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# AtlantOS Exploitation Plan

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## 1. Introduction

Observation of the Atlantic Ocean is based on a growing number of in-situ infrastructures mainly supported by national agencies to fill specific information need. While national initiatives remain essential for progress in ocean observation, the lack of a global strategy has led to a lack of synchronisation, the construction of various knowledge and data repositories, limited connectivity between the observing networks and incomplete integration of the data and information. Such fragmentation is also an impediment to the implementation of new and more efficient technologies in a blue/green growth context. Moreover, the lack of an overall system perspective makes it hard to identify and close information gaps, and to pinpoint opportunities to improve efficiency. A few reference efforts like DataONE <https://www.dataone.org/> best practices and Earthcube, the LTER and NEON networks show that this is a realisable goal. The Blue Growth agenda spells out new opportunities for marine and maritime sustainable growth, which in turn increases the need for more and better-integrated ocean information that can support improved marine knowledge and decision making for exploration, exploitation and conservation as well as the UN 2030 Agenda for Sustainable Development. Balancing the intensive exploration and exploitation of the Atlantic Ocean with good ecosystem state and sustainable use of its marine resources, ultimately promoting the maintenance of its good environmental status, requires the best available integrated information for the whole Atlantic Ocean spanning local, regional and basin scales across all oceanographic domains - physical, chemical, and biological. Similar initiatives are ongoing on land, and are based on the recognition, support and incentive of new international frameworks in observation.

The Framework of Ocean Observing was outlined by a group of experts in charge to develop a strategy for the future to foster progress in sustained ocean observing considering the recognition that more integration across disciplines is needed. The Framework of Ocean Observation is responsive to user needs and societal drivers.

The **vision of AtlantOS** is to improve and innovate Atlantic observation by using the Framework of Ocean Observing to obtain an international, more sustainable, more efficient, more integrated, and fit-for-purpose observation system. The AtlantOS initiative aims to have a long-lasting and sustainable contribution to the societal, economic and scientific benefit arising from this integrated approach, by implementation beyond the project's lifetime. Advances will be achieved by improving the value for money, extent, completeness, quality and ease of access to Atlantic Ocean data required by industries, product supplying agencies, scientist and citizens.

### 1.1 Objectives

The overarching target of the AtlantOS initiative is to deliver an advanced framework for the development of an integrated Atlantic Ocean Observing System that goes beyond the state-of-the-art, and can be sustained after the project's lifetime. This overarching target will be achieved by i) improving international collaboration in the design, implementation and benefit sharing of ocean observing, ii) promoting the engagement and innovation in all aspects of ocean observing, iii) facilitating free and open access to ocean data and information, iv) providing and disseminating methods of achieving quality and integration on ocean information, v) strengthening the Global Ocean Observing System (GOOS) and the Blue Planet Oceans and Society initiative within the Group on Earth Observations (GEO), thus support observing systems that are critical for the Copernicus Marine Environment Monitoring Service and its applications, and vi) contributing to the aims of the Galway Statement on Atlantic Ocean Cooperation.

This target be supported by eleven top-level objectives:

**Objective 1 - Establish European leadership in a cooperative design of Integrated Atlantic Ocean Observing System.** This objective will be achieved by expanding upon existing capabilities and applying the systems design processes of the Framework for Ocean Observing (doi:10.5270/OceanObs09-FOO) based on the identification of sustained ocean observing requirements, through the refinement of priority Essential Ocean Variables (EOVs), the evaluation of gaps in the present observing system, enhancement of existing capacities, consideration of feasibility, and by maximizing its impact on information needs. A key gap

remains the inclusion of biological EOV with relevance for life in water (UN sustainability goal 14).

Work packages addressing this objective: WP1

**Objective 2 - Enhance and integrate ship-based and autonomous platform observing networks so they become sufficiently mature for long-term sustainability.** This objective will be achieved by implementing more cost-effective multi-use platforms with improved capability and durability, measuring synchronously more interlinked variables (especially biogeochemistry and biology), improving accurate and timely data delivery, and by systematically filling observational gaps for specific under-sampled areas.

Work packages addressing this objective: WP2 and WP3

**Objective 3 - Support existing communities and networks observing EOVs in the Atlantic – with their international expertise in the design, development, operation and maintenance of Integrated Atlantic Ocean Observing System networks – by disseminating best practices, harmonizing data processing and normalizing quality control procedures.** This objective will be achieved by fostering trans-Atlantic cooperation (e.g. with NOAA’s ocean observing initiatives and NASA’s Earth Observatory etc.) and engaging new partners in the Integrated Atlantic Ocean Observing System.

Work packages addressing this objective: WP1,2,3,6,7

**Objective 4 - Close the gap between continental shelf and deep ocean observing networks.** This objective will be achieved by harmonizing observing strategies, using coastal facilities to test and develop novel technologies for the remote open ocean, and applying new sensors and technologies needed to achieve full ocean monitoring.

Work packages addressing this objective: WP4

**Objective 5 - Showcase the power of integrated trans-Atlantic observing to provide information necessary to contribute to the UN sustainability goals and to cope with global challenges such as climate change, increased pressures on natural resources, declining ecosystem state, loss of species and global-scale hazards.** This objective will be achieved focusing on two examples: the subpolar North Atlantic and the subtropical South Atlantic. Both regions have productive high-seas fisheries and play important roles in the Atlantic Ocean overturning circulation and the marine carbon cycle.

