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Engagement Strategy

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EXECUTIVE SUMMARY

The overall objective of INTAROS is to build an efficient integrated Arctic Observation System (iAOS) by extending, improving and unifying existing systems in the different regions of the Arctic. This requires engagement of a broad group of research institutions, educational institutions, operational agencies and stakeholder groups.

This document, *Deliverable 1.3 - Engagement Strategy*, describes how collaboration will be developed between actors inside and outside the INTAROS consortium. This document is intended to:

- Be a baseline document for establishment of the Pan-Arctic Observing Forum (PAOF).
- Support the project in efficiently describing the target audiences when engaging with stakeholders, attracting more users, and improving data usage and information flow between society and science.
- Describe measures to be implemented both during and after the project, to engage actors both in Europe and across the Arctic.

On this strategy the following 5 groups of stakeholders were identified:

- EU Agencies
- Decision- and Policy-makers
- Researchers and Research Organisations
- Maritime and Marine Industry
- Local Communities

And, the following 10 measures will be used to engage them:

- Measure 1: Stakeholder workshops
- Measure 2: Web portal & social media
- Measure 3: Science-Policy Briefing Papers & Documents
- Measure 4: Conferences and Events
- Measure 5: Training
- Measure 6: One-to-One Meetings
- Measure 7: INTAROS Roadmap
- Measure 9: Cross- EU project activities.
- Measure 10: MoU

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1. Introduction:

INTAROS is working closely with a range of other projects and initiatives. There are many activities both in Europe and on other continents of relevance to monitoring and observation in the Arctic. A key objective of INTAROS is to collaborate and build synergies with these other actors to ensure complementarity and to ensure that the project learns from and advances on existing achievements.

Goals of the Engagement Strategy in INTAROS

Engagement in INTAROS is designed to function on a number of levels, from engagement with decision-makers and policy-makers, collaboration with international organisations, interaction with researchers, and working together with the public at large.

A central objective of INTAROS is to establish a Pan-Arctic Observing Forum (PAOF), bringing together diverse representatives from a cross-section of the Arctic community. The PAOF is an ambitious, new, international consortium that will:

- Formalize collaboration with EU-PolarNet, ATLANTOS, ICOS, EPOS, INTERACT, JERICO-NEXT, Copernicus services, ESA initiatives, ENVRIPLUS, SIOS KC, BlueAction and APPLICATE, and others.
- Establish cooperation and coordination with projects funded under the Departmental Research Initiatives (DRI) in the USA that are relevant for Arctic research as well as National Science Foundation (NSF) funded programmes.
- Establish and maintain links to various stakeholders such as Arctic Council working groups (e.g. Arctic Monitoring and Assessment Programme - AMAP), global programmes (e.g. World Meteorological Organization - WMO), Global Ocean Observing System (IOC/GOOS), World Climate Research Programme (WCRP), Copernicus services, industries, environmental organisations, local communities and decision makers.
- Include indigenous and local perspectives and knowledge in project planning and implementation.
- Prepare a data management plan and a data governance framework that link up to existing European initiatives such as Copernicus and EMODnet.
- Develop a roadmap for a future sustainable Arctic Observing System.

In Europe, there is no organization similar to Arctic Observing Network (AON) in USA and ArcticNet in Canada, This PAOF forum will therefore be an instrument to ensure Europe's role in the development of a future sustained Arctic Observing System. The forum will interact with AON, ArcticNet, Sustaining Arctic Observing Networks (SAON) and other relevant organisations. The forum members will be ambassadors for an Arctic observation system, which means that it will have members representing political decisions makers, international/intergovernmental organization (with an Arctic focus); research, indigenous and local civil society organizations, industry, and other stakeholders. The Forum will contribute to the development of the strategy in *Task 1.5. Roadmap for a future Sustainable Arctic Observing System*.

2. Stakeholders in INTAROS: Who and Why?

EU Agencies and Funding Institutions

Who: European Agencies such as the European Environment Agency (EEA), the European Space Agency (ESA) and the European Maritime Safety Agency (EMSA) are important international actors in management of the natural environment, ocean and atmosphere. These agencies are responsible for providing independent and reliable data and information on the environment and the maritime sector, particularly with regard to developing, adopting, implementing and evaluation policy. They provide information to help EU member nations to make informed management decisions and coordinate international networks for data gathering and sharing. They also provide technical and scientific advice to other stakeholders and the public at large.

Why: European Agencies are usually long-standing authorities in their area of relevance. In Europe, these agencies are the point of reference in terms of knowledge on a given theme as well as holders of insight into the directions of new EU Policy and research agendas. Involving European Agencies as stakeholders in INTAROS will facilitate a flow of information across all levels of the development cycle, from the bottom up and the top down. It is also hoped that these agencies will be able to provide valuable insights with regard to the INTAROS task of developing a road map for developing the future integrated Sustained Arctic Observing System (SAOS). By engaging such Agencies in INTAROS, the results of the project will be more readily accessible to decision makers in those agencies, which is the objective of *Task 7.2 - Informing decision-makers in European agencies and businesses*. One of the key outputs of INTAROS is the integrated Arctic Observation System (iAOS), a tool designed to be used by decision makers: by engaging decision makers in these Agencies, we can maximize the appropriateness of the system as well as its uptake by end users.

Decision- and Policy-makers

Who: The Arctic Region is warming at roughly twice the global average rate, with a dramatic reduction in summer sea ice extent as one of the clearest indicators of this trend. Physical and biological processes are being transformed across the entire region. Change in the Arctic environment is leading to a wealth of interconnected social transformations. Arctic states dispute territorial claims as the Arctic reveals its increasing economic and strategic potential, while the international community also seeks to have a voice and a guaranteed research presence in the region. The region's indigenous peoples are stepping up their efforts to gain control over the developments taking place in their territories, while maintaining their cultural continuity. Meanwhile, conservationists are increasingly highlighting the need to protect the fragile Arctic environment.

