Final Report Summary - ERICON-AB (The European Polar Research Icebreaker Consortium AURORA BOREALIS)

Executive Summary:
The current global climatic and environmental changes will have significant impacts on the future livelihood of mankind. Polar marine research is today in the political limelight because the Polar Regions respond to global change faster and more dramatically than any other region of the world, being at the same time best indicators and main victims of the changes.

The ERICON-AB (AURORA-BOREALIS)-Project, provides the European and international scientific community and policy makers with a unique instrument for understanding the current and past climatic changes and their future evolution. The project, funded by a grant from the EC (European Commission) under FP7, has been concluded highly successfully at the end of May 2012. Many ERICON-recommendations are presently making it into national and international road maps for future polar research and the design of new research icebreakers.

The ERICON-AB-Project benefitted from technical feasibility studies developed by the marine architects of SCHIFFKO/later WÄRTSILÄ in Hamburg (the AURORA BOREALIS-version) and AKER ARCTIC in
Helsinki (the AURORA SLIM-version). The expected expenses to build the AURORA BOREALIS would be close to 800 M€ and close to 500 M€ for the AURORA SLIM. Both versions would fulfill the scientific demands defined in strategic perspectives for marine polar research in both hemispheres for the next 2-3 decades.

The ERICON-Project calls for the construction of an innovative research icebreaker with technical capabilities surpassing all existing or planned research icebreakers. The AURORA BOREALIS combines into one ship the following features: all season capability for operations in the central Arctic Ocean and in the Southern ocean, autonomous operations in ice-covered oceans, dynamic positioning against the drifting sea-ice cover, moon pool for the deployment of sensitive instrumentation, deep-sea drilling. These features pose AURORA BOREALIS in the forefront of international polar marine science and provide capabilities which go far beyond the possibilities of one single nation. ERICON therefore calls for the formation of an international consortium of nations sufficiently motivated and capable to support the science called for in a decadal “Science Plan” for polar marine sciences.

The ERICON-deliverables in general cover the following major items:

1) Science Perspective for polar marine research for the coming 2 decades;
2) Contributions of the proposed facility to fulfill members strategic research objectives;
3) Guidelines for access and usage of an international vessel in the polar marine areas;
4) Recommendations on scientific management;
5) Potential contributions to environmental monitoring and decision support systems in the Polar Regions,
6) Verified estimates on construction, crewing and support of a new international research icebreaker;
7) A business plan;
8) Proposals for a possible organisational structure;
9) A report on a possible organisational structure;
10) A report on major operational barriers; etc.

The ERICON-results show clearly that no real progress in polar marine research can be achieved beyond the present status-quo, if the research community does not get access to a facility of the capabilities and capacities of the new and innovative research icebreaker as proposed by ERICON.

The major remaining challenge is to find nations and research institutions which are motivated enough to accept a commitment for the construction of the vessel and its deployment for the coming decades. The urgency of the changes in the polar oceans in real time calls for immediate action.

ERICON documents in the public domain are available at the following website: under ESF polar activities at http://www.esf.org/publications/polar-sciences.html or at http://www.eri-aurora-borealis.eu/; a complete set of all ERICON and AURORA documents on CD will soon be available for a wider distribution.

Project Context and Objectives:

The Polar Regions and their Impact on a Sustainable Future for Modern Societies
Understanding and responding to the dynamics of on-going global change is of highest urgency and societal relevance and consequently immense attention is paid to the Polar Regions by the highest political authorities. It is recognized that securing the future of humankind requires immediate action and a considerable intensification of polar research. The properties of northern and southern high latitude marine and terrestrial areas are at present subjects of intense scientific debate. They react more rapidly and intensely to global changes than any other region on Earth. At the same time they are also a major driver of...
intensely to global changes than any other region on Earth. At the same time they are also a major driver of climate change and hence their impact is not only of regional, but also of global importance. While the polar land surfaces are characterized by extreme habitats, they are at least accessible to scientists during all seasons. This is not so for the polar oceans. Signs of dramatic changes are currently observed: News about the shrinking Arctic sea-ice cover, potentially leading to an opening of sea passages for commercial traffic to the north of North America and Eurasia, of the calving of giant table icebergs from the Antarctic ice shelves, of changes in the Southern Overturning Circulation of the deep polar oceans, of the increase in global sea level rise witness such changes in real time. In the Arctic these processes will open up new and un-investigated provinces of non-living resources, while habitats of living resources may be changed. Dedicated research vessels capable to operate during all seasons of the year and under unfavourable weather conditions in the central Arctic Ocean and in the Southern Ocean are required to fulfil the new needs of polar ocean research for all marine disciplines. Today, no available ship has the required capabilities and capacities; in addition these vessels are few and outdated, thus having to split research efforts between the Arctic and the Southern oceans.

The European Initiative

The European Polar Board has taken the initiative to develop a plan for a novel and dedicated research icebreaker with technical capabilities hitherto unrealised, which will enable it to autonomously operate in the central Arctic Ocean even during the severest ice conditions in the deep winter serving all marine disciplines of polar research including deep-sea drilling: The AURORA BOREALIS. Such a ship will necessarily offer possibilities whose effective use reaches far beyond the capacities and capabilities of an individual nation. Therefore complex interdisciplinary experiments can only be conducted under close international and inter-/multidisciplinary co-operation. The AURORA BOREALIS will act as a basis to support such research efforts and fulfil the operational needs of the science community as well as political obligations of governments, which have a high interest in the polar oceans, their seafloors, the environmental properties, and the impact of these regions on the adjacent sub polar and polar habitats of indigenous and non-indigenous populations.

Main interests in the project

The AURORA BOREALIS project, through close connection with the European Science Foundation’s European Polar Board will support multidisciplinary research in areas like Climate Change, biodiversity assessments, geohazard analysis, resource engineering or long-term monitoring. It will foster the integration of diverse scientific disciplines such us Glaciology, Biology, Meteorology, Geosciences into common scientific frameworks. The generation of joint research programmes at the European level will be an important facet of the cooperation. Research missions comprising several years will examine in a holistic way the properties and dynamics of processes controlling the central Arctic environments. The project will be beneficial for the understanding and analysis of natural resources, northern sea routes, helping the delineation of EEZs through scientific research, mapping gas hydrate and submarine permafrost distributions. New technologies in extreme environments will be tested and the project serves as proliferator of key marine technologies for participating countries.

AURORA BOREALIS will be a “European scientific flagship facility” (also open to non-European partners), a multidisciplinary platform for studies ranging from the sub-seafloor into the atmosphere. The ability of
A multidisciplinary platform for studies ranging from the sub-seafloor into the atmosphere. The ability of AURORA BOREALIS to penetrate into the harshest conditions on Earth and to carry out research even in the polar winter will set new standards in the fields of polar research and naval architecture, including environmental safety of the highest standards. Currently, no polar research vessel has the capability to autonomously operate in pack ice except during the optimal ice conditions of the late summer season. AURORA BOREALIS, in contrast, is planned as a multi-purpose icebreaking research vessel for Arctic and Antarctic operations with the capability to autonomously navigate in sea-ice with a thickness of more than 2.5 metres. This will for the first time facilitate year-round research, e.g. on the nature of global environmental change. The ship shall have the unique capability to perform scientific deep-sea drilling operations in water depths between 100 and 5000 metres with a penetration of more than 1000 metres into the seafloor, even while being located amid drifting pack-ice fields. An innovative, high-performance dynamic positioning system shall enable the ship to keep position in such a demanding environment.