Work packages addressing this objective: WP5

**Objective 6 - Significantly upgrade the performance, coverage, and cost-effectiveness of Integrated Atlantic Ocean Observing Systems through innovations in sensing approaches.** This objective will be achieved through an increased engagement of the European industry in ocean sensor and instrumentation markets, and in services to ocean observation, leading the development of metrology standards and best practices for ocean observing. AtlantOS involves a number of SMEs and provides framework concepts to reducing the cost of monitoring by efficiency gains delivered through networks and countries sharing resources and infrastructure during the creation, operation and maintenance of the Integrated Atlantic Ocean Observing System, addressing the chronic under-sampling of biogeochemical and biological parameters by supporting existing activities and the creation of new networks, observation technologies and programmes.

Work packages addressing this objective: WP6

**Objective 7 - Provide new information products in several societal benefit areas (i.e. climate, disasters, ecosystems, health and fresh water security) including increased safety for offshore activities and coastal communities.** This objective will be achieved by integrating all relevant data from Earth Observing satellites and the in-situ systems, and by facilitating their free and open access and use in synthesis and ocean model forecast systems by using the framework of the marine monitoring and information services of Europe, Canada, the United States and other Atlantic countries based on the FAIR Guiding Principles ( i) to be findable, ii) to be accessible, iii) to be interoperable, and iv) to be reusable).

Work packages addressing this objective: WP8

**Objective 8 - Improve systems evaluation by providing quantitative and near-real-time information on the technical performance of the Integrated Atlantic Ocean Observing System networks and their timely data delivery.** This objective will be achieved by analysing and documenting the adequacy of observing and associated information products from Integrated Atlantic Ocean Observing System for each Essential Ocean Variable, developing a strategy for Integrated Atlantic Ocean Observing System long-term sustainability and contribution to GEOSS based on existing plans of international partners, EU Member States and key European initiatives.

Work packages addressing this objective: WP9

**Objective 9 - Develop a results-oriented dialogue with key stakeholder communities.** This objective will be achieved by enabling exchanges between the products and services to be delivered by an Integrated Atlantic Ocean Observing System and associated ocean information systems will deliver and the demands and needs of these key communities: the innovation and industry community, the regulatory and implementing community, and the research funding community building on the Galway Statement on Atlantic Ocean Cooperation.

Work packages addressing this objective: WP10

**Objective 10 - Engage a wide range of interested organizations and individuals over the course of AtlantOS.** This objective will be achieved by motivating and mobilizing new and young talent to participate in Atlantic Ocean observation-related activities, and by developing a dynamic, gender and diversity balanced community of interested individuals and bodies around the activities of an Integrated Atlantic Ocean Observing System by supporting inclusive and open observing networks within the Integrated Atlantic Ocean Observing System. The AtlantOS Gender and Diversity Committee (GDC) will develop a strategic work plan related to gender and diversity within AtlantOS and access the implementation of the work plan during the project's lifetime.

Work packages addressing this objective: GDC supported by all WPs

**Objective 11 - Enable free and open access to all data.** This objective will be achieved by maximizing all developed intellectual property to its fullest extent to achieve maximum benefit for and on behalf of the stakeholders, through provision of open access to peer-reviewed publications, with a combination of green and golden Open Access, and through the provision of open access to research data, by taking part in the "Pilot on Open Research Data in Horizon 2020". WP7 and WP11 developed a

Work packages addressing this objective: All

AtlantOS will transform existing observing activities into a framework for an integrated Atlantic Ocean observing system that will cover the whole Atlantic basin from Fram Strait in the north to the southern tip of South America and Africa (*Obj.1*). AtlantOS will support sustained ocean observation, which is needed to understand basin scale ocean processes and their development through time, for example the meridional ocean overturning circulation or upwelling systems and their impacts on ocean heat transport, biogeochemistry and marine ecology (*Obj.2*). AtlantOS will contribute to filling existing observational gaps (*Obj.1 and 4*) by developing strategies for increased coverage and readiness of ship-based and autonomous platform observing networks and improved coordination, as well as by linking to the remote sensing and modelling communities. AtlantOS will improve access to Integrated Atlantic Ocean Observing System observations by harmonizing data output and services in collaboration with and across the networks involved (*Obj.3,6,7*). AtlantOS is fully committed to implementing a free and open data sharing policy (*Obj.11*). AtlantOS will harmonize existing workflows and processing procedures to improve the performance of data management structures taking full advantage of new developments in the GEOSS Common Infrastructure. *Coordination* will happen through the GOOS observing networks, the GOOS Regional Alliances (e.g. EuroGOOS and US-IOOS) and in cooperation with the GEO Blue Planet Task community. Following the outline of the Galway Statement, AtlantOS will strengthen trans-Atlantic collaboration by linking European partners with strategically important partners from Canada, the United States and the South Atlantic region. AtlantOS will develop a results-oriented dialogue with key stakeholder

communities (*Obj.5,9,10*) through a process that enables a meaningful exchange between the products and services that an Integrated Atlantic Ocean Observing System can deliver and the demands and needs of the stakeholder communities (*Obj.7*). Finally, AtlantOS will establish a structured dialogue with funding bodies, including the European Commission, United States and Canada thereby contributing to the implementation of the Galway Statement on Atlantic Ocean Cooperation (*Obj.8*), and as well as engagement of other interested countries to ensure sustainability and adequate growth of the Integrated Atlantic Ocean Observing System.