Evidence-based policymaking' is now central to the agenda. Accurate information is therefore extremely important, yet at present we know very little about the Arctic Region. Critical physical processes are poorly understood, ecosystems remain unstudied and undiscovered, and indigenous voices go unheard. This lack of knowledge compromises our efforts to detect, predict or manage the interrelated physical, biological and social impacts of climate change, making sustainable development almost impossible. A coordinated and sustained observing system is therefore mandatory for the Arctic Region, to provide baseline data and ensure sustained monitoring.

INTAROS therefore target funding agencies, natural resource management and environmental agencies, local and national authorities, and pan-Arctic organizations.

Why: Decision and policy-makers could make use of the knowledge generated by INTAROS to improve their own strategies for changing policy or practice within their departments or ministries. The project will develop policy briefs containing pertinent, high quality and near real-time information and guidance to aid local, national and international decision-making. This will showcase ‘real-world’ examples of the benefits of cross-weaving indigenous and local observation systems with scientific observation systems.

Researchers and Research Organisations

Who: INTAROS linkages to research can roughly be divided into 3 groups:

- **Individual researchers:** PhDs, postdocs, and senior scientists working at universities, governmental research institutes or other research centres.
- **Professionals:** engineers and technicians working in support of scientific activities.
- **Research Organisations:** Universities, Research Centres, technological centres, think tanks, R&D departments of private companies. Many INTAROS partners are research organisations and INTAROS as a whole is part of broad scientific networks. INTAROS has direct links to important research organisations including the World Climate Research Programme (WCRP) and its core program CLIVAR, the Arctic Council’s AMAP working group and several working groups within the International Council for Exploration of the Sea (ICES).

Why: Researchers and Research organisations are an important part of the INTAROS project, both as direct participants and stakeholders. Research Organisations, individual scientists and professional support will benefit from the tools for integration of data from atmosphere, ocean, cryosphere, terrestrial sciences and from community-based observing programs, provided by institutions in Europe, North America and Asia and made available through INTAROS. At the same time they will give valuable support to INTAROS by identifying some of the critical gaps in the existing in situ observing network.

Maritime and Marine Industry

Who: The EU initiative Blue Growth is the long-term strategy to support sustainable growth in the marine and maritime sectors as a whole. INTAROS therefore aims at demonstrating how an improved Arctic Observing System can support business development, security and efficiency of selected marine industries – maritime transport, oil and mineral exploitation (incl. support to oil spill cleanups), tourism, fishery, and wind energy – without compromising the vulnerable Arctic environment.

Critical information for all these industries for long- and short-term investment planning, risk assessment and operational purposes is knowledge of the environmental fields affecting marine operations in the Arctic Ocean.

INTAROS will seek to establish a result-oriented dialogue with key commercial maritime stakeholders including representatives from shipping industry, Arctic Marine Shipping Assessment (AMSA), International Maritime Organization (IMO), DNV GL, oil industry, insurance companies, petroleum safety authority, fish industry etc., to discuss the products and services that an IAOS system might deliver in the future as well as the demands and needs of these communities.

Why: One of the main objectives of INTAROS is to demonstrate the value and benefits of an upgraded Arctic Observing System in support of Blue Growth in the Arctic to foster business development, increase safety and protect the environment by integrating data, products and services from EMODnet and Copernicus Marine, Meteorological and Security Services with those produced by INTAROS.

Local Communities

Who: Fishermen, herders, hunters and other people living in the Arctic heavily depend on the region's living resources for their livelihoods and culture. The better the information and knowledge they have, the more capable and prepared they will be for the challenges being brought about by the rapid changes in the Arctic environment. INTAROS is contributing to supporting the resilience of Arctic communities. The project will work closely with two identified communities one based in Longyearbyen, Svalbard and the other in Disko Bay in Greenland in order to enhance the understanding among community members, decision-makers and scientists of issues of primary interest to these communities. Topics of potential interest include economic development (e.g. changes in ecosystems, new transportation routes and associated risks), natural hazards (e.g. avalanches, landslides, seismic events, extreme weather) and climate change.

Why: INTAROS will significantly enhance community-based observation programs that draw on indigenous and local knowledge as a basis for participatory research and capacity-building within Arctic communities. Moreover, INTAROS will improve the professional skills and competences for those working and being trained to work within community-based observing in the Arctic. INTAROS will promote cross-weaving and connection within community-based observing programs as well as between community-based observing programs and scientists-led observing programs. The work of INTAROS in community-based observing helps strengthen the societal and economic role of the Arctic region and support the EU strategy for the Arctic and related maritime and environmental policies.

The two selected communities, Longyearbyen, Svalbard, and Disko Bay, Greenland, (i) are high-risk regions in terms of climate change impacts as well as loss of biological diversity, (ii) can potentially benefit significantly from community-based observing programs in terms of enhancing resilience and adaptation to climate change through improved governance, and (iii) are characterized by economies in which institutional set-ups and available funding would benefit from efficient and low-cost observing programs at local levels. The activities of the present project will therefore contribute significantly to moving forward community-based observing programs in these communities.

Educational Institutes

Who: INTAROS will contribute to development and implementation of modules within Climate Change teaching packages for high school students and teachers in Greenland as part of collaboration with high schools in Greenland, Government of Greenland, Greenland Institute of Natural Resources and Aarhus University. Further activities will aim to link high schools with ongoing climate monitoring programs and activities and real life data collection, including community-based monitoring initiatives such as the EU BEST funded PISUNA project. INTAROS will also collaborate with other educational initiative in the Arctic, such as EDU-ARCTIC, a project coordinated by Institute of Geophysics at the Polish Academy of Sciences (IGF PAS). The goal of EDU-ARCTIC is to stimulate the interest in science, technology,

engineering and mathematics (STEM) education related to the Arctic among students between the ages of 13 and 20 (<https://edu-arctic.eu/>).

