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Recommendations on the renewal and strategic realignment of the German fleet of research vessels

– Extended Abstract –

The complete paper “Empfehlungen zur zukünftigen Entwicklung der deutschen Forschungsflotte” is available at http://www.wissenschaftsrat.de/download/archiv/10330-10.pdf

The German marine fleet comprises seven ocean-going research vessels, four of which are going to be decommissioned due to old age within the next ten years. RVs “Sonne” and “Poseidon” are scheduled to go out of service in 2010; the research icebreaker “Polarstern” will reach the end of her operational lifetime in 2016, RV “Meteor” is due to retire in 2019. For this reason, the Federal Ministry of Education and Research (BMBF) has asked the German Council of Science and Humanities (Wissenschaftsrat) to draw up recommendations on the overall development and future requirements of the German research fleet in the next decades. The recommendations were passed by the Council on the occasion of its sessions from November 10th to 12th, 2010 in Lübeck.

SUGGESTIONS FOR A STRATEGIC REALIGNMENT AND THE ADVANCEMENT OF EUROPEAN POLAR RESEARCH

The German Council of Science and Humanities proposes to renew and to strategically realign the German research fleet. In order to secure the internationally recognized position of German marine and polar science in the future, this involves the timely re-placement of both, RV “Meteor” and RV “Polarstern”. In addition, the Council sees a chance to provide Germany with a distinct profile on a European and an international level: given the present state of the German research fleet, a “window of opportunity” for research in both polar regions could be created by operating two research ice-breakers simultaneously for a limited period of time. The Council suggests that a successor to Germany’s research icebreaker “Polarstern” be operational in 2016. As “Polarstern” still is in a good condition, the recommendation includes extending the ship’s operational life time for a few years (3 – 5) to have two icebreaking research vessels working in both, the Arctic and Antarctica at the same time.

The polar regions play key roles in the global climate system. They respond to, amplify and drive changes all over the Earth system and will therefore be parts of the world which are of supreme scientific interest over the next decades. The changes that take place in the polar regions over the next 5 to 10 years are par-

ticularly crucial. Comprehensive research lately conducted within the scope of the International Polar Year 2007/2008 has shown that the polar regions of all regions of the world are the most sensitive and quickest to react to global change. This has consequences not only for the sea ice cover but also for the glacier melt and sea level. There is therefore a great urgency and scientific necessity to carry out research in the polar regions, especially the Arctic, now and in the decades to come. Exploration of the marine, terrestrial and atmospheric areas of the polar regions, their current condition and history provide crucial data to compile reliable climate models and make forecasts about climate change. Scientific questions with respect to the Arctic which need to be addressed urgently relate to the albedo effect (changes in the sunlight reflected from the surface of the Earth's surface or ice), the exchange processes by which the ocean and the atmosphere interact, and nutrient circulation at high latitudes. Other urgent scientific questions relate to how the changes in ice covered seas affect biodiversity and marine eco-systems. In order to study climate change adequately, in particular to provide sufficiently consistent time series on which authoritative climate models have to be based, board measurements with annual and seasonal resolution are required in both polar regions in the future. The seasonal resolution of the key processes and parameters, which determine the climate and ecosystems, is one of the greatest challenges for Arc-tic research, particularly in the winter months. As a highly industrialized country, Ger-many should be especially committed to the study of climate change. As a main re-search site with a highly capable research infrastructure, Germany should continue to be engaged in high-level research in this area.

The concept of providing two icebreaking research vessels at the same time would open up a window of opportunity which would initially allow a limited period of simultaneous, as it were, bipolar research in the Arctic and Antarctica throughout the year. Such a "bipolar" approach was already developed by the German Council of Science and Humanities in 2006 in the "Aurora Borealis" recommendation. Since the evaluation and recommendation of the "Aurora Borealis" project, however, developments have occurred which have changed the starting position in terms of scientific relevance and the urgency of its realisation. Apart from a change in cost from a projected EUR 355 million for construction and EUR 17.5 million for operation (2006) to an estimated EUR 650 – 850 million for construction and EUR 36 million for operation (2009), the following aspects need to be reviewed:

_ Changes concerning the scientific case on which the project was based: a drilling rig was designed for the "Aurora Borealis" with which sediment cores of up to 1 000 m in length could be extracted and which are valuable to marine geosciences for research into the history of the Earth. Information about shorter time scales, however, is crucial to climate research over the coming decades. For this reason, drilling cores of only 200 m in length would be suffi-

cient in this aspect. Sediment cores of this length can meanwhile be extracted – better than a few years ago – by the sea bed drilling rig (MeBo) or developments of this drilling technology.

