2016

WATERBORNE TP contribution to the elaboration of the next work programs

BLUE GROWTH 'TECHNOLOGY BRICKS' DEMONSTRATORS FOR THE PREPARATION OF OFFSHORE PILOT PROJECT(S)

WATERBORNE BLUE GROWTH WORKING GROUP

Blue Growth 'Technology Bricks'

Demonstrators

For the preparation of offshore pilot project(s)

A Waterborne TP Blue Growth Working Group document, elaborated to support the European Commission DG RTD in elaborating the next H2020 work programs.

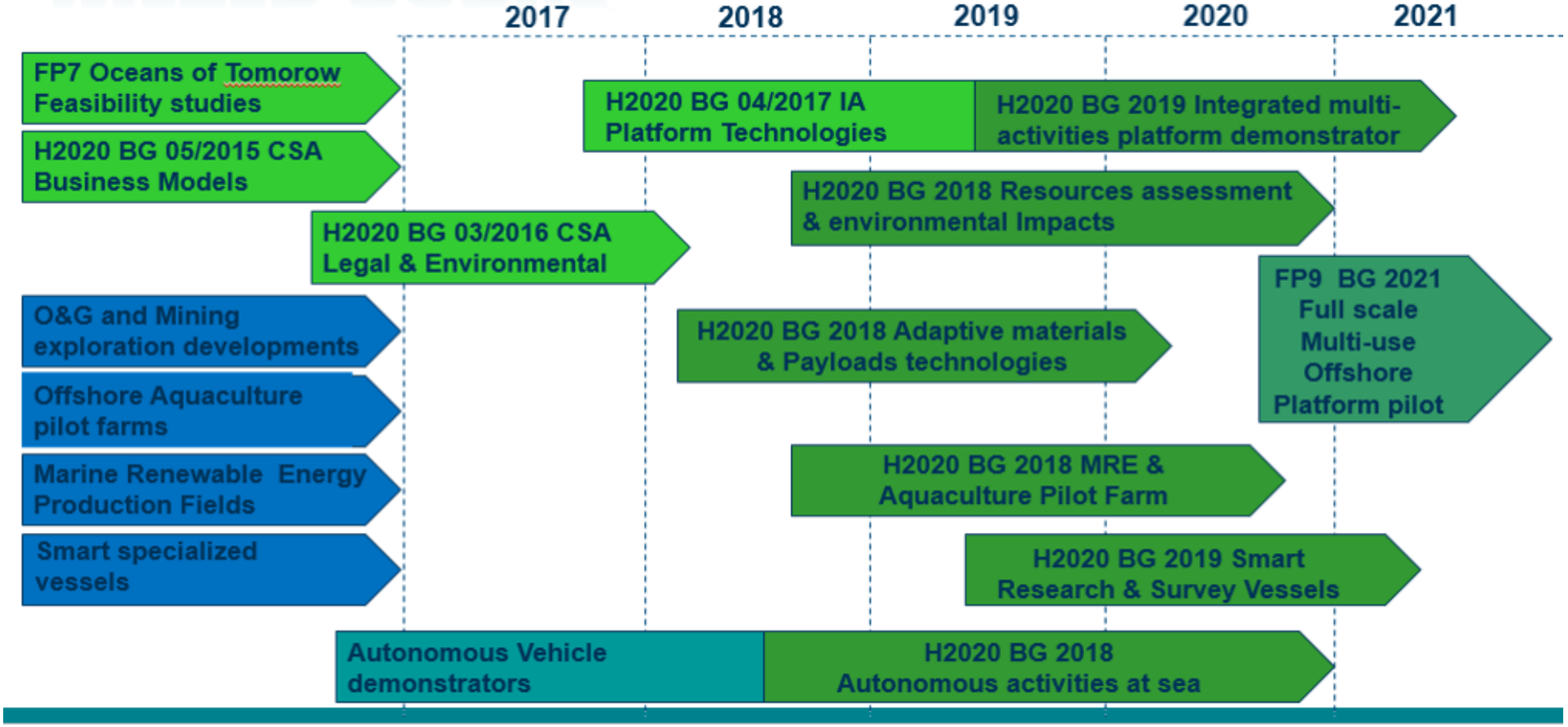
1. Introduction

The oceans are the planet's future (oceans are believed to be the only way to fulfil mankind's growing needs for food, energy, water, organic or mineral resources, etc.) and this prompts the need to develop significantly industrial activities at sea. The Waterborne community is willing to contribute to this by providing engineering and technology solutions to support businesses willing to harness the economy of the sea. These businesses can cover areas as diverse as renewable energies, aggregate mining, shallow and deep sea mining, offshore oil and gas, interdisciplinary survey and research, logistics and ship repair, shipping, yachting and marinas, cruise tourism, coastal tourism, fisheries, maritime security, biotechnologies, desalination, aquaculture, fish-farming, etc.

