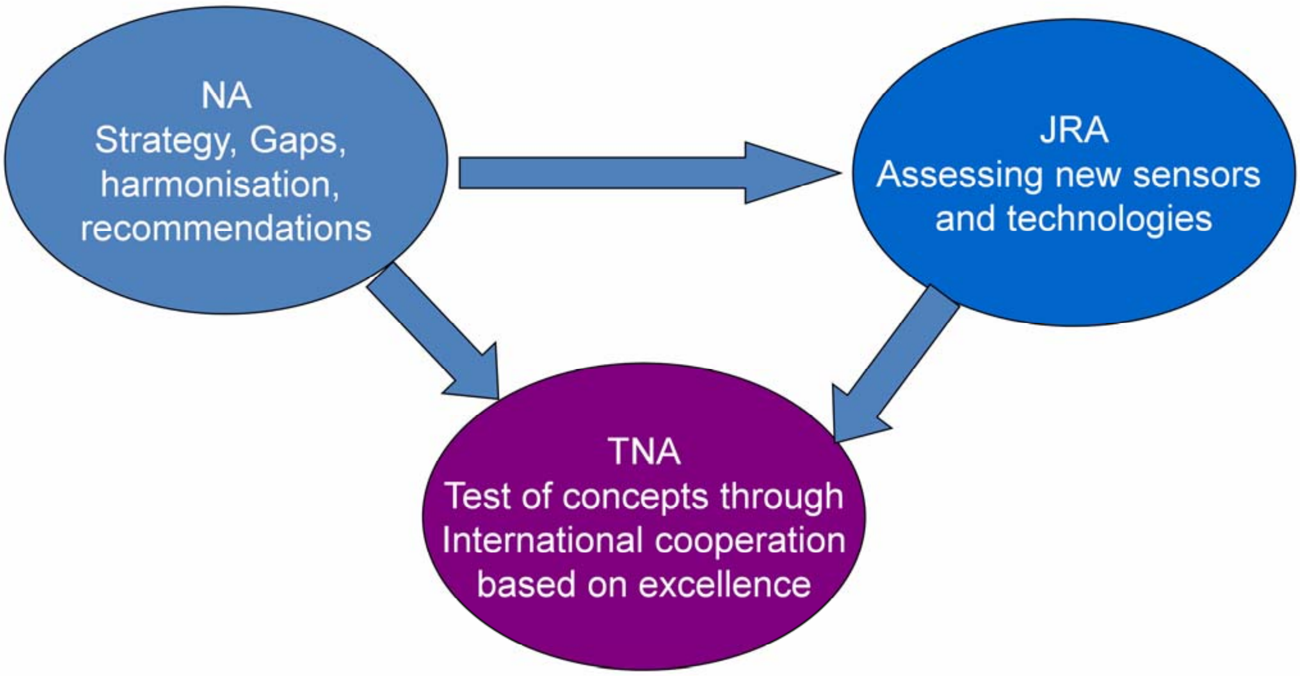

Figure 2. Interactions and feedbacks between project activities.

If thematic links are identified between selected TNA projects and the R&D work programme of WP10, it is recommended that this synergy would be exploited in order to generate possible adding-value within JERICO. The JERICO management board is to be used for easing the process.

8. Conclusions

As a guideline document this report will drive JERICO activities during the contract duration. In addition it will help to enhance interactions in-between WPs, as an internal support document, and in-between communities related to the 3 different platforms (gliders, fixed platforms and ferryboxes) as a public document. It is a first stage of a general state of the art related to coastal observation systems, from which the consortium will build upon to establish a common strategy for the future.

9. Glossary

ADCP	Acoustic Doppler Current Profiler
ECOOP	European COastal-shelf sea OPerational observing and forecasting system
EGO	Everyone's Glider Observatories
EMODNET	European Marine Observation and Data Network
FCT	Forum for Coastal Technolgy
GEOSS	Global Earth Observing System of Systems
GMES	Global Monitoring for Environment and Security
GOOS	Global Ocean Observing System
INSPIRE	Infrastructure for Spatial Information in the European Community
JERICO	Joint European Research Infrastructure network for Coastal Observatories
JRA	Joint Research Activities
MSFD	Marine Strategy Framework Directive
OCO	Operational Coastal Oceanography
ROOS	Regional Ocean Observing System
SA	Service Access
TNA	Trans National Access
TOP	Targeted Operations
WFD	Water Framework Directive