The Planning of the world’s largest Multinational Marine Research Facility for the Polar Oceans

After a careful scientific assessment of Arctic Ocean research needs (published in 2004 by ESF) the European Polar Board and its partners have taken steps to further the planning process towards generating this new facility. At present, it consists of 2 major efforts:

Governance: The 4.56 Million EURO European Project ERICON-AB (European Research Icebreaker Consortium – AURORA BOREALIS, cf. www.eri-aurora-borealis.eu) is financed by the European Commission under 7th Framework Program (FP 7) and coordinated by the ESF in Strasbourg www.esf.org. It runs from 2008-2012 and is designed to prepare the strategic, legal, financial and governance frameworks for the vessel. AURORA BOREALIS is included in the priority list of the European Commission’s „European Strategy Forum on Research Infrastructures“ (ESFRI) within the FP 7, is the largest Environmental Sciences project on the roadmap and is specifically mentioned in the European Commission’s recently published Arctic Communication. Currently, 10 countries participating in this preparatory project: Belgium, Bulgaria, Finland, France, Germany, Italy, The Netherlands, Norway, Russia, Romania. Denmark will become an official ERICON partner in the coming months. Interests to cooperate ERICON-AB have been expressed by the science communities in Spain, and Ireland.

Innovative Technology: Following an earlier feasibility study, a principal technical design and General Arrangement Planning for the vessel was completed by Wartsila Ship Design in Hamburg in 2008-09. The contract issued by the AWI and funded by a 5.2 Million EURO grant from the German Federal Ministry for Education and Research (BMBF) also involved specialised subcontractors like “Aker Arctic Technology” in Helsinki and the “HSVA” (Hamburg Ship Model Basin). These expert advisors provided extensive ice tank testing of the model. Initial decisions about construction will be prepared in late 2010-11.

For the first time, routine scientific deep-sea drilling will become possible even in drifting pack ice, without support by additional icebreakers. To perform these drilling operations AURORA BOREALIS has to be kept exactly on position in the floating ice. A dynamic positioning system capable for manoeuvring and staying on position in drifting sea-ice is mandatory for this task – an absolute novelty in the shipping industry. Extensive model tests in the ice tanks of the Hamburg Ship Model Basin (HSVA) and Aker Arctic Helsinki have proven that AURORA BOREALIS is indeed able to dynamically position in closed sea-ice cover with thickness of two meters and more. Another unique characteristic of AURORA BOREALIS are the two moon pools (7x7 meters each). These are continuous vertical funnels in the midst of the hull into the water below the vessel that enable scientists to deploy equipment into the ocean without being subject...
The water below the vessel that enable scientists to deploy equipment into the ocean without being subject to wind, waves and ice. The aft moon pool is mainly dedicated to drilling operations, while the forward moon pool is reserved for most other scientific works. This allows as a first the deployment of very sensitive and expensive equipment, e.g. remotely operated (ROVs) or autonomous (AUVs) underwater vehicles within closed sea ice cover. Scientific laboratories are located on several decks around the moon pool, which is designed in an atrium-like shape with circular walkways and preparation areas. In order to optimally equip the ship even for mission specific expeditions, containerized laboratories can be also loaded here and become fully integrated into the scientific workflow on board.

Committed partners and sharing expenses: The European Commission has recently published (in November 2008) an Arctic Communication, requesting inter alia specifically the completion of the AURORA BOREALIS project. The ERICON-AB project is carried out with partners from 10 European countries.

The ERICON project is continuing in negotiations with several countries on the political level to advance the decision on financing of the project. Interests from Italian shipyards and multiple national polar programmes are also pursued. ERICON will work towards the foundation of an AURORA BOREALIS Political Council and legal entity, with decisions on financial commitments sought at the end of 2011.

How will the expenses of the project be divided is the subject of a business planning process conducted as part of ERICON-AB, but it is estimated that core construction costs will range from 635-850 M Euro (subject to financial panel validation) while running costs are projected to range between 30-45MEuro/year including financial support to the management structure. One structure for financial participation under discussion consists of a system of shares – where stakeholder ministries will have to commit funds for these elements. In order to support clusters of smaller countries, using risk share financing facility of the European Investment Bank will also be assessed. Exact costs and participation models will be generated and proposed during the business planning process with advice from a dedicated panel of financial experts and stakeholders of the ERICON-AB project.

Expected benefits at scientific level

Realising this new major infrastructure facility will add substantial new capacities to marine polar research; it will result in additional 15,000 scientist-days/year if operated for at least 300 days/yr and bring the participating countries into a position of international leadership. It will free up capacities of existing polar research vessels, which could be devoted to expeditions in the Southern Ocean where they are much needed. AURORA BOREALIS can be considered to be closely complementary with that of SIAOS (Svalbard Integrated Arctic Observing System), which is another element of the EU-ESFRI Roadmap. A participation in AURORA BOREALIS will expand and establish dedicated scientific working groups/communities capable to make efficient use of the abilities and capacities of this novel research ice breaker.

The Arctic and Antarctic deep-sea drilling perspectives will be incorporated in close cooperation with ECORD and IODP, and it is expected that the AURORA BOREALIS will also serve as “Polar dedicated” research platform for the ocean basins in the high latitudes.

Project Results:

1. Introduction
The European Research Icebreaker Consortium – AURORA BOREALIS (ERICON-AB) cf. www.eri-aurora-borealis.eu is financed by the European Commission under 7th Framework Programme (FP 7) and the first initiative ever to plan the building of a pan-European ship for research activities in the polar and marine realm.

The project runs from 2008 - 2012 and was designed to prepare the strategic, scientific, international, financial, organisational and legal framework towards a final decision of partner countries for the construction of the research vessel AURORA BOREALIS. 12 countries (Ireland as a corresponding member is included) and 18 partners participate in the preparatory phase: Belgium, Bulgaria, Denmark, Finland, France, Germany, Italy, The Netherlands, Norway, Russia and Romania. Spain expressed its interest.

The project has been removed from the priority list off the European Strategy Forum on Research Infrastructures’ (ESFRI) in March 2011, four months after the official hearing at the European Commission (EC). The removal had naturally significant impacts on the gained momentum of the project. The enlargement process of the consortium stopped abruptly and advocacy work towards important stakeholders was largely hampered.

In the course of the development of the project the ERICON AB consortium entered into negotiation with the EC. A set of new deliverables have been added to the original contract and existing deliverables modulated. This was necessary to better match new realities and to enable the transfer of important outcomes to ongoing and future projects and initiatives.