Why: The project wants to ensure that the next generation is informed on changes in the Arctic and the potential impacts. This is vital to equip them with the knowledge required for adapting to and managing under these changed conditions. Therefore the project contributes to devising tailored information which contributes to education in high schools, but also for the general public.

3. Measures: The following activities will be performed: What, How and When?

Measure 1: Stakeholder workshops

Aimed at: The key stakeholder groups in the Arctic: the scientific community (various disciplines); regional stakeholder groups (Europe, USA, Canada, Russia, Japan, China, Korea); users (service providers, private sector users (shipping, oil/gas, fishing, aquaculture, recreation) and assessment users like governmental agencies, AMAP, IPCC special report, civil society organisations, NGOs); national funders of observing systems and observation providers (in situ and satellite, public and private, scientists and community members).

Objective: Selected representatives from the key stakeholder groups will be invited to several INTAROS workshops to present and discuss their requirements for iAOS. INTAROS will implement three dedicated workshops. The first workshop focused on giving input from the Stakeholders to *Task 1.1 Consolidation of high-level requirements of iAOS (lead: EuroGOOS)*. The second workshop will monitor the status of developments and give advice for the remaining part of the project, and will be organised as part of *Task 1.2 Establish and maintain cooperation with key stakeholder groups in Europe and internationally (lead: EuroGOOS)*. The third workshop will involve stakeholders in the development of the iAOS roadmap in *Task 1.5. Roadmap for a future Sustainable Arctic Observing System (lead: NERSC)*.

When: The first workshop was organized in May 2017. The second workshop is planned for June 2019, and the final workshop is expected to take place in February 2021. There will also be stakeholder workshops organised by other partners in the ¹EU Arctic Cluster where INTAROS will be involved.

Where: The first workshop took place in Brussels, Belgium. The locations of the other workshops have yet to be decided, but priority will be given to easily accessible locations in Europe.

Measure 2: Web portal & social media

Aimed at: Different stakeholder groups, namely: policy and decision makers; business sectors; service providers; scientists; local communities; high school teachers and students; and the general public.

Objective: The INTAROS website launched on March 2017, is one of the main channels for communication of all project relevant information, such as public downloadable products, presentations, news and events related to the project work scope. Furthermore, the website provides basic information regarding the project beneficiaries and links to their websites. Through the area “Stories” the INTAROS website also helps to disseminate personal stories on how INTAROS activities are increasing understanding of the Arctic and also on how the outcomes of INTAROS can affect living conditions of the people inhabiting Arctic regions. A blog is also foreseen and it will assist in sharing more easily individual stories to a wider range of stakeholders. At same the same time Social Media channels will help INTAROS to

¹EU Arctic Cluster partners: APPLICATE, ARICE, BLUE ACTION, EU-PolarNet, ICE-ARC, INTAROS, INTERACT, NUNATARYUK

broaden the target audiences as those channels tackle users that wouldn't find this kind of information by the conventional means.

When: Throughout the project

Where: [Online](#)

Measure 3: Science-Policy Briefing Papers & Documents

Aimed at: The policy briefs will provide pertinent, high quality and near realtime information and guidance to aid local, national and international decision-making.

Objective: These briefs will showcase 'real-world' examples of the benefits of cross-weaving indigenous (Disko Bay) and local observation systems with scientific observation systems. These policy briefs with proposed recommendations will be presented and discussed at a workshop with representatives of local communities, civil society organizations and government and academic researchers in each community (Longyearbyen, Disko Bay). Moreover, the policy briefs will be also presented to Senior Arctic Officials of the Arctic Council to promote innovative approaches that connect bottom-up and top-down observation systems for improved decision-making.

When: January 2021

Where: To be announced

Measure 4: Conferences and Events

Conference Attendance

Aimed at: decision-makers and policy-makers, international organisations and researchers.

Objective: INTAROS has been and will continue to disseminate INTAROS results at conferences and workshops, including the roadmap for a future SAOS in different events. At high level conferences, INTAROS will contribute to sessions/exhibitions to promote the EU Arctic Cluster.

When and where: Highly ranked conferences such as: Arctic Frontiers (Tromsø, Norway), Arctic Observing Summit (AOS2018), Arctic Circle (Iceland), Arctic Science Summit Week, ISAR-5 (Fifth International Symposium on Arctic Research) (2018), POLAR2018, OceanObs 2019, Arctic Science Ministerial Meeting in Berlin in 2018, COP-meetings, and European Maritime Day conference.

Conference Organisation

Aimed at: Scientific Community in each of the thematic areas of INTAROS

Objective: Presenting project outcomes to the scientific community and highlighting and building support for the establishment of the PAOF

When: Dedicated EGU, AGU, iLEAPs sessions will be organized during the project to present its outcome to the scientific community. We will participate in relevant workshops, where the results of INTAROS will be presented (e.g. Royal Society Discussion meeting on ‘Soil-atmosphere carbon fluxes- experimentalists meet modellers’ taking place on 12-13 of October 2017 in Kavli Royal Society International Centre, UK). We will also organize side events at OceanObs 2019, and during the annual Arctic Science Summit Weeks. One special issue in a high-profile journal will be initiated and populated jointly with international partners with a focus on interdisciplinary research (e.g. the ARCTIC Journal). We will contribute results from INTAROS to White papers prepared for the Arctic Observing Summit , which will take place in Davos, Switzerland in June 2018

Where: Different locations depending on the conference, more likely in Europe, and the USA

Measure 5: Training

Summer School

Aimed at: Younger Scientists

Objective: A key objective of INTAROS is to develop the professional skills of younger scientists in improving their knowledge on the uniqueness of the Arctic and in working with observational data collected during the project, both from scientist-executed and community-based approaches. To reach this objective a summer school will be arranged. The theme will cover observing systems, with a special focus on existing and emerging technologies and solutions for Arctic waters, atmosphere and land, including space-based, in-situ and community-based observations. Lecturers will be invited from the INTAROS consortium. Teaching material used at the summer school will be further distributed and utilized as an educational package openly available to schools and universities, interested in observation-based research in the Arctic. Lecture material developed for the INTAROS summer school will be made available as an open educational package to other universities and schools arranging training events or courses where Arctic field work and analysis of the collected data is a component.