In order to harness the economy of the sea and develop commonalities between activities, it is proposed to develop several technology bricks enabling deployment of these activities in a synergetic manner and pave the way for a full scale 'pilot platform' (starting circ. 2020), with the demonstration of "technology bricks".

This work would capitalise on the FP7 Oceans of Tomorrow project results such as TROPOS, H2OCEAN, MERMAID and some of the on-going efforts to extend data ocean collection. Furthermore, it will coordinate with the H2020 CSA (MARIBE). In a similar way, this submission is coordinated with other submission from the Waterborne Technology Platform related to the Vessel for the Future work programme.

Blue Growth Roadmap



2. Challenges

As some challenges are cross sectorial and could benefit to different industries, when possible, Waterborne is advocating for joint calls, especially with area of commonalities such as Transport, Port and Logistic, ICT and others.

In order to take advantage of the blue economy the Waterborne TP Blue Growth WG believes that the following five challenges need to be overcome:

- **Challenge 1** - Exploration, resource evaluation and monitoring, environmental baseline and impact assessment:
    - The oceans are to date largely unexplored and therefore, before harnessing ocean resources, there is a compelling need to know the location, qualities and quantities of resources.
    - Another enabler to industrial activities at sea is the capability to set an environmental baseline (where we are now), and to assess the potential impact on the environment of the industrial activities. Also, it is vital to anticipate security problems that may arise in the border exposed to piracy networks or during the process of exploitation of natural resources, fish, electricity, raw materials, or others.
    - Currently these areas are covered using crewed boats frequently operating in hostile sea conditions.
        - To decrease risks taken by workers and control insurance costs, increasing technical awareness and reducing cost be sustainable this should be done through swarms of unmanned vehicles (UsV, UuV, UaV).
        - This myriad of unmanned vehicles (surface, underwater and aerial) have to be transported, stored, maintained, repaired, launched, retrieved and controlled at sea by a family of specialised research survey vessels (oceanography, geology and geophysics, etc.), able to acquire big amounts of data during operation, especially benefiting from the adoption of last generation sensor systems.
- **Challenge 2** - Technologies and engineering for seaborne and subsea activities:
    - To enable activities at sea, new technologies developed must be economically and environmentally sustainable, clean, safe, reliable, maintainable and self-sufficient (energy, fresh water, waste management …).
    - At the same time, related technology to the deployment, recovering, driving, and maintenance of a lot of equipment and tools will be required to work at and under the sea.
- **Challenge 3** - Smart and adaptive materials and structures:
    - These materials and structures are needed to improve the vessel or offshore platforms ability to operate in ever-changing environments and conditions.

- They will be necessary to support a use in harsh conditions (high depth, cold temperature, corrosion, very large structure).

- **Challenge 4** – Specialized vessels:
  - The new activities at sea brings forward the need for new vessels concepts, such as specialised ships able to service and man these new activities, in heavy and harsh conditions, e.g.: in the arctic regions.
  - These vessels could be: installation and maintenance vessels for renewable energy conversion, offshore platform deployment vessels, specialised vessels for aquaculture, command and control vessels for UxVs, etc.
  - New challenges have to be addressed in order to allow operations in deep waters (i.e. from more than 500m up to over 3,000m) and/or in remote waters (i.e. sea areas significantly far from any coastal area).
  - New kind of versatile ships (innovative, modular, multi-purpose and cost-efficient) have to combine various functions, based on standardized modules for easy manufacturing, operation and refurbishment, capable to operate without restrictions in remote areas where rescue or clean-up operations are difficult and costly, ensuring safety of on-board operations.

- **Challenge 5** - Acceptability, Regulation, Insurance and Legal issues:
  - Existing international regulations including maritime insurance framework dealing with maritime offshore activities are either related to ships or oil and gas platforms. These may not suit the developments in Blue Growth.
  - Through the evolution of sustainable development of the seas by introducing new technologies and operating conditions there will be the need to review and propose laws / regulations / insurance to ensure safe operation and level playing field.

3. Detailed Gap to be addressed in the upcoming H2020 Calls

➢ **<u>Integrated multi-activities platform (required funding ; (20m€):</u>**

Challenges 1, 2 & 3

1. Offshore logistic hub platform modular structure demonstrator

Taking advantage of offshore design and engineering companies' current workload, it is time to technically de-risk the modular structure project and to launch studies regarding platform construction industrial process (assembly, transport, installation). The offshore logistic hub is the most synergetic and economically relevant project to confirm the ability to build and maintain over a long period large offshore modular and versatile perennial structures (>10ha).