The negotiations as such as well as the EC requested changes of (i.e. addendum to D. 5.2 discussing a governance structure for a polar fleet) and the addition of new tasks (notably 1.15 and 1.19) entailed the necessity of the project’s prolongation.

Beside the finalisation of the requested work also the publication of the main outcomes of the work packages 2 (i.e. D. 2.5 “monitoring issues in the Arctic”, D. 2.7 “the ERICON AB Science Plan” and D. 2.8 “research services in the polar marine realm”), 4 (i.e. D. 4.1 “the calculation of construction and operation costs” and D. 4.2 “ERICON AB business plan”) and 6 (i.e. D. 6.1 “the choice of legal instruments for a floating single sited research infrastructure” and D. 6.2 “the identification of major legal issues relating to future operation of a pan-European research vessel in Arctic”) has been finalised. By doing so all the milestones have been fulfilled.

The achieved results will serve as reference documents for similar endeavours attempting to better structure the use of new or existing heavy research icebreaker or icebreakers with research capacities as well as ice-margin and blue ocean vessels. So far no such documents existed. In addition, the project’s outcomes might be useful as a scheme for other ESFRI funded research infrastructure projects or EU funded projects dealing with polar and marine research vessels and networks of research vessels. Beside the publication of the reference documents the innovative concept of the ERICON AB project itself served as a template for upcoming initiatives in the polar and marine field, that are part of the ERICON AB legacy.

This legacy is also included in the polar vision component of the in January 2012 submitted EUROFLEET 2 proposal as well as the jointly organised workshops of the Alfred Wegner Institute for Polar Research and the European Polar Board on the “Perspectives for the coordinated usage of European Icebreakers in support of Future Arctic Research Challenges” in Bremerhaven, November 2011 and another international workshop in Montreal April 2012. Results of the workshops as well as the potential alternatives to the current ERICON AB concept are presented in Deliverable D.1.15 “Publication of an updated science
Current ERICON AB concept are presented in Deliverable D 1.15 “Publication of an updated science perspective for Arctic research platforms” (i.e. the discussion of existing European and international polar research vessels and geometries on international co-operations) and D 1.19 “Final report for using and disseminating foreground knowledge” (i.e. the discussions on alternatives to the AURORA BOREALIS research vessel). Both deliverables are combined in a “package” as their contents are linked and could be better discussed in one report and presented in this package.

2. Project deliverables and milestones

The updated list of the deliverables is showed in the attached document “Project deliverables and milestones”. In comparison with the original list, the deliverable D 2.9 “Strategic workshops with funding agencies in dedicated countries and meetings with representatives from institutes and/or national polar operators” replaces the deliverable D 1.21. The deliverable D 4.3 “Recommendations and guidance to the usage of EU instruments EIB and structural funds” has been deleted on request from the EC. The Public Deliverables are highlighted in green; Technical Reports are highlighted in blue.

3. Major achievements

3.1 Strategic Integration and Science Management of Polar Research Icebreaker Facility within European Research Area (Work Package 2)

This work package concentrates on the overall strategic integration of the facility in the context of the European Research Area and international cooperative frameworks. In the following, the most significant achievements and results are presented.

Significant results:
The deliverable D. 2.5 “A Model of how polar research facilities can contribute to an environmental monitoring and decision support system in the Polar Regions” shows that Europe and its global partners would benefit from acquired knowledge in several fields, such as understanding of climate change and related processes in Polar Regions, developing of European environmental and maritime policies and services, supporting industrial sectors such space and telecommunication, promoting international co-operations in the Arctic and contributing to polar policy advisory for decisions affecting the sustainability of Polar Regions.

The deliverable shows that a pan-European research vessel such as the AURORA BOREALIS (AB) with unique technical characteristics would serve as observational platform for integrated studies on climate change in the Polar Regions by acquisition of physical, biological, geological and chemical data and deployment of instrumentation for monitoring. Currently environmental monitoring systems in the Polar Regions providing in situ measuring are poor, not adequately covered or does not integrate existing instrumental networks both at land or ice- and space-based (satellite). However, monitoring data is needed for a number of programmes, aiming at transforming the field data into information. This information is needed by the public, and will be used to support decisions concerning the environment. In addition, the data can be used for many other purposes, e.g.: Climate model development, Weather forecasts by international and national meteorological institutions (including EEA and WMO), Fundamental and applied research on marine/atmospheric/environmental processes (science plan) – channelled via open calls, Support of several national monitoring programmes.
The deliverable demonstrates how Europe and its global partners would benefit from acquired knowledge to:
- Advance research and the understanding of climate change and related processes in Polar Regions
- Help to develop European environmental and maritime policies and services
- Further industrial sectors such as space and telecommunication
- Promote international co-operations in the Arctic
- Contribute to polar policy advisory mechanisms and support for decisions affecting the sustainability of Polar Regions

The deliverable includes a list of the most important existing policy and scientific monitoring activities in the Polar Regions, in which AURORA BOREALIS (AB) could contribute to advance knowledge. A set of different programmes, networks are given in each chapter as examples. Special focus has been given to the Arctic realm because it is of higher interest for Europe from a political and economic point of view. The AURORA BOREALIS would bridge gaps in Arctic and Antarctic research by assessing the state of the Arctic and Antarctic, by monitoring environmental effects all year round over long periods of parameters ranging from living (census of marine live, health status) to non-living resources, by quantifying pollutions or ocean acidification in the polar oceans and, last but not least, by gaining of new insight in the climate change processes in the Polar Regions.

As a supplementary benefit, the AURORA BOREALIS would help to reduce costs through the pooling of monitoring programmes, the potential limitation of costs related to environmental degradation (litter, oil spills, invasive species, chemicals, loss of natural resources) and by protecting human population against negative effects of environmental degradation.

The AURORA BOREALIS would have linkage to different industrial sectors by means of:
- Calibration of remote-sensing data for commercial Earth observations and telecommunication satellites and meteorological satellites
- Testing bed for innovative solutions devices (sensors etc.)
- Pooling and assessing of the scientific and technical requirements (what equipment is needed for which purpose?)
- Adaptation of monitoring frequency and compatibility in view of existing monitoring and needs
- Monitoring targets (how to cover the data gaps in the dedicated regions)
- Establishment of research services e.g. ice management, sea ice mapping

In addition, The Aurora Borealis would bridge the gap between research and policy and the translation of research results into policy development (stakeholders and general public). Besides giving high visibility to Europe, the Aurora Borealis will facilitate the coordination between national polar and marine research priorities and agendas by contractual access even for nations with no capacities of a own polar programme. It will also provide meteorological and oceanographic data, track pollution or other climate relevant events in the polar realm, baseline data for several European agencies and European directives. From an international point of view, Aurora Borealis provides a unique platform for intergovernmental collaboration and will be able to contribute to integrated and sustained observation system in the Arctic, such as SAON, and in the Antarctic (ANTOS).