When: The first training event in Longyearbyen, Svalbard took place 7 - 10 August 2017 with 5 students and one teacher from the Amalie Skram Upper Secondary School in Bergen. This was a field trip organized jointly by the Norwegian project REGIMES and INTAROS. The aim of the trip was to interview people and get insights into the present life in Longyearbyen and Svalbard , and how climate change affects everyday life, but also how it could affect the future. Among other things, the group met the Governor of Svalbard (Sysselmannen) and representative of the local government in Longyearbyen. In 2020, a summer school will be developed and organised in Longyearbyen with wider participation of students from several countries. The theme will cover observing systems, with a special focus on existing and emerging technologies and solutions for Arctic waters, atmosphere and land, including space-based, in-situ and community-based observations. By then significant results from INTAROS observations systems and the integration of other data will be available.

Where: The INTAROS summer school will be organized at UNIS (Norway) in collaboration with NERSC and FMI. Through the developed teaching material, INTAROS will contribute to the annual winter/summer schools in Hyytiälä (Finland) organized by U Helsinki, and to the

academic courses organized by the University of the Arctic (among which are INTAROS partners such as AU, AWI, FMI, MISU, U Helsinki, UL, UNIS, UiB).

Scientific Exchanges

Aimed at: PhD students and Younger Scientists

Objective: Improve the professional skills and competences for those working and being trained to work within this subject area.

When: Short-term scientific exchange and training of 2-6 week duration. These exchange visits are planned to take place from 2018 and onwards until the end of the project, and will typically be organised in conjunction with the field experiments planned in WP3 (Enhancement of in situ systems). INTAROS will have two main deployment periods, summer 2018 - summer 2019, and summer 2019 – summer 2020. Practical training linked to deployment and recovery of sensors and platforms will be organised in conjunction with these periods. After recovery of instruments, exchange visits and training dedicated to data processing and analysis will be organised.

Where: Project partners will provide details of laboratory projects, or ship-based activities where they can offer training and these will be announced widely, using the INTAROS public web site, social media, community mailing lists and web sites, as well as the scientific networks of the partners.

Programme on Arctic Affairs

Aimed at: Younger Scientists

Objective: The programme will provide university students from all over the world with new knowledge in Arctic climate, ecology, strategy and social conditions. Contributions from INTAROS will be based on the outcomes of the application case studies to be developed during the lifetime of the project.

When: 6 week program to be advertised

Where: Greenland Institute of Natural Resources in Nuuk

Workshops

Aimed at: Local Communities

Objective: Many people of the Arctic depend on the region's natural resources for their livelihoods and culture. The better the information and the knowledge they have, the more capable and prepared they will be for the challenges being brought about by the changes in their environment. The goal is to facilitate exchange of experience and to build further capacity in community-based observing in the Arctic.

When and where: [Fairbanks, Alaska, May 2017](#). Izma-Komi and Zhigansk/Yakutia, Russia, September 2017. Quebec, December 2017. Further workshops to be announced.

Teaching Packs

Aimed at: Local Communities, teachers and students from lower and upper secondary schools in Europe and beyond

Objective: Those living in the Arctic depend on the region for their livelihoods. The better the information and the knowledge they have, the more ready they will be for the challenges being brought about by the changes in their environment. The goal is to facilitate exchange of experience and to build further capacity in community-based observing in the Arctic. There will be a particular focus on professional and cross-disciplinary skills and competences of young people to help ensure the sustainability of community-based observing into the future.

The other objective is to enhance the literacy on the Arctic environment and challenges among young people – students from lower and upper secondary schools and their teachers by elaboration and dissemination of two packages of educational materials. Each package will consist of methodological material for teachers, and multimedia material and worksheets with tasks for students. Packages will be presented during webinars and workshops dedicated to STEM teachers. Organisers will put emphasis on practical use of data collected within INTAROS observations and explanations of worksheets and tasks for students using data.

When: To be announced/ Educational packages will be prepared by September 2020 and disseminated via webinars and workshops, which will be conducted by the end of November 2020.

Where: Educational packages will be available online. Webinars will be conducted online. Venue for workshops will be decided on the later stage, depending on location of other education events for STEM Teachers in Poland and other partners' countries.

Measure 6: One-to-One Meetings

Aimed at: Managers and industries working with living marine resources in the Arctic.

Objective: To demonstrate the use of iAOS products based on both in situ (incl. CBM) and space-based systems

When: Throughout the project

Where: To be decided

Measure 7: INTAROS Roadmap

Aimed at: The key stakeholder groups in the Arctic.

Objective: A Roadmap for the further development of iAOS will be developed in close collaboration with research infrastructure projects (RIs) in particular ENVRIplus, and with

other actors working with observing systems in the Arctic. The Roadmap will be presented as a reference document to national and EU policy makers aiming to place the iAOS on the ESFRI Roadmap.

When: By the end of the project.

Where: Online on the EU Arctic Cluster and at several conferences and workshops.

Measure 9: Cross- EU project activities.

Aimed at: The currently funded Horizon 2020 Arctic projects

Objective: INTAROS takes part in the EU Arctic Cluster – a network, which merges the most up-to-date findings on Arctic change and its global implications. Its objective is to provide guidance and policy-relevant information and to support the EU in advancing international cooperation, in responding to the impacts of climate change on the Arctic's fragile environment, and on promoting and contributing to sustainable development. In doing so, the EU Arctic Cluster cooperates closely with policy makers, indigenous peoples, local Arctic communities, business representatives and the European civil society.

When: Throughout the project

Where: Online via the [EU Arctic Cluster](#) website and at several conferences and workshops (e.g. Arctic Circle conference, 2017).