➢ **<u>Resources assessment and environmental impact: (required funding ; 32m€):</u>**

Challenges 1, 2 & 4

It is a fact that activities at sea are expanding in number and intensity at a constant pace. Safe and secure exploitation of these activities require more and more control, monitoring and intervention at sea mobilising extensive means in harsh and unsafe environment.

2. **Unmanned Autonomous Activities at Sea (25m€)**

The survey and monitoring of subsea area / water column around any maritime activity will require the development of multi-sensors or multi-missions swarm of UxVs vehicles and associated docking systems (incl. data transfer and energy re-loading), as well as top-of-the art subsea acoustic, optical and electro-magnetic sensors.

3. **The next-gen advanced research survey vessels (7m€)**

The increase use of UxVs and the needs for extensive monitoring activities create the need to develop a new generation of versatile survey research vessels, being capable as motherships of accommodating, operating and maintaining the last generation of unmanned vehicles (UxVs), and also being able of surveying individually as a stand-alone unit.

- **Application of Innovative Materials for Maritime Structures (required funding ; 10-15m€):**

Challenges 2 & 3

4. **Applying new materials and structural solutions for platforms, offshore renewable energy and deep sea mining**

Load carrying marine structures for new BG markets are currently almost exclusively made from steel with welding as the main joining method. This increases cost and lead time for offshore assembly, increases weight and does not provide optimal resistance to wear and aging under extreme conditions. Moreover, there is a large threat that simple standard steel structures cannot be produced in Europe competitively. Hence, there is a need for:

- **Strengthening the research and innovation strategies of the Waterborne industries in Europe (5 m€)**

Challenge 5

5. **Strengthening the effectiveness of RI capacities of the Waterborne industries in Europe through improved cooperation between stakeholders**

Research and development on BLUE activities, including Transport and Blue Growth technologies is currently wide spread through KEI and industrial challenges in H2020, national and regional programs and private initiatives. There is a limited overview and use on existing results and solutions, competences and actors and consequently cooperation and technology transfer is limited.

Hence, there is a need to support and coordinate the current effort to structure and harmonise the work done by all the different sectors of the Waterborne industries.

Annexes 1:

Detailed Gap to be addressed in the upcoming H2020 Calls

- **Integrated multi-activities platform (required funding ; (20m€):**

1. Offshore logistic hub platform modular structure demonstrator

Taking advantage of offshore design and engineering companies' current workload, it is time to technically de-risk the modular structure project and to launch studies regarding platform construction industrial process (assembly, transport, installation). The offshore logistic hub is the most synergetic and economically relevant to confirm the ability to build and maintain over a long period large offshore modular and versatile perennial structures (>10ha).

- Integrated multi-use platforms are a maritime "circular economy" concept development relying on an integrated platform management system that:
  - Commands and controls all utilities (energy and fresh water) and facilities that support implanted industrial activities.
  - Provides tools and assets to guarantee optimised logistic flows and operational handling systems, for loading and unloading solid goods at sea.
  - Properly integrates all platform based IT systems to wide area networks through robust and secured connectivity (SATCOM, plus cable and LOS systems).
  - Is able to perform remote monitoring and control, as well as operation and decision making.
- This new type of integrated multi-use platforms should have to combine several functions based on standardized modules for easy fabrication, at sea operation and repair, capable to operate without restrictions in remote areas.
- Energy production and management, storage, dispatching, conversion (incl. undersea), as well as security and safety of large platforms are key aspects that are mainly common with the Waterborne "Vessels of the Future" initiative. Some ad hoc demonstrators will address large modular industrial platform specifics like safe energy integrated storage capability, or safe and secure approaches for logistic external and domestic flows.
- Even if waste emission is related not only to the platform, but also to hosted industrial activities, a waste control system will take advantage of ship systems developed under the "Vessels of the Future" programme. Nevertheless, the bio remediation of offshore waste (solid, liquid, gas) will require specific demonstrations.
- In the same way, the human factor will be addressed beyond what has been done for reduced manning marine systems. In addition, the shortage of qualified man power willing to work offshore justify exploring under which conditions, family life can become a reality at sea, via explorative concept of combined offshore industrial zone and offshore village.
- Maintenance policy and maintenance systems will need to be developed to address the variety of activities of the platform.

- **Resources assessment and environmental impact: (required funding ; 32m€):**

It is a fact that activities at sea are expanding in number and intensity at a constant pace. Safe and secure exploitation of these activities require more and more control, monitoring and intervention at sea mobilising extensive means in harsh and unsafe environment.

2. **Unmanned Autonomous Activities at Sea** (25m€)

The survey and monitoring of subsea area / water column around any maritime activity will require the development of multi-sensors or multi-missions swarm of UxVs vehicles and associated docking systems (incl. data transfer and energy re-loading), as well as top-of-the art subsea acoustic, optical and electro-magnetic sensors.