_ Environmental conditions: the general conditions under which the "Aurora Borealis" was to be used have changed significantly since the 1990s. The polar regions react particularly sensitively to climate changes and are changing faster than other regions of the world. There is extreme urgency and scientific need to conduct research in the Arctic. Since the realisation of the "Aurora Borealis" project has to date been beset by the failure to find a consortium, which would have agreed to give pledges of funding to realise and implement the "Aurora Borealis" project in a timely manner, another solution to explore the rapid changes in the polar regions would be very desirable.

Considering the changed starting position with respect to the planning of the "Aurora Borealis" project, it has to be said that too few dedicated research vessels are researching in the Arctic, particularly in the Central Arctic region, let alone operating on a regular and permanent basis. The vessels in use do not consistently have the technical specifications to meet the demands of modern Arctic research, and cannot be used throughout the Arctic and all the year round i.e. during the Arctic winter as well. The "Polarstern" is worldwide the only dedicated and modern research vessel which is navigating the Arctic but as it is sailing between Antarctica and the Arctic over the year, it is not exclusively available for Arctic research. The Swedish "Oden", which is likewise used alternately in both polar regions, is in contrast built purely as an icebreaker which is also equipped for research purposes and can be equipped with the necessary laboratory facilities. In 2014, it is planned to put the US American (NSF) multidisciplinary research platform, the just 80 m long research vessel and icebreaker "Sikuliaq", which is also not designed as a heavy duty icebreaker, into operation for Arctic research. The Norwegian planned icebreaking research vessel, which a consortium, comprising the Norwegian Polar Institute in Tromsø, the University of Tromsø and the Institute for Marine Research in Bergen (IMR), is responsible for operating, and which is to be used in the Arctic and Antarctica, will not navigate the Central Arctic region. It should be noted that the icebreakers of the different national coast guard services are not research vessels but can be equipped on a case by case basis for research work. Three Canadian icebreakers of the coast guard service which are also used for research purposes operate in Arctic waters: the "Louis S. St. Laurent", meanwhile 40 years old, and at 120 m the largest icebreaker in the Canadian coast guard service, |[1] the "Amundsen",

|[1] The "Louis S. St-Laurent" will be replaced by a new icebreaker called the "John G. Diefenbaker". The vessel is expected to enter service in 2017. Construction costs are estimated at CAD 720 million.

converted into a research vessel in 2002/2003, and the “Des Groseilliers” put into service in 1982. From the USA, the “Healy”, which belongs to the coast guard, navigates the Arctic and is most comparable in terms of technical capacities with the “Polarstern”. Furthermore, the coast guard ships may not be used in the Eurasian Basin or leave territorial waters. Pan-Arctic research should be the objective of modern Arctic research. The Chinese “Xue Long” , approx. 170 m long, occasionally undertook research voyages in the Arctic in 1999, 2003 and 2007. |[2] Another research voyage is planned in 2010. Charter and cooperation opportunities for European polar scientists and oceanographers are still in their infancy. This would require the faster building of networks of researchers to observe and explore polar regions intensively over the coming years when they are likely to undergo most change. The “Akademik Fedorov” and “Kapitan Dranitsyn” from the Russian Federation navigate the Arctic, their operations being influenced significantly by factors other than research (tourism and commercial purposes). In addition, the Russian Federation works primarily with tent and container stations on the ice and uses icebreaking vessels rather for transport purposes to the stations.

There is therefore, despite the number of icebreakers that can be used in the Arctic, a great lack of modern, technically well equipped platforms that can be used reliably at any time of the year for research purposes. The planned construction of individual new icebreakers will not solve this problem because almost all the new vessels planned will continue to be used in both polar regions and undertake research voyages every two years. However, this will not be sufficient to explore climate change adequately. The “Polarstern” extension period would for the first time provide a vessel which was designated exclusively for the Arctic. One can only talk about continuous and systematic Arctic research since the 1990s. Until then, polar research was primarily orientated at Antarctica, also because the Arctic ice was much more difficult to access and break. Only since changes in the sea ice cover started to occur some time ago did the opportunity present itself to pursue the objective of matching the level of research of this region with that of Antarctica. The “Polarstern” has taken part in the systematic and continuous exploration of the Arctic since the first dedicated research voyages in the Arctic at the end of the 1980s. The vessel is optimally equipped to continue to support exploration of the Arctic.