Measure 10: MoU

Aimed at: Projects and institutions that are not formal partners in INTAROS

Objective: To extend the collaboration between INTAROS and a wider community of institutions developing Arctic observing systems

When: A MoU has been signed between INTAROS and the Chinese Digital Belt and Road Initiative represented by the Institute of Remote Sensing and Digital Earth, Chinese Academy of Science (RADI, CAS). More MoUs are planned with other programmes and projects

Where: To be decided

4. Expected Results and Impacts.

This engagement strategy is designed to promote the collaboration between institutions working with Arctic observing systems, including community-based systems, across Europe, North America and Asia. By doing so we expect a greater involvement of a wider group of stakeholders with support from the EU Arctic Cluster, EU infrastructure projects and operational programmes, is expected.

Hopefully, by applying the identified measures, stakeholders will be benefited directly from their involvement in INTAROS projects and will recognise its relevance.

Involving **European Agencies** as stakeholders in INTAROS will facilitate a flow of information across all levels of the development cycle, from the bottom up and the top down.

Decision and policy-makers will make use of the knowledge generated by INTAROS to improve their own strategies for changing policy or practice within their departments or ministries.

Researchers and Research organisations are an important part of the INTAROS project, both as direct participants and stakeholders, and will benefit from the integration of information facilitated by INTAROS.

INTAROS will demonstrate to the **Maritime and Marine Industry** the value and benefits of an upgraded Arctic Observing System in support of Blue Growth in the Arctic.

Local Communities will benefit from an enhanced community-based observation programs, and, at the same time improve the professional skills and competences for those working and being trained to work within community-based observing in the Arctic.

Overall, by the involvement of all the stakeholders, INTAROS is preparing for the establishment of the Pan-Arctic Observation Forum and the development of the Roadmap for future sustainable Arctic observing systems.

Annex I: List of Identified Stakeholders and Actors to be Engaged.

Councils, Networks, and Organisations

International Coordination Initiatives:

The [Arctic Council](#) is the leading intergovernmental forum promoting cooperation, coordination and interaction among the Arctic States, Arctic indigenous communities and other Arctic inhabitants on common Arctic issues, in particular on issues of sustainable development and environmental protection in the Arctic. INTAROS will establish links with the Council, especially through some of its working groups (e.g. [Arctic Monitoring and Assessment Program](#)) and will ensure that roadmap for an implementation of a future Sustainable Arctic Observing System will be in line with the strategies and recommendations of the Council. There will also be strong engagement with The [Sustaining Arctic Observing Networks](#) (SAON) initiative, which was initiated by the Council.

The vision of the [Global Earth Observations \(GEO\) Cold Region Initiative](#) (CRI) is to provide coordinated Earth observations and information services across a range of stakeholders to facilitate well-informed decisions and support the sustainable development of the cold regions globally. The GEOCRI mission is to develop a user-driven approach for Cold Regions information services to complement the mainly current science-driven efforts, which will strengthen synergies between the environmental, climate, and cryosphere research efforts and foster the collaboration for improved earth observations and information on a global scale. INTAROS intends to engage with GEOCRI and contribute to the achievement of its goals.

The [World Climate Research Programme](#) (WCRP) facilitates analysis and prediction of Earth system change for use in a range of practical applications of direct relevance, benefit and value to society. WCRP aims to determine the predictability of climate and the effect of human activities on climate. They will be a member of the stakeholder panel and INTAROS is represented through one of its partners on the WCRP core project [CLIVAR](#) on the ocean-atmosphere system and also contributes to the WCRP grand challenge on regional sea level change and coastal impacts.

The [Transatlantic Ocean Research Alliance](#) which promotes Atlantic cooperation between the European Union, Canada and the USA has as one of its goals to study the interplay of the Atlantic Ocean with the Arctic Ocean, particularly with regards to climate change. Several USA and Canadian research institutes are partners in INTAROS and will contribute to the achievement of this goal

The Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organisation ([IOC-UNESCO](#)) promotes international cooperation and coordinates programmes in marine research, services, observation systems, hazard mitigation, and capacity development in order to understand and effectively manage the resources of the ocean and coastal areas. By applying this knowledge, the Commission aims to improve the governance, management, institutional capacity, and decision-making processes of its Member States with respect to marine resources and climate variability and to foster sustainable development of the marine environment, in particular in developing countries. IOC coordinates ocean observation and monitoring through the Global Ocean Observing System ([GOOS](#)) which

aims to develop a unified network providing information and data exchange on the physical, chemical, and biological aspects of the ocean. Governments, industry, scientists, and the public use this information to act on marine issues. IOC's work in ocean observation and science contributes to building the knowledge base of the science of climate change. IOC sponsors the World Climate Research Programme (WCRP) and the IOC's GOOS serves as the ocean component of the Global Climate Observing System (GCOS), which supports the Intergovernmental Panel on Climate Change (IPCC). UNESCO-IOC is co-convenor with the World Meteorological Organization of the World Climate Change Conference which aims to systematically make the existing knowledge on climate science available to a wide variety of potential users.

The [Arctic Portal](#) is a gateway to Arctic information, providing visualization of Arctic data and links to the Arctic data repositories (mainly for hydrological and terrestrial cryospheric data). Each of them provides integration, standardization, and access to Arctic data in their specific thematic area. The Arctic Portal has also developed a Data Management System (DMS) for permafrost monitoring parameters of the Global Terrestrial Network for Permafrost (GTN-P).

The International Council for the Exploration of the Sea ([ICES](#)) is an organization that develops science and advice to support sustainable use of the oceans. ICES advances this through the coordination of oceanic and coastal monitoring and research, and advises international commissions and governments on marine policy and management issues.

Joint Technical Commission for Oceanography and Marine Meteorology ([JCOMM](#)), is an intergovernmental body of technical experts that provides a mechanism for international coordination of oceanographic and marine meteorological observing, data management and services, combining the expertise, technologies and capacity building capabilities of the meteorological and oceanographic communities. The creation of this Joint Technical Commission results from a general recognition that worldwide improvements in coordination and efficiency may be achieved by combining the expertise and technological capabilities of World Meteorological Organization (WMO) and UNESCO's Intergovernmental Oceanographic Commission (IOC).