Finally, the AURORA BOREALIS would contribute to society and the Public Understanding of Science by bringing processes and changes into the public visibility, by providing virtual access to a unique ship expeditions to remote areas, data for teachers, hands-on experience and training for young researchers.
expeditions to remote areas, data for teachers, hands-on experience and training for young researchers on a floating university.

It should also be mentioned, as an important issue, that the AURORA BOREALIS would be able to undertake Search and Rescue Operations in case of emergency in Polar Regions.

The deliverable 2.6 “Development of strategies for the character and usage of a future large European research icebreaker (mission specific versus strategic)”

The deliverable explores two different modes of decisions and how the future programme architecture is designed.

Ship time is the regulatory unit of those specific activities. The “strategic mode” aims at fulfilling long term strategic requirements of funding agencies or major established programmes. To implement the strategic mode a long-term vision incorporated into the funding/planning cycles of funding agencies is required. The vision would be developed by the ERICON AB Governing Council (GC) The office of the GC would in a transparent way inform the user of the vessel, i.e. the scientists or potential third parties on the established rules and instruments for participation. The GC can decide to annually allocate ship time to specific programmes (e.g. repeated programmes for experiments and measurements, monitoring programmes, disciplinary or geographical driven research programmes of the jointly established ERICON AB Science Plan, Once the strategic framework has been decided, the responsibility will be transferred to the Science Committee (SC).

The long-term strategy will be defined by the partners (owners and users) that contribute to the running costs of the vessel on a long-term basis. This will provide an incentive to become a partner.

The “mission specific mode” aims at implementing specific projects evaluated on a case-by-case basis (e.g. short-term programmes for new emerging research topics or challenges due to changing boundary conditions, short-term programmes for third non-partner countries or industry partners.

Mission specific projects will fill the potential gaps in the ship schedule, but will also allow the science community to submit proposals on any subject included in the overall science plan. It is essential to maintain an adequate balance between the two modes, to fulfil long-term commitments as well as to encourage new ideas in the community. In all cases prioritisation will rely on external review and reflect scientific merit.

The deliverable D.2.7 “A 15 years Science and Implementation plan for a future large research icebreaker and other platform in the Arctic and Antarctic” is a community-produced science perspective which comprises a perspective for both Polar Regions.

The development of the Science Perspective started in 2010 with the establishment of the Scientific Advisory Panel (ESAP), composed of 29 top-level polar scientists designed by members of the ERICON AB Stakeholder and the European Polar Board in late 2009. In two ESAP Meetings (18-19th November 2010 at the ESF in Strasbourg, France and 9th April 2011 in Vienna in Austria) the Science Plan was discussed and distributed into the five main core themes and key questions also including technology. The science plan was circulated within the Partners until March 2012 for contributions and comments throughout its completion with substantial discussions and additional comments.

The AURORA Science Plan addresses two scientific communities. The first one is the general polar science community, which requires a research vessel for conducting its field and sea work throughout all seasons of the year with henceforth wide scientific perspectives. The other is the deep-sea drilling community, which would use the ship mainly during the summer months to study the structure and properties of oceanic crust and the history of the oceanic depositional environments that can be deduced from the oceanic sediment cover.

This has only been done once in the ice-infested waters of the central Arctic during the Integrated Ice
This has only been done once in the ice-infested waters of the central Arctic during the Integrated Ice Drilling Program (IODP) 302, aka, ACEX Coring Expedition, whereas around Antarctica substantial progress has been achieved by using the drilling platforms of the Deep-Sea Drilling Project (DSDP), the Ocean Drilling Program (ODP) and the IODP during the ice-free seasons and by using a drill rig from the land fast sea-ice very close to shore on the Cape Roberts Project (CRP) and from the ice shelf in the ANtarctic geological DRILLing project (ANDRILL). However, in Antarctica, neither the CRP-tools nor the conventional drilling vessels, which cannot enter ice-infested waters, are able to cover all desirable drilling locations. So far, mainly due to the lack of a suitable ice-capable drilling platform, it has not been possible to investigate many of these locations due to the lack of a suitable ice-capable drilling platform. These scientific targets will now receive renewed attention in this report.

The Science Plan is organized following a thematic scheme of five major core topics each encompassing a number of high-priority scientific key questions embracing the most important scientific questions that should be addressed in the next fifteen years. It also includes a technological chapter compiling the technological requirements to address those scientific questions.

The scientific topics addressed in the science plan are:

- The Changing Polar Oceans, Ice and Atmosphere
- The Polar Marine Biosphere
- Polar Paleo-climate and Paleo-environment
- The Polar Ocean’s Geological History
- Seafloor Processes and Natural Hazards

The five scientific topics, in which this Science Plan is structured, provide an umbrella under which technologic and scientific research needs and strategies can be identified. The key questions addressed on each of the chapters have been kept intentionally general.

The philosophy of this science plan is to explicitly acknowledge the importance of carrying out research in the Central Arctic Ocean and Antarctic ice infested waters throughout the entire year. Understanding the past and future changes of the Polar Regions is decisive, as our present knowledge about these changes and their impacts on humans and resources is far smaller than in any other regions of the world.

A dedicated platform for polar research with drilling capacities will allow scientists of all polar disciplines to address the five research topics by establishing interdisciplinary campaigns with common goals.

The science plan is not intended to cover in detail all the research that can be carried out in Polar Regions, but to provide a collection of the most relevant, outstanding scientific questions which implications are of enormous importance to understand the underlying processes of this time of change, and which can only be achieved by mean of novel technology.

The concept provides a pathway to the development of an international cooperation in polar scientific research opening up long-term perspectives to international programs. In parallel it enables adequate knowledge and sound policy advice to governments on the status of changes to the global environment.

This Science plan will provide a basis for future scientific investigations of Polar Regions and define a ‘decadal’ strategy for European cooperation in Polar Science.

The deliverable 2.8 “Draft agreement documents on research services” summarises the nature and extent of essentially needed research services in support of science for a future European Research Icebreaker. The recommendations on best practices and proposed operating procedures can be used to set up such contracts in the future, once a commitment for an ERI is achieved.

The principal scope of work and the integration into the project was defined by Task 2.3 within WP 2: “The provision of essential research services related to a dedicated polar research icebreaker. This task will
provision of essential research services related to a dedicated polar research icebreaker. This task will concentrate on defining the provision of essential research services (staffing, site, research proposal handling) interfacing with Work package 5 on the creation of appropriate advisory structures (science/logistical) to the governance. The definition of these associated services has a major impact on the running costs of the facility and it is essential to determine with a high degree of confidence the level, scale and scope of these essential services. The deliverable D. 2.8 consider the location of the most appropriate homeport and the site of operations by consideration of the existing or future vessel handling facilities in a number of Arctic rim states.