### 1.3 Concept and approach

The ocean is critical to the Earth's global systems by regulating weather and climate, the concentration of oxygen and greenhouse gases in the atmosphere and nutrient recycling as well as by providing important food resources and refilling the Earth's fresh water supplies. The Atlantic is impacted substantially by the surrounding continents and civilization, and pressures such as the degradation of coastal environments, pollution, destructive fisheries practices, biodiversity decline, bleached and dying coral reefs, receding polar ice sheets, sea-level rise and ocean acidification. In 2015 the UN General Assembly formally accepted a new set of 17 measurable Sustainable Development Goals (SDGs). While under the Millennium Development Goals, the ocean was captured under the broad goal of ensuring environmental sustainability, the SDGs give the ocean a much needed and focused attention with SDG 14 'conserve and sustainably use oceans, seas and marine resources for sustainable development'. The ten SDG 14 targets aim to prevent and reduce marine pollution, sustainably manage and protect ecosystems, minimize and address the impact of ocean acidification, effectively regulate harvesting of the ocean, conserve at least 10 per cent of coastal, increase the economic benefits to Small Island Developing States and Least Developed Countries from the sustainable use of marine resources, and increase scientific knowledge. The scientific contribution to an Integrated Atlantic Ocean Observing System is to shed light on the many natural and human induced processes affected, by articulating an effective and efficient network system of observing infrastructure, products and services. AtlantOS brings together scientists, industry and other stakeholders from around the Atlantic to give a concrete structure to improved and better coordinated efforts in observing, understanding and predicting ocean dynamics in order to deliver integrated ocean information for a large range of societal benefits. SNAPP (Science for Nature and People Partnership) could be a precedent that some of the world's most wicked problems bring together long-lasting the best minds in science with actors that are part of the problem-solving and eager to implement science's findings. AtlantOS will build on the largely independent observing systems that have emerged to meet the needs of particular research disciplines and stakeholders – the majority of these measuring ocean physics. It is now critical to extend the scope of the existing Atlantic observing networks to more fully include ocean biogeochemistry and biology, and to integrate efforts across these scientific disciplines, because 1) many of the ocean-related problems faced by societies today are interdisciplinary in nature; 2) the limited resources available for ocean observing systems require strong international cooperation and leveraging, and 3) many of the risks and opportunities of ocean exploitation (e.g. fishing, deep-sea mining) require collocated biological, biogeochemical and physical oceanographic observations, and scientific concepts for the definition of the good ecosystem state, as well as for conservation of resources for future generations.

AtlantOS will integrate existing international observation systems around the Atlantic such as a network of profiling floats (Argo) and surface drifters, a collection of deep hydrographic surveys (GOSHIP), a network of Ships of Opportunity near surface observations, a network of continuous plankton recorders (CPR), an impressive array of deep ocean and coastal moorings (OceanSITES), fishery surveys and high precision sea floor mapping observation. Several emerging networks are being established around gliders, cabled observatories, and (meta)genomic observation just to name a few. AtlantOS will support activities to share, integrate and standardize these in-situ observations, reduce the cost by network optimization and deployment of new technologies, and increase the competitiveness of European industries, particularly of the small and medium enterprises (SMEs) of the marine sector. AtlantOS will promote innovation and methods for identification, documentation and exploitation of innovative observing systems by adopting a



Strategy for Knowledge and Innovation Management that encapsulates the guiding principles of Horizon 2020.

### 1.3.1 Technology readiness level

The challenge is to conduct the research and innovation activities necessary to increase performance and efficiency of the Integrated Atlantic Ocean Observing System, when these are mostly sustained by national initiatives. To build on existing capacities around the Atlantic and also to fill the observational gaps in space and time and for many important ocean variables, with the Integrated Atlantic Ocean Observing System through the optimization of existing systems, it needs strategies for better coordination, harmonization and integration and the use of new ocean observation technologies. This is a focus of AtlantOS.

Some project activities explore the feasibility of a new or improved technologies and sensors development currently at technology readiness levels (TRLs) 4-6. This includes proven prototypes for nutrients (TRL 5-6), the development of pCO<sub>2</sub> optodes (TRL 4), pH sensors (TRL 6), dissolved inorganic carbon and total alkalinity sensors (TRL 4) and improved oxygen sensors (TRL 6). It is our aim to accelerate the TRL of these systems such that prototypes will be demonstrated on platforms used by AtlantOS networks (TRL 7). AtlantOS will develop roadmaps for technologies to fill gaps in emerging EOVS including biological and (meta)genomic survey instrumentation and sensors including a review of technologies currently at TRLs 3-5 and adaptation test and demonstrations of in-situ oceanic genomic sensors, and sampling approaches dedicated to new pressures such as plastic littering. The metrology aspects of Integrated Atlantic Ocean Observing System are at TRL 9 for most physical parameters, TRL 6 for many biogeochemical parameters, and at only TRL 4 for most (meta)genomic measurements. We will coordinate and promote a progression to a minimum of TRL 7 in areas with less mature metrology practice. AtlantOS will improve the technological readiness for interoperability of the data system to a TRL 6-9, depending on the data type. Limited pilot actions are aiming to show technical feasibility in a near-to-operational environment aiming to integrate the individual existing technologies (i.e. in-situ, remote observations and models) into single products, targeting a TRL of 5-6. A number of pilot data and information products will be generated to support specific user needs at a TRL 6-7.

### 1.3.2 Research and innovation activities linked to AtlantOS:

For its nature and overall strategy, AtlantOS will bring together several networks, initiatives and research and innovation activities, established at international, European and national level.