International Research Initiatives.

The [Year of Polar Prediction](#) (YOPP) is established by the [World Meteorological Organization](#) (WMO) and aims to improve the environmental prediction capabilities for the polar regions and beyond, by coordinating a period of intensive observing, modeling, verification, user-engagement and education activities. YOPP field work will take place from mid-2017 to mid-2019 with a subsequent consolidation phase (2019-2022).

The Multidisciplinary drifting Observatory for the Study of Arctic Climate ([MOSAIC](#)) will be the first year-round expedition into the central Arctic exploring the Arctic climate system. The project with a total budget exceeding 60 Million € has been designed by an international consortium of leading polar research institutions, under the umbrella of the International Arctic Science Committee (IASC), led by the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI), Arctic and Antarctic Research Institute (AARI) and the University of Colorado, Cooperative Institute for Research in Environmental Sciences (CIRES).

National Research Initiatives:

There are several national Arctic research initiatives that are important contributors to building Arctic observing systems. These include [FRAM](#) (Germany), [Nansen Legacy project](#) (Norway), [SEARCH](#) (US), [ArCS](#) (Japan) and others.

European Infrastructure Programmes (ESFRI) and National Infrastructures

[ENVRIplus](#) is a Horizon 2020 project bringing together Environmental and Earth System Research Infrastructures, projects and networks along with technical specialist partners to create a more coherent, interdisciplinary and interoperable cluster of Environmental Research Infrastructures across Europe

The [European Strategy Forum on Research Infrastructures](#) (ESFRI) has a key role in policy-making on research infrastructures in Europe. In particular the ESFRI contributes to the development of a strategic roadmap that is identifying vital new European RIs over the next decades. INTAROS will work closely with a number of ESFRI related initiatives including those listed here.

The [Integrated Carbon Observing System](#) (ICOS) research infrastructure (RI) integrates national networks consisting of atmospheric and ecosystem stations across Europe and marine stations covering the North Atlantic and European marginal seas. Scientists in INTAROS are directly involved in ICOS and will provide it with new data from the Arctic. INTAROS will thereby benefit from full integration with the ICOS RI.

[ACTRIS](#) is the European Research Infrastructure for the observation of Aerosol, Clouds, and Trace gases. It is composed of observing stations, exploratory platforms, instruments calibration centres, and a data centre. ACTRIS serves a vast community working on models and forecast systems by offering high quality data for atmospheric gases, clouds, and trace gases. In INTAROS, new cloud and atmospheric composition data from Arctic stations will be standardized and made available through ACTRIS and via its integration with the iAOS.

The [European Plate Observing System](#) (EPOS) brings together Earth scientists, national research infrastructures, ICT (Information & Communication Technology) experts, decision makers, and the public to develop new concepts and tools for accurate, durable, and sustainable answers to societal questions concerning geo-hazards and those geodynamic phenomena (including geo-resources) relevant to the environment and human welfare. It aims to integrate existing infrastructures in solid Earth sciences into a single infrastructure. Partners in INTAROS are directly involved in EPOS and will provide new data from observations undertaken in the project to EPOS.

The [Svalbard Integrated Arctic Earth Observing System](#) (SIOS) has been proposed to be a regional coordination instrument of observational systems for long-term measurements in and around Svalbard. The SIOS Knowledge Centre (KC) is hosted by the University of Svalbard (UNIS). INTAROS will collaborate directly with the SIOS KC with respect to data dissemination and outreach. Moreover a training course will be held at UNIS.

[HAUSGARTEN](#) is the key site in the [European Multidisciplinary Seafloor and Water Column Observatory](#) (EMSO), and a member of the [Long-Term Ecological Research - Network](#) (LTER). HAUSGARTEN contributes to the above-mentioned ESFRI projects SIOS (Svalbard Integrated Arctic Earth Observing System) and ICOS (Integrated Carbon Observation System).

INTAROS will add new monitoring capability to HAUSGARTEN and benefit from full integration with data from HAUSGARTEN

The [FRAM](#) Ocean Observing System is an infrastructure funded by the German [Helmholtz Association](#) (HGF) to provide data on Earth system dynamics, climate variability and ecosystem change. As part of the [Fixed-point Open Ocean Observatory network](#) FixO3 project, the FRAM infrastructure provides free-of-charge access to external users under the objective of Transnational Access. INTAROS will integrate existing data from FRAM and complement it with new observations.

The [FMI Sodankylä-Pallas research station](#), located north of the Arctic Circle, lies in an excellent location for receiving data from all polar orbiting spacecraft. Thus FMI has equipped it to serve as a cal/val site for the NASA SMAP and ESA SMOS missions representing the boreal forest zone. It hosts a unique infrastructure for long-term multidisciplinary measurements: soil, ecosystem, cryosphere, atmosphere (troposphere, clouds stratosphere, ionosphere). The site is part of integrated atmospheric networks such as GAW, ACTRIS, IASOA and EMEP. INTAROS will increase the station's observation capabilities and ensure the integration of the collected data into the iAOS.

In 2007, Denmark launched the Programme for Monitoring of the Greenland Ice Sheet ([PROMICE](#)) to assess changes in the mass balance of the ice sheet. The two major contributors to the ice sheet mass loss are surface melt and a larger production of icebergs through faster ice flow. PROMICE is focused on both processes. Ice movement and discharge is tracked by satellites and GPSs. The surface mass balance is monitored by a network of weather stations in the melt zone of the ice sheet, providing ground truth data to calibrate mass budget models.

Projects

H2020 funded Arctic projects

[ENVIRI-PLUS](#) (2015-2019) is a cluster of research infrastructures (RIs) for Environmental and Earth System sciences, built around ESFRI roadmap and associating leading e-infrastructures and Integrating Activities together with technical specialist partners.