- Enabling and integrating unmanned autonomous activities at sea among platforms, vessels and shore.
- Development of an autonomous system, designed specifically for operations in offshore environments
- Increasing the current state of the art of autonomous systems through the development of new vessels design and concept including architecture
- Enhanced and Cost Effective Communications will underpin multiple enablers such as data collection, sensors, etc. that is currently unable to perform cost effectively or at great depth.

3. **The next-gen advanced research survey vessels** (7m€)

A new generation of survey research vessels, being capable as motherships to accommodating, operating and maintaining the last generation of unmanned vehicles (UxVs), and also being able to surveying individually as a stand-alone unit.

- The vessels should have characteristics of flexibility, modular payloads and powerful and robust onboard IT infrastructure, able to receiving, managing, storing, processing and sending data to land stations.
- The enhanced possibility of data acquisition from the motherships and unmanned vehicles will require the support of specifically designed onboard IT infrastructure, allowing for data managing, processing, storing and transferring to land stations.
- Modularity should be a paradigm pursued within cabins and public areas, as well as within the design of laboratories, that represent the payload of the ships and also for the unmanned vehicle, thus adapting missions to specific requirements.

- **Application of Innovative Materials for Maritime Structures (required funding ; 10-15m€):**

4. **Applying new materials and structural solutions for platforms, offshore renewable energy and deep sea mining**

Load carrying marine structures for new BG markets are currently almost exclusively made from steel with welding as the main joining method. This increases cost and lead time for offshore assembly, increases weight and does not provide optimal resistance to wear and aging under extreme conditions. Moreover,

there is a large threat that simple standard steel structures cannot be produced in Europe competitively. Hence, there is a need for:

- Evaluation of smart and adaptive materials (including FRP with natural fibres, fire resistant composites, innovative steel and metallic materials, fibre reinforced concrete, etc.), for hull structures and outfitting, which will improve the ability to sustain changing environmental and operational conditions;
- Development of new materials adapted to modular platforms naval architecture in view of their applicability under maritime conditions exploring synergies to create a critical market size and unified standards for new materials, development of standard materials and joints;

➢ **Strengthening the research and innovation strategies of the Waterborne industries in Europe (5 m€)**

5. Strengthening the effectiveness of RI capacities of the Waterborne industries in Europe through improved cooperation between stakeholders

Research and development on BLUE activities, including Transport and Blue Growth technologies is currently wide spread through KEI and industrial challenges in H2020, national and regional programs and private initiatives. There is a limited overview and use on existing results and solutions, competences and actors and consequently cooperation and technology transfer is limited.

Hence, there is a need to:

- Support and coordinate the current effort to structure and harmonise the work done by all the different sectors of the waterborne industries in coordination of the ETP.
- Strengthen the effectiveness of research and innovation capacities of the Blue industries in Europe through improved cooperation between stakeholders, including decision-makers, and enhanced definition of strategic research and innovation needs.
- Assist the European technology platforms (ETP), the European Commission (EC) and Member States and Associated States (MS/AS) in defining research needs for their strategies and programmes in order to realise the objectives of the EU.

Annexes 2:

WATER*BORNE*^{TP} and non WATER*BORNE*^{TP} members formally participating to the Blue Growth Working Group:

- **Blue Growth Working Group: Who and Why**

Given the new challenges raised by the scarcity of resources and land available, ocean are believed to be the only way to fulfil mankind's growing needs for food, energy, water, organic or mineral resources, ert. This is prompting the need to develop significantly industrial activities at sea. In order to provides the Commission with the best possible feedback from industries interested by this new opportunity for sustainable growth, the **WATER*BORNE*** ^{TP} community created in June 2014 the so called **WATER*BORNE*^{TP}** Blue Growth Working Group that will contribute with the provision of engineering and technology to support the businesses willing to go at sea for businesses that can be as diverse as renewable energies, aggregate mining, shallow & deep sea mining, offshore oil & gas, shipping, yatching & marinas, cruise tourism, coastal tourism, fisheries, maritime security, biotechnologies, desalination, aquaculture, fish farming, etc.

- **DCNS**
- **Limerick University**
- **MTI Holland/IHC**
- **IRT – Institut Jules Verne**
- **Fraunhofer CML**
- **Forskningsradet**
- **TSI**
- **Force**
- **Hidroteknik**
- **University of Lisboa**
- **BSHC**
- **SEA Europe**
- **CTO**
- **CMT**
- **Cruise Council**
- **CEREMA**
- **National Maritime College of Ireland**
- **SINTEF**
- **Konsortium Deutsche Meeresforschung**
- **Ocean Energy Europe**
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