To better address the extent and focus of this deliverable within the task description, initial discussions were held among partners during two meetings of the ERICON AB Science Support and Governance Unit (Trieste, 2010 and Vienna, May 2011) to define the scope of this deliverable more precisely. The following items were defined for the analysis works, as focus points for this report and the recommendations for TRS implementation planning:

- Define Technical Research Services (TRS) that are needed for the operation of a European Research Icebreaker in an overview format.
- Assessment of modus in which TRS are to be provided to the consortium
- Check results with proposed proposal handling system (Del. 2.4 and Del. 5.1)
- Issue recommendation for provision of TRS by partners or 3rd party organisations
- Interact with cost calculation schemes, potential cost impact
- Draft and publish report on TRS of a European Research Icebreaker
- Outline mainly non-quantitative cost implications for provisions
- Review and recommend a suited home port location and forward logistics bases
- Cross-reference governance and science management aspects (D 5.2 D 2.4)

Large infrastructures: During the various assessment stages of existing Technical Research Services in European Institutions, it became clear that a more streamlined definition and re-organisation would be needed for the specific needs of European Research Icebreaker (ERI) operations.

In particular, when reviewing the available equipment in polar research centres, it is evident that the current ERICON AB partners alone are unable to provide the complete coverage of science support systems and personnel that is needed for a vessel like the ERI from their respective institutional resources in the current form.

This is largely due to the fact that a significant proportion of existing infrastructure (instruments, personnel) is owned by or under the organizational governance of national marine science organizations or research centres that are currently either not ERICON AB partners, or are performing mainly “Blue Ocean” research, or act as national excellence centres providing equipment to all marine research institutions and universities in their respective country. In contrast to the ship’s operation itself, most of the instrumentation that is used in polar marine operations does not differ substantially from the one used in blue ocean research. National agreements exist in most partner nations, sometimes informally, to share, barter or lend equipment between these national institutes. However, to be of use for ERICON AB such agreements would have to be re-negotiated on a national level to include ERICON AB activities.

In contrast, international sharing or co-operation agreements for infrastructure in a long-term contractual form (i.e. beyond single expeditions) remain scarce, but are increasingly seen as attractive way to lower investment costs for expensive equipment. No coherent European exchange programme for large-scale marine equipment exists to better use limited and expensive facilities that are often under-utilised in many
marine equipment exists to better use limited and expensive facilities that are often under-utilised in many countries. Steps into the direction of a more universally usable exchange programme have been made with OFEG (Ocean Facilities Exchange Group), more importantly EUROFLEETS. It remains to be evaluated in the implementation phase of ERI if such initiatives could be used successfully for ERI operations or whether they create conflicts of interest between ERICON AB partners that are simultaneously members of these other programmes.

Data Bases: To date, no publicly accessible, comprehensive database for all available large marine scientific equipment exists in Europe that is actively used for infrastructure exchange. A review of existing databases revealed that most are highly selective and/or incomplete in cataloguing large equipment. Steps towards achieving usable databases have been undertaken by various groups, especially EurOceans (European Network of Excellence for Ocean), OFEG-TECH, ERVO (European Research Vessels Operators), and IRSO (International Research Ship Operators) more recently. Most of these groups, however, may be either limited in their resources, their institutional membership or sometimes their long-term commitment beyond the lifetime of a project.

Thus, available resources of the entire ocean research community could be in principle at disposal for ERICON AB operations, but additional framework agreements between national institutions would be needed to secure access. Existing exchange facilities should be approached and supported for organising TRS once an ERI reaches sufficient commitment for implementation.

An ERICON AB management and organisation structure is needed for TSR provision pathways and protocols. The task rests with the ERICON AB Management Office as described in Deliverables 5.1 and 5.2. After discussions with expert organisations and marine research service providers it is recommended that provision of equipment and supporting personnel should, whenever possible, remain combined, i.e. one supplier for the tool and the expert engineer/specialist. ERICON AB Partners should act as principal institutional TRS suppliers, either directly or as contractual contact point to other national institutions.

Under the strategic deliverable 2.9 several important strategic workshops with funding agencies in dedicated countries and meetings with representatives from institutes and/or national polar operators meetings (Seoul, Korea, San Francisco, USA) and workshops (Bremerhaven, Germany and Montreal, Canada) took place in which the future of polar research vessel(s) operated at European and or international level has been discussed. Major outcome of those workshops and meetings are presented in the deliverable package of 1.15 and 1.19.

3.2 International access (Work Package 3)

Within work package 3 (International access to the AURORA BOREALIS polar research facility and theatre of operations) a set of actions taking the initial steps towards the discussion of international access mechanisms and future collaborations with different research programmes ranging from national marine and polar research programmes are bundled. Discussions on forms of access and access privileges for the research vessel and its future theatre of operations are crucial. Because of the complexity and multi-level approach of such an initiative most of the tasks of WP 3 started at an early stage of the project to initiate discussions on various geometries on cooperation, agreements and integration steps. Continuous liaison Mechanisms between ERICON and IODP/ECORD systems for support to Scientific Ocean Drilling in the Polar Regions has been achieved and maintained via the European partner countries represented by ECORD, the European Consortium for Ocean Research Drilling and its decision entity the ECORD Council. They resulted in a deep integration level of ERICON and IODP/ECORD for the
ECORD Council. They resulted in a deep integration level of ERICON and IODP/ECORD for the implementations of drilling projects with the AURORA BOREALIS through protocols for usage of the dedicated Arctic/Antarctic Drilling facility.

In parallel, protocols for the access of the “non-drilling” research communities encompassing a broad spectrum of research fields in the marine and polar realm have been proposed. Based on experiences of European icebreakers with research capabilities, the respective national vessel admission criteria and the comparison of existing proposal handling systems, a submission and proposal system for AB for the “non-drilling” has been conceived. Further details can be achieved in Report 2.

The analysis of UNCLOS Articles and reviews of recent international meetings related to marine scientific research and shipping in the Arctic as well as in the Southern Ocean provide an estimation of shipping conditions and planning scientific research in particular with AURORA BOREALIS, in polar waters. The conditions for AURORA BOREALIS are presented under item “3.2 WP 3 International access” and, in greater detail, within work package 6 “Legal structures-implementing agreements, ownership and operational barriers” and the future legal advisory panel (LAP).

Another objective of this work is to investigate the administrative, political and legal framework related to national Economic Exclusive Zones (EEZs) in the Arctic. D. 3.3 “Report on the administrative, legal and political issues of operating the AURORA BOREALIS in the Arctic Region summarises the current access procedure in the Russian EEZ mainly based on the experience of the German research icebreaker “POLARSTERN” and of different Russian research vessels (“PROFESSOR SHTOKMAN” and “AKADEMIK IOFFE”) and includes the setup of a draft standard template for future access applications in Russian Exclusive Economic Zones.

Finally, the potential involvement of those countries which are not supporting neither the construction nor the platform costs, but may contribute to the scientific operation costs, has been explored in the cost sharing and participation models in WP 5 on governance and WP 4 on financial aspects and presented in RP 3.