[EU-PolarNET](#) (2015-2020) aims to develop and deliver a strategic framework and mechanisms to priorities science, optimize the use of polar infrastructure, and facilitate network building to create new projects.

[APPLICATE](#) (2016 – 2019) is investigating ways to improve weather and climate prediction in the face of a rapidly changing Arctic.

[BLUE ACTION](#) (2016 – 2021) is improving our ability to describe, model, and predict Arctic climate change and its impact on Northern Hemisphere climate, weather and their extremes, and to deliver valuable climate services of societal benefit.

[INTERACT](#) (2016 - 2020) is focused on building capacity for identifying, understanding, predicting and responding to diverse environmental changes across the range of environmental and land-uses in the Arctic.

[NextGEOS](#) (2016-2020) will implement a federated data hub for access and exploitation of Earth Observation data, including user-friendly tools for data mining, discovery, access and exploitation. This data hub will be supported by a strong commitment to the engagement of

Earth Observation and related communities, with the view of supporting the creation of innovative and business oriented applications.

Other European Projects

[AtlantOS](#) (2015-2019): This project is focussed on developing in-situ Atlantic Ocean Observations for a better management and sustainable exploitation of maritime resources. The scope of AtlantOS and INTAROS are very similar and the two projects slightly overlap in the northern North Atlantic.

[JERICO-NEXT](#) (2015 - 2018) aims to improve and innovate the cooperation around coastal observatories in Europe. It is providing operational services for the timely, continuous and sustainable delivery of high quality environmental data and information products related to the marine environment in European coastal seas.

[GAIA-CLIM](#) (Gap Analysis for Integrated Atmospheric ECV CLImate Monitoring) (2015 - 2018) aims to improve our ability to use ground-based and sub-orbital observations to characterise satellite observations for a number of atmospheric Essential Climate Variables (ECVs). INTAROS will review the outcomes from this project as part of its gap assessment work and will use the Maturity Matrix Approach developed in the project to determine the maturity of various existing observing systems.

[BRIDGES](#) (Bringing together Research and Industry for the Development of Glider Environmental Services) (2015 - 2019) is developing two deep gliders with a wide range of scientific payloads for application in marine sciences and ocean monitoring for operational applications and in fulfilment of the European Marine Strategy Framework Directive.

International Projects

Japanese led [Arctic Challenge for Sustainability](#) (ArCS) project and a number of United States and Canadian programmes

Observation Programmes

European Observation Programmes

Another programme of the European Commission, but with a specific focus on Observations is [COPERNICUS](#), which is establishing a European capacity for Earth Observation and Monitoring. Relevant elements for INTAROS are the [Copernicus Marine Environmental Monitoring Service](#) (CMEMS), Copernicus Climate Change Service (C3S) and the Copernicus Service for Security. Earth observation satellites managed by organisations including ESA and EUMETSAT play a key role in the observing system, supported by *in situ* data. INTAROS will have strong links to CMEMS, mainly as a provider of *in situ* and EO data for validation of the forecasting models that form part of the CMEMS service. The [Copernicus Land Monitoring Core Service](#) (LMCS) is the European flagship programme on Earth Observation. The monitored key parameters in the cryosphere are the areal snow extent, snow water equivalent and lake ice extent. INTAROS partners will establish direct links between the iAOS and the data archives and services provided by the Copernicus LMCS for cryosphere data, and will exploit and make available emerging snow products (melt state, soil freezing/thawing) and novel data sources provided by non-operational science missions (e.g. EAS SMOS, NASA SMAP, TerraSAR-X, Cosmo-Skymed).

The European Space Agency's [Climate Change Initiative](#) comprises fourteen parallel projects geared to Essential Climate Variable data production, plus a dedicated climate modeling user project for assessment of the products, a portal providing all products under one roof, a toolbox to facilitate the combining and analysis of the products, and a visualization tool supporting outreach. INTAROS will ensure that its activities are complementary to those of the CCI. Some of the *in situ* data collected will also be used to assess products available from the CCI.

The [European Marine Observation and Data Network](#) (EMODnet) consists of more than 160 organisations assembling marine data, products and metadata to make these fragmented resources more available to public and private users relying on quality-assured, standardised and harmonised marine data which are interoperable and free of restrictions on use. INTAROS will ensure that its data management and governance framework is in line with EMODnet and other relevant data infrastructures and data and metadata will be integrated where possible.

International Observation Programmes

[Argo](#) is a global array of 3,800 free-drifting profiling floats that measure the temperature and salinity of the upper 2000 m of the ocean. This allows, for the first time, continuous monitoring of the temperature, salinity, and velocity of the upper ocean, with all data being relayed and made publicly available within hours after collection. Argo is a major contributor to the [WCRP](#)'s Climate Variability and Predictability Experiment ([CLIVAR](#)) project and to the Global Ocean Data Assimilation Experiment ([GODAE](#)). The Argo array is part of the Global Climate Observing System/Global Ocean Observing System OceanView ([GCOS](#) /[GOOS](#)). The European contribution to ARGO is coordinated by Euro-ARGO ERIC.

[SEARCH](#) (Study of Environmental Arctic Change) is a collaborative program with an adaptive structure built to achieve SEARCH goals and engage the research community, government agencies and other Arctic stakeholders in the study of Arctic environmental change. SEARCH aims to improve understanding, advance prediction, and explore consequences of changing arctic sea ice; document and understand how degradation of near-surface permafrost will affect arctic and global systems; and improve predictions of future land-ice loss and impacts on sea level.

The [Global Atmosphere Watch](#) (GAW) Programme maintains and applies long-term systematic observations of the chemical composition and related physical characteristics of the atmosphere, emphasizing quality assurance and quality control, and delivering integrated products and services related to atmospheric composition. Each of the six GAW World Data Centers (WDCs) is responsible for archiving one or more GAW measurement parameters or measurement types, and is operated and maintained by its individual host institutions. In selected Arctic GAW stations, the quality of atmospheric composition data and the number of available data products will be enhanced by INTAROS through advanced data processing.