Links to Copernicus Marine Service and EMODnet: EMODnet is an initiative from DG MARE as part of its Marine Knowledge 2020 strategy. Its main purpose is to unlock fragmented and hidden marine data resources and to organize an improved access to quality-assured, standardised and harmonised marine data. Copernicus is a major European programme for Earth Monitoring and is the main European contribution to GEO/GEOSS. The Copernicus Marine Service, implemented in particular through the MyOcean-1 & 2 projects and the European Center for Ocean Monitoring and Forecasting partnership, has set up a pan-European service for ocean monitoring and forecasting for the global ocean and European seas. In-situ and satellite observation are routinely assimilated in ocean models to provide in integrated descriptions and short-term forecasts of the ocean physical and biogeochemical state. These core “integrated” products serve a wide range of applications and users. EMODnet and the Copernicus Marine Service will be kept closely coordinated with several of the AtlantOS activities. AtlantOS will ensure a real-time and delayed mode data flow from AtlantOS networks towards EMODnet and the Copernicus Marine Service. Some AtlantOS design studies will use Copernicus modelling and data assimilation systems. The Copernicus Marine Service will thus immediately benefit from the upgraded data information flow for ocean analysis and forecast models running for the Atlantic basin. Impact of AtlantOS networks for the Copernicus Marine Service will be quantified. New ocean information products will also make use of the products from the Copernicus Marine Service to showcase the importance of ocean observing for several of the GEOSS societal benefit areas.

International research and innovation activities feeding into AtlantOS: There are strong links between the partners in this project and other projects in Europe and around the Atlantic. GOOS, GEO, GEOSS and the “Oceans and Society: Blue Planet” Initiative, GODAE OceanView and international research programmes (e.g. CLIVAR, IMBER and SOLAS) will feed into most of the AtlantOS work packages including advanced ocean observatory capabilities such as RAPID-MOCA, OOI, OSNAP, SAMOC, and FP7 NACLIM. The ship-based observations will be carried out through existing International networks such as GO-SHIP, the Ship of Opportunity Program, the Global Alliance of Continuous Plankton Recorder Surveys network and the national plankton and fish surveys coordinated through the International Council for the Exploration of the Sea. The various autonomous platforms and associated networks such as the profiling float network Argo, moored observatories under OceanSITES and Glider networks have been progressively implemented and organized at national level and integrated at European level as part of several FP7 funded projects and/or of the ESFRI roadmap on European research infrastructures (e.g. Euro-Argo, EMSO, ICOS). Argo and its enhancement towards biogeochemistry and deep observation will be undertaken in the context of recently launched Euro-Argo ERIC European Research infrastructure (Partner 41). Glider activity is presently maturing as part of European infrastructure design study GROOM. The FP7 Fixed Point Open Ocean Observatories (FixO3) project seeks to integrate European open ocean fixed point observatories and to improve access to these key installations for the broader community, while contributing to the larger international network OceanSITES. The integration with coastal and regional systems will build on work conducted by EuroGOOS, FP7 JERICO and the European Environment Agency in recent years on identifying the optimal configuration for the regional and coastal ocean observing systems. Similar activities within US-IOOS, UNESCO Intergovernmental Oceanographic Commission (IOC) and the Global Sea Level Observing System will also feed into AtlantOS. AtlantOS will also benefit from the links to FP7 projects (i.e. Common Sense, NEXOS, SCHeMA, SenseOCEAN) developing a range of multi-parameter sensors for the marine environment, some of which will be directly applicable for filling the gaps in the in-situ variables for the Integrated Atlantic Ocean Observing System. AtlantOS will also link to biosensor development projects BRAAVOO, EnviGuard, Mariabox, Sea-On-AChip, SMS to develop roadmaps for the routine observation of biology and hard to measure chemical targets. AtlantOS will benefit from ongoing data management activities that are part of MyOcean 1 & 2, EMODnet and SeaDataNet for the establishment of data infrastructures and FP7 COOPEUS for harmonizing standards and policies on the international level. All these initiatives and projects will feed into the data flow and integration activities which will also receive inputs from all of the main international observing networks (e.g. Argo, GOSUD, OceanSITES, EGO, DBCP). Harmful Algal Bloom forecasting and prediction is one of the core objectives of GeoHab. AtlantOS will work closely with the Joint Technical Commission of Oceanography and Marine Meteorology (JCOMM), a joint programme of the World Meteorological Organization and IOC which works internationally through Expert Teams on Maritime Safety Services, Waves and Coastal Hazards Forecasting Systems. Dissemination and the strategic work on IAOOS sustainability will be carried-out in collaboration with and drawing on the expertise of IOC, many FP7 projects, JPI Oceans and the Partnership for Observation of the Global Oceans.

National research and innovation activities feeding into AtlantOS: AtlantOS will tie in with a large number national ocean observing research programmes around the Atlantic including: MEOPAR (CA), IOOS (US), Coriolis (FR), MANIDA (DE), Ministry of Science (BR), Council for Scientific and Industrial Research (ZA) and several national operational observing systems coordinated through the EuroGOOS/ROOSes, IMON integrated Monitoring programme (UK), COSYNA (DE) and RAIA observatories (ES), OOI (US), VITALS (CA), OVIDE (FR), and RAPID (UK), 53°N and FRAM arrays (DE). A key element is to link activities with similar initiatives around the Atlantic basin including the USIOOS, Regional Alliance in Oceanography for the Upper Southwest and Tropical Atlantic, the activities of GOOS in Africa and the IOC.

## 2. Exploitation and impact

### 2.1 Exploitation of results

A key objective of publicly-funded research is that it should lead to the dissemination of new scientific



knowledge, the exploitation of results and informed decision-making. Innovation is understood as a reflective process including the implementation of knowledge and technologies in societal processes. AtlantOS will deliver the below named exploitation products (2.1.3) to achieve an exploitation of results. The strategic use and management of Intellectual Property (IP) in international research initiatives and in business is essential for strengthening the European scientific and technological base, boosting innovation and ensuring growth in the EU. In this context our consortium is aware that Horizon 2020 places much emphasis on systematic Intellectual Property exploitation strategies as a means to better protect innovation initiatives, and to reap commercial and economic benefits from EU-funded research.