Even after the official ending of this work package, linkages between the ERICON AB consortium and other relevant initiatives have been continued. The ERICON AB coordinator attended the ECORD Council meetings on a regular basis; a joint EMSO-SIOS-ERICON AB town-hall meeting took place at the European Geosciences Union General Assembly (EGU) in Vienna in April 2010 with the attendance of Hervé Pero from the European Commission; Representatives from programmes from the polar and marine realm {e.g. SCAR, IASC, SAON (Sustained Arctic Observing Network) etc.,} have been met in the framework of specific meetings, sessions, conferences or workshops.

Both diverse research communities emphasize the crucial need of a holistic systematic data collection from both polar hemispheres to constraint global change prediction modelling in polar regions and stated an increasing demand of a research support such as AURORA BOREALIS to advance collection of new, sound and reliable data, impossible to obtain thitherto.

3.3 Financial Frameworks and Resource Engineering (Work package 4):

Deliverable 4.2 provides an overview of the financial framework, the cost-sharing model and model of participation for the research icebreaker AURORA BOREALIS in the light of her current design. The deliverable also sets the minimum level of commitment required for participating in the construction and the running costs. This together with the related percentage of scientific berth capacity allocated in return, should provide potential partners with sufficient information to move towards a decision on financing the construction of the vessel and its operations.
construction of the vessel and its operations.

However these decisions cannot be taken on the sole consideration of these financial models and further elements, such as the weight of each partner in the governance of the project, should also be analysed when taking this decision. Details of the proposal handling system or the way scientific priorities are set are also important and should be considered together alongside the financial framework to guarantee the maximum level of return on investment to the partners.

From a broader perspective, the development of these models around the common concept of juste retour making a clear differentiation between the scientific and the industrial interest, allows the integration of any kind of potential partner, public or private. The cost sharing model of the running cost is a perfect example of this flexibility, where the possibility to shift between the scientific, the mixed and the economical model at any time during the funding cycle, guarantee a smooth integration of any type of partner. These models are therefore attractive for a large number and partners are more likely to commit for an extended period of time. This innovative approach promoting a maximization of the access to the facility, offers them with a strong return on investment without jeopardizing the scientific dimension of the project. The combination of these particular elements is crucial to secure the long term operations of the vessel.

Furthermore the flexibility of these models and the robustness of their founding principles make them easily transferable. In a context of increasing international collaborations and the development of several European of research infrastructures, these models could serve as a base for consideration for any other polar and marine research infrastructure either single sited or distributed.

Following the analysis of the different cost items an overview of the overall running cost for the Aurora Borealis is summarised in the attached Table.

3.4 Developing organisational and governance frameworks for management of a dedicated multinational polar research facility (Work Package 5).

The Deliverable 5.1 develops the organisational and governance framework for the management of a dedicated multinational polar research facility. The concepts developed within Work Package 5 and presented in Deliverable 5.1 5.2 and 5.3 are focusing on the research icebreaker AURORA BOREALIS, but could be transferred to any project involving the management of a multi-nationally owned and operated infrastructure.

The overall structure considered for the management of the AURORA BOREALIS has been identified. The roles and means of each of the bodies that compose the structure are synthetized in the table attached.

The content of this document and the work of the work package 5 in general, should not be considered on its own but analysed together with the work performed on the cost sharing models, models of participation, proposal handling system and legal framework. Indeed a strong link exists between these different elements, which are all influencing the level and type of benefits a partner would get in return of its investment in the project. The interrelation between the contribution and these benefits is called juste retour. Juste retour is achieved when the benefits are proportionate to the level of contribution. The position a partner would have in the governance represents, via the voting rights and control over the
position a partner would have in the governance represents, via the voting rights and control over the
operation of the vessel, one of the possible benefits a partner would receive in return of its investment.
Deliverable 5.1 introduces briefly the description and purpose of the each of the bodies considered.
Further information considering their internal organisation and mode of operation shall be developed in
Deliverable 5.2 and 5.3. The Deliverable 5.2 (part I) “Report on a possible organisational structure –
functional responsibilities (Science support, administration, operations) of a possible pan-European
network of polar research vessels, possibly with related polar research facilities” develops in more detail
the organizational structure of the ERICON AB management agency established in D. 5.1.
Building on the outcomes Deliverable D. 5.1 “on the organisational framework of the ERICON AB
managing entity and the management office” as well as on D. 2.4 “on the proposal handling system” the
Deliverable D. 5.2 Part I summarises aspects of the anticipated activities of the management office in the
operational phase and describes the interaction between the different units. The organizational structure of
the ERICON AB management agency is developed in more detail. Especially the assignments and the
functional responsibilities as well as personnel requirements of the different management departments
were developed. In addition essential research services and the provision of different research services
are treated.

The development of the deliverable D. 5.2 part I started with a meeting of the WP5 partners in
Copenhagen on 9th of March 2011. The structure and the content of D 5.2 part I have been defined at that
meeting. This was followed by a survey of existing governance structures and essential research services,
mainly by means of publicly accessible web databases, personal communication, review of existing
information in printed, recorded or web-published content. After the first draft has been compiled, it was
sent by email for improvement and corrections to all WP5 partners and then finalized.
The Deliverable D. 5.2 (part II) is an addendum requested by the EC in March 2011 after the project’s
removal from the ESFRI Roadmap. The idea behind is to modify the project in a way that it generates
results that are still valuable for the European polar research community. The EUROFLEETS I project and
the experience gained in this project served as a best practice example for the development this part.
Additionally, the governance structure of other distributed infrastructures as e.g. LIFEWATCH was used
as an example as well.
The part II was introduced after the strategic reorientation of the projects goals. This deliverable describes
the organizational structure for a potential network of research vessels instead of a single pan-European
vessel. Within D. 5.2 part II the respective functional responsibilities and personnel requirements for the
different departments within a distributed infrastructure has been assigned.
In comparison to the ERICON AB governance model (D. 5.1 and D. 5.2 part I) with a truly European
Icebreaker, the Polar vessels included in the fleet model will still be national research vessels. This means
that ship operations, logistical and scientific support to the cruises etc. would stay under national
responsibilities.
A lean management office financed out of a “common pot” would support the consortium by allocating
ship-time to successful proponents and scheduling of the cruises in close cooperation with the national
ship operators. Further considerations on the governance of such a fleet-type approach have been
deepened at workshop organised by the Alfred Wegener Institute for polar and marine research in
Montreal in April 2012. Main results are presented in the deliverable package 1.15 and 1.19 (compare
respective chapters).

The results of work package 5 together with the results of Deliverables 2.8 4.2 and 6.1 – shall ensure
effective implementation and the generation of an appropriate governance structure for the proposed
vessel.
3.5 Legal structures – implementing agreements, ownership and operational barriers (Work Package 6)

The Deliverable 6.2 “Identification of major legal issues relating to future operation of a pan-European research vessel in Arctic” reflects the discussions and the recommendations made in the course of the Legal Advisory Panel set up in 2009. In response to the interests formulated by the polar and marine scientific communities, represented by ERICON-AB partner institutions this deliverable presents the general legal framework that would be applicable during the operation of a pan-European research vessel in the Arctic and analyses some pertinent legal questions. The deliverable also provides guidelines to be used by the research institutions and by the decision makers regarding legal and other matters relevant to the operation of a pan-European research vessel in the Arctic.