The [Integrated Global Radiosonde Archive](#) (IGRA) consists of radiosonde and pilot balloon observations at over 2,700 globally distributed stations. Data and metadata are given in standardized format and are utilized by the operational services. The measured essential weather and climate variables include pressure, temperature, geopotential height, relative humidity, dew point depression, wind direction and speed, and elapsed time since launch. A selected set of 150 IGRA upper air stations that fulfils climate requirements has been designated as the [GCOS Upper-Air Network](#) (GUAN): WMO members owning GUAN stations take

responsibility on the station's continuous performance monitoring, regular maintenance and sustained technical and operational support. A further subset of 30-40 GUAN sites has been selected as the [GCOS Reference Upper-Air Network](#) (GRUAN) to serve as an international reference observing network of sites measuring essential climate variables above Earth's surface, designed to fill an important gap in the current global observing system. GRUAN measurements provide long-term, high-quality climate data records from the surface, through the troposphere, and into the stratosphere. These are being used to determine trends, constrain and calibrate data from more spatially-comprehensive observing systems (including satellites and current radiosonde networks), and provide appropriate data for studying atmospheric processes. The Arctic subsets of IGRA, GUAN, and GRUAN are assessed in INTAROS to identify the main gaps with respect to the coverage and accuracy required for the Arctic operational and monitoring applications.

The [International Arctic Systems for Observing the Atmosphere](#) (IASOA) coordinates the activities of individual Observatories to provide a networked, observations-based view of the Arctic. Specifically, it coordinates the installation of new instruments, the development of operating procedures, and the creation of the datasets. It also mobilizes its network to support national and international research programs such as INTAROS, which include the development of multidisciplinary and integrated observational capacity in the Arctic. In INTAROS, selected data from IASOA observatories will be processed to higher levels, and through the iAOS the accessibility and usability of the data from the IASOA network will be enhanced.

The [International Arctic Buoy Programme](#) (IABP) is network of drifting buoys in the Arctic Ocean that provides meteorological and oceanographic data for real-time operational requirements and research purposes including support to the [World Climate Research Programme](#) (WCRP) and the [World Weather Watch](#) (WWW) Programme. In INTAROS, the IABP network will be integrated with experimental buoys, made available through the iAOS.

The [Pan-Eurasian EXperiment](#) (PEEX) is a multidisciplinary climate change, air quality, environment and research infrastructure program focused on the Northern Eurasia, in particular Arctic and boreal regions. It is a bottom up initiative by several European, Russian and Chinese research organizations and institutes. INTAROS will coordinate the assessment of PEEX data and metadata, to enable their harmonization and accessibility, and will foster the implementation of the marine Arctic component of PEEX.

The [World Glacier Monitoring Service](#) (WGMS) coordinates the collection of standardized observations on changes in mass, volume, area and length of glaciers with time (glacier fluctuations), as well as statistical information on the distribution of perennial surface ice in space (glacier inventories). Such glacier fluctuation and inventory data are high priority key variables in climate system monitoring; they form a basis for hydrological modelling with respect to possible effects of atmospheric warming, and provide fundamental information in glaciology, glacial geomorphology and quaternary geology. INTAROS partners will assess selected WGMS variables, and deliver new products resulting from the integration of in situ and satellite data from the Copernicus program.

The Global Land Ice Measurements from Space ([GLIMS](#)) began as an ASTER Science Team project. It is a project designed to monitor the world's glaciers primarily using data from optical satellite instruments. Analysis results include primarily digital glacier outlines, related metadata, and literature references, and increasingly includes snow lines, center flow lines, and

hypometry data. Surface velocity fields will be included in the future. Results from analysis done by the Regional Centers are sent for archive to the National Snow and Ice Data Center ([NSIDC](#)).

The Global Terrestrial Network for Glaciers ([GTN-G](#)) is the framework for the internationally coordinated monitoring of glaciers and ice caps in support of the United Nations Framework Convention on Climate Change ([UNFCCC](#)).

Funding agencies

The EU H2020 programme is a major funding source for Arctic research through the Arctic Cluster projects, Infrastructure projects, ERC grants and other projects. The largest contributors to Arctic research are the national polar programmes which include research stations in Arctic and Antarctica, icebreakers, and numerous projects with PhD and postdoc scholarships. Space agencies, in particular ESA, NASA and JAXA, are major contributors to the observing systems through satellite earth observation programmes. Operational monitoring by satellites is supported by agencies such as NOAA, Eumetsat and the Copernicus programme.

In the US, [ONR Arctic and Global Prediction Programme](#) of the Office of Naval Research (ONR) increases research in the Arctic. The program has three focus areas: improving understanding of the physical environment and key processes in the Arctic Ocean; investigating new technologies, e.g., sensors, platforms, navigation and communications, that may enable a sustained observational capability in the challenging Arctic environment; and developing integrated ocean-ice-wave-atmosphere models for improved Arctic prediction at a variety of time scales.

Private Sector

The coordination activities for ship time access, required for the field deployments, will take place in Task 3.0. We will develop collaboration with icebreaker operators from China, South Korea, Sweden and Germany (based on tentative agreements), make arrangements with INTAROS partners to optimally use ship time available within the consortium and explore prospects to use of ships of opportunities or support from other projects and programs

Association of Fishers and Hunters in Greenland's ([KNAPK](#))

[Royal Greenland](#) is the largest company in Greenland with 2000 employees. Owned by the Greenland Government. The world's largest producer of cold water shrimp but involved in most of the fishing industry in Greenland.

Civil Society Organisations

The ambition of WP6 is to demonstrate application of iAOS by delivering a suite of products targeted at issues of societal importance for indigenous and local communities, government agencies, the and in the Arctic, for Europe and on global scale. These pilot applications will demonstrate services towards selected, but diverse groups of end-users.

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INTAROS

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