## **2.1.1 Ownership, protection and transfer of results**

### **2.1.1.1 Ownership of results**

Results are owned by the party that generates them.

Joint ownership: two or more parties own results jointly if they have i) jointly generated them and ii) it is not possible to a) establish the respective contribution of each party or b) separate them for the purpose of applying for, obtaining or maintaining their protection. The joint owners must agree on the allocation and terms of exercise of their joint ownership to ensure compliance with their obligations under the grant agreement. Unless otherwise agreed each of the joint owners shall be entitled to use their jointly owned results for non-commercial research activities on a royalty-free basis, and without requiring the prior consent of the other joint owners. Furthermore, each of the joint owners shall be entitled to otherwise exploit the jointly owned results and to grant non-exclusive licenses to third parties if the other joint owners are given a) at least 45 calendar days advance notice and b) fair and reasonable compensation.

### **2.1.1.2 Protection of results and visibility of EU funding**

Each party must examine the possibility of protecting its results and will adequately protect them if i) the results can reasonably be expected to be commercially or industrially exploited and ii) protecting is possible, reasonable and justified. If a party decides to protect its results it must consider its own legitimate interests and the legitimate interests of the other project parties.

EASME (the Executive Agency for Small and Medium-sized Enterprises) under the power delegated by the EC may, up to 4 years after the lifetime of AtlantOS, assume ownership of results to protect them, if the owner (beneficiary) intends to disseminate its results without protecting them. This is not valid if i) the protection of results is not possible or ii) the potential for commercial or industrial exploitation is not given or iii) the results are planned to be transferred to another beneficiary that intend to protect them.

Applications for protection of results must include the following statement to declare EU funding:  
*“The project leading to this application has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 633211”.*

### **2.1.1.3 Transfer of results**

Each party may transfer ownership of its own results. However, it must ensure that the above obligations also apply to the new owner and that this owner has the obligation to pass them on in any subsequent transfer. The transferring party shall ensure that the rights of the other parties will not be affected by the transfer.

## **2.1.2 Access rights to results**

All beneficiaries will provide each other access, on a royalty-free basis, to results needed for implementing their own tasks under the action. Furthermore, all parties will give each other, under fair and reasonable conditions, access to results needed to exploiting their own results.

Access will also be given to affiliated entities if this is needed for those entities to exploit the results generated by the beneficiaries to whom they are affiliated. Such requests should be made directly to the party that owns the results.

The above-named noted request for access may be made up to one year after the end of the AtlantOS funding period (30/06/2019).

All AtlantOS consortium parties will give access to their results, on a royalty-free basis, to EU institutions, bodies, offices or agencies for developing, implementing or monitoring EU policies or programmes. However, such access rights are limited to non-commercial and non-competitive use.

EASME may use, for its communication and publishing activities, information related to the action, documents as well as other material, such as pictures or audio-visual material that it receives from any party of the consortium.

### 2.1.3 Obligation to exploit results

Each consortium partner will take measures which ensure direct or indirect exploitation of its results by:

- i) Using them in further research activities
- ii) Developing, creating or marketing a product or process
- iii) Creating and providing a service
- iv) Using them in standardisation activities

In case results are incorporated in a standard, the party concerned will ask the standardisation body to include the following statement in the standard if possible:

*“Results incorporated in this standard received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 633211.”*

#### AtlantOS exploitation products

Task	Exploitation Products	Target Group
1.2	Task 1.2 will deliver two reports: <ul style="list-style-type: none"> <li>• Existing observation system and gaps which rely on engaging observing community</li> <li>• Cost and feasibility study of present and planned AtlantOS observing system. Two stakeholder workshops are planned for this task</li> </ul>	Policy Makers, Scientific Community, Funding Agencies, Implementing Organizations, Users of data
1.3	Recommendations for Atlantic observing network evolution	Policy Makers, Scientific Community, Funding Agencies, Implementing Organizations
2.4	Direct involvement of users in the fisheries and zooplankton observations	Scientific Community, Stakeholders
2.5	Involve users in project and in data acquisition	Scientific Community, General Public
3.1	<ul style="list-style-type: none"> <li>• Involvement of users in the development of the extension of the Argo Network</li> <li>• Consolidation of the European Strategy for Argo for the next decade</li> </ul>	Scientific Community, Stakeholders, Policy Makers
3.4	<ul style="list-style-type: none"> <li>• Development of an app<sup>1</sup> to visualize gliders deployment on smart phone</li> <li>• Support glider data flow from PI toward integrator</li> </ul>	Scientific Community, General Public (for app)
3.5	<ul style="list-style-type: none"> <li>• Delivery of a report on Pirata network enhancement</li> <li>• Free access to data</li> </ul>	Scientific Community
3.6	<ul style="list-style-type: none"> <li>• Enhance the observation coverage so that weather</li> </ul>	Scientific Community, Stakeholders,