The first chapter of the deliverable draws a comprehensive map of different Arctic maritime boundaries and legal zones under sovereignty or jurisdiction of coastal States. It also includes recent developments in this area, and notably the delimitation treaty of 15 September 2010 in the Barents Sea and the Arctic Ocean between Norway and Russian Federation. It also describes some of the important pending maritime delimitation cases in the Arctic: between Canada and Denmark (Greenland) in the Lincoln Sea, and between Canada and the United States in the Beaufort Sea. In conclusion the authors come up with some suggestions with regard to the operation of a pan-European research vessel in the disputed waters or seabed areas. The authors notably emphasize that there are still boundaries between Arctic States, which have not been delimited; therefore the disputed areas (water column and seabed) between coastal States in the Arctic remain. Prudent behaviour is recommended if a pan-European research vessel envisages conducting research in disputed areas. All claimant States should be involved in the research project in order to avoid delays and other complications.

The second chapter addresses the legal framework applicable to navigation in Arctic waters, and discusses the impact of the international and coastal States’ national regulations (focusing on Russian Federation and Canada legislations) on the operation of a pan-European research vessel. The navigation issues are particularly topical in the light of recent developments in the Arctic region where the legal regimes at international and national levels are set to change.

The third chapter is devoted to one of the crucial issues for a polar pan-European research vessel: it deals with the legal framework applicable to marine scientific research in the Arctic. The UNCLOS provides for a specific regime for marine scientific research based on the different areas of water or seabed where it takes place. Regarding scientific drilling it should be underlined this is one of a few limited situations when the coastal State has a discretionary power to refuse consent for research in its EEZ or on the continental shelf. As the vessel intends to be operated routinely in the areas under jurisdiction of a small group of coastal States, it is recommended that a multilateral agreement be reached in advance via a simplified procedure.

The fourth chapter focuses on a number of complex issues related to the third party liability of sea-going vessels, insurance for the crew and scientific staff, and international liability of participating States. It also provides an overview of the international legal framework for the settlement of different claims that could occur in the course of operation of a pan-European research vessel. The deliverable gives some guidelines to mitigate the liability of the owners and operators of the vessel in case of litigation. It is recommended to take out Insurance to cover the liability up to at least the limits of the Convention on Limitation for Maritime Claims. Special liability arrangements to address the settlement of claims and
Limitation for Maritime Claims. Special liability arrangements to address the settlement of claims and allocate costs should be concluded between the relevant scientific institutions (owners and charters of the vessel), including appropriate mutual waivers of liability and knock for knock arrangements.

4. Consortium and project Management (Work-package 1)

4.1 Consortium management tasks and achievements

The project has been removed from the priority list of the European Strategy Forum on Research Infrastructures’ (ESFRI) in early March 2011, four months after the hearing at the European Commission (EC). The removal had naturally significant impacts on the gained momentum of project. The enlargement process of the consortium stopped abruptly and advocacy work towards important stakeholders was largely hampered.

In the course of the development of the project the ERICON AB consortium entered into negotiation with the EC. A set of new deliverables have been added to the original contract and existing deliverables modulated. This was necessary to better match new realities and to enable the transfer of important outcomes to ongoing and future projects and initiatives. However, the negotiations as such as well as the change of different deliverables (i.e. part II of D. 5.2 “on the governance of a polar fleet”) and the addition of new demanded tasks dealt for example within D. 1.15 and D. 1.19 entailed the necessity of the project’s prolongation.

The publication of the main outcomes of the work package has been finalised. Also the publication of the main outcomes of the work packages 2 (i.e. D. 2.5 “monitoring issues in the Arctic”, D. 2.7 “the ERICON AB Science Plan” and D. 2.8 “research services in the polar marine realm”), 4 (i.e. D. 4.1 “the calculation of construction and operation costs” and D. 4.2 “ERICON AB business plan”) and 6 (i.e. D. 6.1 “the choice of legal instruments for a floating single sited research infrastructure” and D. 6.2 “the identification of major legal issues relating to future operation of a pan-European research vessel in Arctic”) has been finalised. Therefore all the milestones have been fulfilled.

The reports mentioned above will serve as reference documents for similar endeavours aiming to better structure the use of new or existing heavy research icebreaker or icebreakers with research capacities as well as ice-margin and blue ocean vessels. So far no such documents existed. Those reports can be used as a blueprint for other ESFRI funded research infrastructure projects or EU funded projects dealing with polar and marine research vessels and networks of research vessels as well as a template for upcoming initiatives in the polar and marine field which are part of the ERICON AB legacy.

This legacy is also included in the polar vision component of the in January 2012 submitted EUROFLEET 2 proposal as well as the jointly organised workshops of the Alfred Wegner Institute for Polar Research and the European Polar Board on the “Perspectives for the coordinated usage of European Icebreakers in support of Future Arctic Research Challenges” in Bremerhaven, November 2011 and in Montreal April 2012. The discussions of the workshops as well as the potential alternatives to the current ERICON AB concept are presented in Deliverable D 1.15 “Publication of an updated science perspective for Arctic research platforms” (i.e. the discussion of existing European and international polar research vessels and geometries on international co-operations) and D 1.19 “Final report for using and disseminating foreground knowledge” (i.e. the discussions on alternatives to the AURORA BOREALIS research vessel).

Both deliverables are combined in a “package” as their contents are linked and could be better discussed in one report and presented in this package.
4.2 The AURORA BOREALIS Legacy

Beside the publication of the reference documents, the innovative concept of the ERICON AB project itself served as a boost for upcoming initiatives in the polar and marine field. Current activities are summarised in the discussion paper combined of D. 1.15 “Publication of an updated science perspective for Arctic research platforms” and D. 1.19 “Final report for using and disseminating foreground knowledge”) discusses alternatives to the AURORA BOREALIS (AB) concept called “foreground knowledge”.

In the first part an assessment of worldwide existing icebreakers capable of doing research has been undertaken including ice-margin i.e. non-heavy icebreakers has been included.

The second part discusses potentials for cooperation between European and international partners in the framework of a pan-European heavy research icebreaker or of a coordination between existing research icebreakers on an international level.

By linking both deliverables, one more based on facts, the other more on discussions a snapshot of the European and international discussion on vessels as important polar research infrastructures is given. This document aims at demonstrating the strategic needs for such vessels and the future gaps in the upcoming decade. It may also be used to guide decision makers on decisions to be made on the funding of future vessels or networks.

Scenarios for European Cooperations: The Fleet-Type Approach: EUROFLEETS is a programme funded by the European Commission that promotes the shared use of several European research vessels. It is aimed to make optimal use of the existing European marine research vessels via a common strategic vision for the European research fleets ensuring that quality of research is carried out without duplication efforts. Building on the success of the EUROFLEETS project a second phase of the programme called EUROFLEETS 2 has been submitted to the EC in early 2012.