Task	Exploitation Products	Target Group
	forecasts are improved <ul style="list-style-type: none"> <li>• Develop and commercialize an affordable sensor for sea-surface salinity so that many more in situ data can be gathered (from drifters) for this parameter</li> </ul>	Civil Society, General Public, Industry
4.1	<ul style="list-style-type: none"> <li>• Development of an overview of gaps between coastal and open ocean observing systems (including "quality" gaps)</li> <li>• Recommendations to re-plan and optimise current observational strategies for continental shelf observing networks</li> <li>• Improve coastal and open ocean connections with wider ocean observing networks</li> </ul>	Scientific Community, Policy Makers, Stakeholders, Industry
4.3	<ul style="list-style-type: none"> <li>• Improved sea level data catalogue for the South Atlantic</li> <li>• Increased use of south Atlantic sea level data by the sea level science community and policy makers</li> </ul>	Scientific Community, Stakeholders, Policy Makers
4.4	Build long-term linkages between AtlantOS and transatlantic partnerships in order to continue to transfer knowledge and optimize the coastal observing system in the Atlantic.	Policy Makers, Scientific Community, Others (Funding Agencies, Implementing Organizations)
5.1	<ul style="list-style-type: none"> <li>• Creating an international transatlantic network of Marine institutions from the northern and southern hemisphere to build on long-term linkages and partnerships for an Atlantic Observing from deep-sea to coastal areas to quantitatively understand climate change and ecosystems and providing a solid bases for forecasts and marine services management</li> <li>• Deliver a report and organize an international conference.</li> </ul>	Scientific Community, Policy Makers, Stakeholder, Others
5.3	Involve data producers in design experiments (sub-polar gyre, South Atlantic) coordinated with task 1.3	Scientific Community, Stakeholders
6.1	<ul style="list-style-type: none"> <li>• Creation of a roadmap for strategic developments for Integrated Atlantic OOS providing a resource for global ocean observation of the future</li> <li>• Deliver technologies for pH, pCO<sub>2</sub>, DIC, TA, (fast) oxygen and nutrients</li> <li>• Developing water and filter sampler technologies and adapting the only oceanic genomic sensor currently at TRL 8</li> </ul>	Scientific Community, Industry, Civil Society, Investors, Customers
6.3	<ul style="list-style-type: none"> <li>• Inventory of existing sharing/access mechanisms</li> <li>• Common infrastructure sharing/access methodology</li> </ul>	Scientific Community, Industry
6.4	A compendium of best practices in ocean observation to further standardization of practices with an initial focus on areas of sensors and data management	Scientific Community, Industry, Stakeholders
6.5	Development of a roadmap for emerging networks, and ways of integrating them with the established observing	Scientific Community, General Public

Task	Exploitation Products	Target Group
	systems. Specifically around biological and (meta)genomics.	
7.1	Recommendation for a most efficient data exchange, quality and documentation of the AtlantOS networks	Scientific Community, Operational Community (CMEMS)
7.2/ 7.3	<ul style="list-style-type: none"> <li>• Interoperable data system of System for the Atlantic</li> <li>• Demonstration of an enhanced system</li> </ul>	Scientific Community, Operational Community (CMEMS)
7.5	Development of EOVS synthesis products (i.e. high level products) from WP2&WP3 networks for ocean, carbon, ecosystem and climate research to contribute to the demonstration of the impact of the Atlantic Observing System for ocean and climate change research	Scientific Community, Operational Oceanography Community
8.1	Demonstration of one societal benefit of the integrated Atlantic ocean observing system through the information products provided in a downstream Harmful Algal Bloom weekly bulletin (TRL 5 - 6)	Scientific Community, Industry (primary target group), General Public, Stakeholders, Policy Makers, Others
8.2	Global storm surge climatology in a WMO hosted database. A globally consistent model for evaluating extreme sea levels from storm events	Scientific Community, Civil Society, Policy Makers, Stakeholders
8.3	Open-source model for ship routing in the Atlantic	Scientific Community, Industry, General Public, Investors
8.4	Oil spill hazard GIS layers for accidental and operational oil spills	Scientific Community, Industry, Civil Society, General Public, Policy Makers
8.5	"Proof of concept" – Demonstration of how the AtlantOS observing systems can provide decision support for offshore aquaculture siting	Scientific Community, Industry (primary target group), Investors, Policy Makers, Stakeholders
8.6	Demonstrate the value of Integrated Atlantic OOS observations in improving physical and biogeochemical reanalyses of the North West European Shelf, using the North West European Shelf regional reanalysis system of the Copernicus Marine Service	Scientific Community, Stakeholders, Policy Makers
8.7	<ul style="list-style-type: none"> <li>• Development of new services for monitoring and management of marine resources</li> <li>• Involve users</li> <li>• Transfer to industry</li> </ul>	Scientific Community, Industry, Civil Society, Policy Makers
9.2	Report on the performance of AtlantOS observing system	Scientific Community, Industry, Policy Makers, Stakeholders, Investors, Customers
9.3	Plans for national, European and international long-term sustainable implementation plans for Atlantic observing system and particularly a mature plan implementation of EOOS (European Ocean Observing System).	National funding agencies in EU and non-EU partners, AORA and JPI-Ocean
10.2	Report on Best Practices in Stakeholder Engagement, Dissemination and Exploitation	AtlantOS partnership, mostly Scientific Community, but it can be presented to outside communities too

Task	Exploitation Products	Target Group
10.3	Stakeholder Engagement 'Support Facility' Test Exercise	AtlantOS partnership + potential users (Industry)
10.5	Demonstration of the Economic potential of OO	Scientific Community, Industry, Policy Makers, Investors, Customers

## 2.2 Engagement and Dissemination

### 2.2.1 Dissemination of own results

During the lifetime of AtlantOS and for a period of 3 years after the end of the project (30/06/2019), the dissemination of results generated by one or several parties will be made as soon as possible by disclosing them to the public by appropriate means, including in scientific publications and presentations. However, prior notice of any planned publication shall be given to joint owners of results to be published at least 45 calendar days before the publication. Any objection to the publication shall be given in written to the coordinator and to the party or parties proposing the dissemination within 30 calendar days after receipt of the notice. If no objection is made the publication is permitted.

An objection is justified if the protection of the objecting party's results or background would be adversely affected or the objecting party's legitimate academic or commercial interests in relation to the results or background would be significantly harmed. An objection has to include a precise request for necessary modification. Subsequent to any objection raised and found justified, the parties involved shall discuss how to overcome the grounds for the objection on a timely basis and the objecting party will not unreasonably continue the opposition if appropriate measures are taken following discussion. The objecting party can request a publication delay of maximum 90 calendar days from the time they raised objection. The publication is permitted after these 90 days, provided any confidential information of the objecting party has been removed as indicated.

All AtlantOS partners commit to notify the AtlantOS Project Coordination Unit (PCU), in a timely fashion, of any planning activities producing 'communication and dissemination output' as identified in the Participant Portal of the European Commission. The following categories are included: organisation of workshops or conferences, web site applications, press releases, flyers, articles published in popular press, videos, media briefings, presentations (oral and poster), exhibitions, thesis, interviews, films, TV clips, scientific publications.

All AtlantOS partners commit to send a copy of their communication and dissemination outputs to the PCU within 30 days from their publication, providing information about the date and place of publication and the audience targeted, as requested by the Participant Portal of the EC. Any communication and dissemination outputs related to AtlantOS and any major results funded by AtlantOS will i) display the EU emblem (<http://europa.eu/about-eu/basic-information/symbols/flag/>) and ii) include the following text:

*"This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 633211."*

Furthermore, any dissemination/communication activity related to AtlantOS will indicate that it reflects only the author's view and that the EC is not responsible for any use that may be made of the information it contains.

### 2.2.2 Dissemination of other party's results and cooperation obligations

If a party would like to include in any dissemination activity another party's results or background it has to obtain a written approval by the owning party prior to dissemination, unless the results or background are already published.

All consortium members commit to take reasonable efforts to cooperate to allow the timely submission, examination, publication, and defence of any dissertation or thesis for a degree which includes their results or background.

### 2.2.3 Open access of peer-reviewed publications

All AtlantOS consortium members acknowledge to submit the 'Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020' ensuring open access to all peer-reviewed scientific publications relating to AtlantOS results.

Open Access (OA) is defined as providing on-line access to scientific information that is free of charge to the end-user and that is re-usable. Scientific information is referred to as i) peer-reviewed scientific research articles and/or ii) research data (guidelines on Open Access:

[http://ec.europa.eu/research/participants/data/ref/h2020/grants\\_manual/hi/oa\\_pilot/h2020-hi-oa-pilot-guide\\_en.pdf](http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-pilot-guide_en.pdf))

#### 2.2.3.1 Routes to Open Access

There are two main routes towards open access that will be pursued by all parties:

- a) Self-archiving (Green OA) which means that the published article or the final peer-reviewed manuscript is archived by the author in an online repository before, alongside or after its publication. Repository software may allow authors to delay access to the article (embargo period).
- b) Open access publishing (Golden OS) which means that an article is immediately provided in open access mode as published. In this model, payment of publication costs is shifted away from readers paying via subscription.

#### 2.2.3.2 Obligations for Open Access publications

- Identify AtlantOS publication through the use of the acknowledgement indicated by the EC (see 2.2.1)
- Deposit a machine-readable copy of the publication in OPenAIRE or directly in the CERN orphan repository <http://www.zenodo.org>
- Send a notification of the deposit to the AtlantOS PCU within 6 month after publication
- Ensure OA on publication within 6 months
- Deposit, at the same time as the publication, the underlying research data from accepted publications via established data centres
- Ensure OA to the bibliographic metadata that identify the deposited publication
- Encourage the authors to retain their copyright and grant adequate licence to publishers.

### 2.2.3 Engagement in AtlantOS

AtlantOS has dedicated an entire work package (WP10) to disseminating and communicating AtlantOS results and engaging with society. The specific goals are 1) the dissemination of the results of the work completed in WP1-9 as well as the active engagement of potential users of data and information from observatories in both commercial and public sectors; 2) the implementation of communication activities including both traditional and more interactive media that encourage the development of a dynamic 'ecosystem' of actors and stakeholders; 3) the structuring of an exchange between the observing communities in Europe, the US, Canada, Brazil, South Africa and as well as in other countries.

In addition to the specific tasks and partners in this work package, other work packages in the project will also contribute to the dissemination of results and societal engagement, in particular the actors involved in WP1, 8, 9 and 11.

The first step in these processes was the definition of the AtlantOS Engagement Strategy, a living document (will develop over the lifetime of AtlantOS) developed by the leaders of WPs 1, 8, 9 and 11 under the lead of KDM. The strategy will be shared by all partners across all WPs, both in Europe and across the Atlantic.



The strategy will specify measures to be implemented both during and after the project, addressing potential users and uses (even beyond the AtlantOS community). This strategy defines the main AtlantOS outputs and precise target audiences together with operational details of how they will be produced and/or addressed; and be a guide, for the actors involved in the work packages, on how to best make available results to all interested stakeholders. An AtlantOS Engagement Board comprising international experts regarding ocean observation issues will be formed to develop strategies to efficiently engage stakeholders and identify ways to improve usage of data and information between society and science. All partners will be involved in the implementation and continuous update of the strategy: all the relevant dissemination and stakeholder engagement activities will be available on the project webpage and bridges will be built between the work packages. This high-level, binding framework will maintain coherence while offering the flexibility to take actions based on the actual needs as identified during the project. Most importantly, it would streamline interactions aiming to avoid stakeholder fatigue. The academic partners in the project have professional communication and public engagement officers in their organizations, and we will take advantage of their advice and network.