As a consequence of the postponement of the construction of a dedicated pan-European polar research vessel and the need to better coordinate European efforts in the polar realm, the EUROFLEETS 2 proposal integrated a “polar vision”. This vision aims at establishing models for implementing a joint coordination of Europe’s Polar research vessels by scheduling and harmonizing the deployment of ice-strengthened research vessels together with the icebreakers POLARSTERN and the ODEN in the already established framework for coastal and ocean going research vessels.

The fleet scheme is difficult to implement for polar research vessels, because the magnitude of the running cost is by an order magnitude higher than of coastal research vessels.

Other challenges remain. To promote a better use of the polar research vessels available by a sharing of ship time between countries the setup of common scientific priorities is needed to avoid duplication of efforts together with a significant financial support from the states to maintain the fleet.

Despite a better coordination of the existing European polar fleet, Europe lacks heavy icebreakers.

Discussion at European and International Level: In November 2011 a workshop organised by the Alfred Wegener Institute and the European Polar Board took place in Bremerhaven, Germany to explore different scenarios for the joint operations of heavy research icebreakers. Basis for this exploratory workshop was the suggestion of the 2010 WR recommendation as alternative to AB to explore the possibility to prolong the lifetime of the German POLARSTERN by about 5 years to intensify the research in the Arctic. In a window of opportunity from 2016/17 to ca. 2021, when the new POLARSTERN 2 is already in place, the old POLARSTERN should be still available. POLARSTERN 1 and the Swedish ODEN could than operate for a European Consortium in the Arctic.

During this window of opportunity the operational costs for POLARSTERN and ODEN would be
During this window of opportunity the operational costs for POLARSTERN and ODEN would be
shouldered by an international consortium similar to the concept of the AURORA BOREALIS. Contribution
of about 20 Mio Euro annually would be needed to have a year-round access to the Arctic (pers. comm. U.
Nixdorf).

The approach would open a perspective for longer-term cooperation between partners in order to support
them in the fulfilment of their national strategic polar research programmes. In the long run a harmonisation
of the different European polar programmes could be considered.

To deepen discussions a follow up workshop took place in April 2012. Held in Montreal in Canada during
the IPY 2012, the workshop gathered also international representatives from the US and Japan, who
confirmed their interest to participate in this initiative. It was suggested that networking could be achieved
by entering into agreements between partners to share and fund jointly operational ship time for the ODEN
and the POLARSTERN for a certain period of time per year. If the vessels were not used by the
consortium they would continue to carry out national programmes or be leased to third parties. However,
long-term political and financial commitments in the order of about 5 years are needed for the successful
implementation of such a programme. While the majority of financial contributions for realisation will need
to come from national resources, the nature and scope of the coordinated usage would fit in the strategic
framework of ERA, potentially mobilising adds for the operation of the icebreaking vessels and the funding
of basic research, especially by new EU member states.

Downsizing of the Current Design of AURORA BOREALIS: Available ice margin vessels are not adapted
to enter the Arctic during all seasons and many existing vessels are subject to operational constraints by
their respective national tasks. As it has been emphasized at the beginning of this paper there are not
sufficient existing European heavy research icebreakers able to penetrate the deep Arctic or operate only
for a limited number per year. A dedicated pan-European research vessel would provide a strong impetus
for coordinating and structuring the European Research Area in the field of polar research. Scientific
outcomes and new knowledge would accumulate rapidly. A pan-European vessel would also support the
establishment of collections of long-term observations urgently needed to understand important processes
related to climate change. In the immediate absence of AURORA BOREALIS the alternative of downsizing
the current design of AB to reduce costs was suggested by the ERICON AB consortium and explored by
Aker Arctic Technology Inc.

The baseline for this approach was that most of the unique capabilities of AB should be kept to allow
scientists to perform innovative research in the upmost conditions. The outcomes of a kick-off workshop
have then been integrated in a new design, which was developed over the summer 2011 by Aker Arctic
Technology Inc. the results presented to the ERICON AB Stakeholder Council in Rome in October 2011.
This new design integrates the new technological developments of the last six years since the original
design had been finalised. The result is a shorter vessel with a simplified overall structure. Expensive
solutions have been removed or changed and the installed power reduced. This is for instance the case of
the six removable thrusters, which have been replaced by three azimuth thrusters. At the time of the start
of the design study, no azimuth thrusters with polar class 1 capabilities existed.

Furthermore the icebreaking capabilities are similar to ones of the previous design with an icebreaking
capability of 2.5 meters of level ice at 2-3 k per knots and the ability to keep station in thick ice.
The main modifications compared to the previous design are the replacement of the permanent drilling rig
by re-movable equipment and the deletion of one of the moon pools. The removal of the permanent drilling
rig has been made at the expense of the scientist’s interests, which necessitates special drilling
capabilities. The results of this updated version is a new vessel with technical characteristics presented in
Capabilities. The results of this updated version is a new vessel with technical characteristics presented in the attached table. It is anticipated to reduce about of 1/3 of construction costs compared to the original design. A full report on the technical details of the update version is available in Annex 2.

Potential Impact:
ERICON AB outreach activities are organized via the official ERICON AB web portal at the AWI and partly at the ESF web page. Both web pages contain publications, reports and material related to the development of the ERICON-AB research facility. Especially the AWI-page is permanently updated and overhauled when necessary. Recent changes encompassed the upload of new deliverables and the publication of articles related to the ERICON AB project. All public deliverables will be stored for a undefined period at both ERICON AB Web pages.
The project logo is showed.
A huge number of presentations have been produced and presented in Portugal, Spain, France, UK, Ireland, Germany, Italy, Poland, Russia, Norway, Sweden, Denmark, Netherlands, Belgium, Finland, Romania, Bulgaria, United States, and Canada.
Brochure and Movies illustrating and promoting the work of the project have been produced and distributed worldwide.
Two web-site have been implemented by AWI (http://www.eri-aurora-borealis.eu/) official ERICON-AB Web-site, and by the European Science Foundation (http://www.esf.org/hosting-experts/expert-boards-and-committees/polar-sciences/recent-epb-initiatives/ericon-aurora-borealis.html)
In addition, based on the re-assessment study of a down-sized version of the AURORA BOREALIS design asked by ERICON AB Stakeholders at their meeting in Rome in October and undertaken by the ERICON AB partner Aker Arctic, the CNR requested to build a model of the AB slim. This model is exposed in the new Aquarium in Rome where a specific tank devoted to scientific activities carried out in the Arctic and Antarctic seas. The scenario will include a small-scale model of an oceanographic ship i.e. the AURORA BOREALIS. The visitors of the Aquarium will have a view from below, and will only see the underwater part of the ship and not the superstructures. The request has been endorsed by the coordinator and officially accepted at the last Stakeholder Council meeting in February 2012 in Strasbourg.

List of Websites:
http://www.eri-aurora-borealis.eu/

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