### 2.2.3.1 Dissemination and engagement measures

**Website & social media** – The project homepage at [www.atlantos-h2020.eu](http://www.atlantos-h2020.eu) is the main project tool for 1) integrating the different levels of information and tailoring the dissemination to different categories of stakeholders (policy makers, business stakeholders, etc.) through fora for mobilizing the stakeholder community (online meeting point, knowledge and exchange hub), 2) for providing information on observing products and services (both current and future) with interactive map, a showcase for products and services, observatory profiles and links to related resources and portals, 3) for featuring the suite of products targeted at issues of societal concern developed by WP8 and demonstrating case studies targeted at stakeholder groups, 4) for e-learning tools (training online, interactive material), 5) for promotion of project outputs, news and events, products and services. The social media campaign will target and engage with project partners, the wider observing communities and the stakeholder community user groups.

**Web-based tools** - Web-based monitoring tools of the observing system data flow and key performance indicators of the Atlantic observing system at European and international level (WP9). Maps on storm surge probability climatology, oil spill hazard, ship routing hazard (WP8) bulletins on Harmful Algal Blooms (HAB), oil spill hazard, aquaculture operation (WP8).

**Science-policy briefing papers & reports** - The scope is to identify key project results in WPs 1-8 to be translated and communicated to stakeholders for supporting the decision-making. A number of reports will be published summarizing the results achieved (list non exhaustive): “Economic benefits Final Report” (WP10), forward-looking assessment of the ocean economy to 2030 and beyond, with particular emphasis on the development potential of emerging ocean-based industries; “Foresight Paper” (WP10) built on work achieved in AtlantOS to inform the European research agenda and drive forward ocean observation as a priority area for the Transatlantic Ocean Research Alliance agreed by the EU, USA and Canada; “Report on sustainability issues” (WP9) and on long-term implementation plan for the Integrated Atlantic Ocean Observing System. National and European plans for long-term implementation (organization, funding, role of the different nations, EU, role and international partners); Assessments on potential, selected sites for offshore aquaculture and other assessments related to observing system fitness for HAB warning, storm surges, aquaculture economy, ship routing, oil spills hazard mapping and others (WP8); “Future of Atlantic Observatories” (WP1), which will be presented at the final Legacy event.

**Strategic events** - A number of strategic “Briefing Events” (WP10) for the presentation of the Science-Policy Briefing Papers to the relevant audiences. An event in cooperation with OECD on the “Foresight Report” (WP10). A final “Legacy Event” (WP10-11) will also be organized in order to present the final outputs at the end of the project. Several workshops for scientific coordination with partners and members/associates.

**Specific actions for motivating young scientists** - We will have a number of young post-doctoral scientists employed to undertake specific tasks within the project and ideally placed to exploit the project results in the form of papers and meeting attendance. Post-doctoral researchers will be joining and working with

some of the best sensor research groups in Europe and gain practical experience in project management and marketing from the involvement of the SME's in the project.

**Participation to conferences and fairs** - We will participate in academic conferences for disseminating scientific results to the scientific community and in conferences, fairs and gatherings addressing themes for the general public (non-scientific events) for disseminating the project's achievements.

**Visual and interactive legacy outputs** - Targeted at communicating with the stakeholder groups defined within the Engagement Strategy. Each output will be accompanied by a strategic dissemination plan designed to achieve maximum outreach and impact. Outputs are going to be a combination of digital and print outputs.

**Other publications** - We will publish our results both in academic journals (in open access) and in popular journals for a lay audience. Brochures and flyers about the project will further raise awareness of AtlantOS as well as its products and services amongst target groups and communities. These will also help drive target users to the AtlantOS website and social media activities, further enhancing communication of the AtlantOS project and its products and services.

**Video- and audiocasting** - Video and audio materials on the major objectives and results of the project for dissemination for a lay audience.

All results from the project will be published after exploration of possibilities for patenting specific products produced in AtlantOS. AtlantOS will close with a number of publications, which aim to contribute to the observatories landscape in the Atlantic region. All project results will be published on the AtlantOS website. AtlantOS will seek to present all its results and products in a coherent form at the large-scale Ocean Observatories 2019 conference (following OceanObs'99 and OceanObs'09).

Dissemination measures in the closing phase of the project: The final report of the project will include a plan for the use and dissemination of foreground, to demonstrate the added value and impact of the project on the European Union. A final publishable summary of the results will be made available to the Commission for dissemination in the public domain. This will include information on realised or expected results, and their wider societal implications. The text will be drafted in such a way as to be understandable for a lay audience. A final project booklet, the '*Blue Print*', will be released as a best practice guide covering the following issues of ocean observation: i) observing platform capabilities, ii) new technologies and workforce training, iii) communication with user communities, iv) financial resources from nations and other sponsors, v) ocean data and information products, vi) national and other partnership, vii) network design and impact studies, and viii) visions for 2030 including a collection of all project publications will be produced at the end of the project. The *Blue Print* will be made available for download on the website.

Dissemination measures after the closure of the project: After the official end of the project, the foreground of the project will be available as a web-based archive for all interested parties. The domain name of the project website will be assigned to GEOMAR. The website archives all documentation related to the project, including publications, and will be accessible for 5 years after the end of the project.

## References

Fair guidelines for data sharing <http://www.nature.com/articles/sdata201618>