Urgently pending key tasks, which could be dealt with using this technology and capacities in polar research, are the all year round, continuous documentation of changes in the cryosphere and biosphere over several years and seasons,

|[2] The Chinese Arctic and Antarctic Administration (CAA) is currently planning another icebreaking research vessel which is expected to be operational in 2013.

and their speed and impact on the processes in the different compartments of the climate system from the atmosphere through the hydrosphere to the bio and geosphere. A period of five years would be useful to understand the phenomena which occur over time scales of a few years (interannual variability). The average regeneration of the surface water is about five years. The operating costs for operations of this kind are calculable and, including any supply flights, are far below the charter prices for multidisciplinary research platforms that can be operated throughout the winter. Bipolar interdisciplinary research objectives spread over several years and full years cannot be achieved using alternative methods such as time-limited chartering of research platforms and the temporary application of the Bark drilling concept |[3].

SUGGESTIONS FOR A TIME-LIMITED OPERATION OF RV "POLARSTERN" WITH EUROPEAN PARTNERS

However, while the Council considers German polar and marine science to be strong, the size of the German marine science community is too small to make full and adequate use of a second vessel's capacities. Moreover, creating a "window of opportunity" for bipolar research for a limited period of time could open the chance to develop a common European approach for polar research and give Europe the chance to build up a leading role in this field. After all, climate change in particular is a "grand challenge" that is not limited to individual countries but affects all.

Regarding the common European use of the "Polarstern" during the extension period and the proposed perspective orientation of European polar research, the Council suggests three options which should be examined to see whether they can be put into practice:

1 – The Council asks the federal government to contact other countries which actively work in marine Arctic research, and look at the possibilities of investigating participation in funding for the research vessel's operation. In doing so, scientific and political players in Europe should build stronger networks and explore the possibilities of establishing an operating association at European level for the "Polarstern" extension period.

2 – It is also necessary to assess whether the "Polarstern" extension period can be financed at least in parts by European funds for marine infrastructure and

|[3] During the "Arctic Coring Expedition" (Acex) in 2004, sediment cores were taken for the first time from the Arctic Ocean. This required a drilling vessel and two icebreaking research vessels which drilled into the ocean floor below the pack ice 205 km from the North Pole.

incorporated in a European operational concept. This could be done with the help of "Eurofleets" and a joint concept to be prepared by the ESF Marine Board with the aim of incorporating a focused polar research program in the 8th Framework Programme. The operating costs could be refinanced by interested European and international research groups applying for vessel time on the "Polarstern".

3 – The Council recommends that German research vessels as a whole should be more closely integrated in the European research fleet and in the OFEG agreement to ensure that barter points gained can be used flexibly. Different categories and sizes of research vessels are involved in the OFEG's vessel barter agreement. The number of barter points acquired depends on the size of the ship. The barter points can be issued as required no matter which vessel they were acquired with. This allows an adequate response to fluctuations in the demand for specific vessel categories which vary according to the term e.g. of EU projects or Collaborative Research Centres.

An examination by the Federal Ministry of Education (BMBF) concerning the financial framework of the "Polarstern" extension period revealed that funds of EUR 20 million (including shipping company resp. personnel) are required annually to operate a vessel of this kind. It must be considered that annual expenditure may rise to up to EUR 30 million because the machine of the 30 year old ship has to be repaired more frequently over the course of time.

To open up European polar research, which could be put to the test within this "window of opportunity", apart from the two reasons given above, it is imperative for the future viability of a national scientific system to become further integrated in the European Research Area and to take on a formative role in shaping it. |[4] With regard to large research infrastructures, which may be seen in this context as setting a structure for the European Research Area, the European Commission has come out in favour of opening up the use of research infrastructures to researchers from other member states and to facilitate this by participating in the operating costs. The use or optimisation of research infrastructures that already exist and the preparation of new research infrastructures, which are of pan-European interest, is already being funded within the 7th Framework Programme. The measures are being supported within the scope of the "research infrastructures" funding which is part of the fourth so-called Specific "Capacities" Programme of the 7th Framework Programme.

|[4] See Wissenschaftsrat: Empfehlungen zur deutschen Wissenschaftspolitik im Europäischen Forschungsraum, Cologne 2010.

Other recommendations concern the German so-called “regional” research vessels that operate in the European coastal and shelf seas. The Wissenschaftsrat advises to critically evaluate whether ship capacities in this segment can be reduced in the future. If this is the case, the decision which ship's operation can be discontinued or which ship is not replaced, respectively, should be linked to the decision about RV “Poseidon” as the next research vessel to be replaced. The decision-making process should take into account capacity requirements for university teaching and promotion of young researchers as well as supra-regional coastal research which is integrated in Europe, internationally visible and competitive. To do so, the entire “regional” and vessel capacities relevant to education should be considered.

Also, the procedures to grant scientific proposals and ship time on the “global” and “oceanic” vessels “Polarstern”, “Meteor”, “Maria S. Merian”, “Sonne” and all successor research ships in these classes should be standardised in the future. Central organization and coordination of the use of the ships in question would help to optimise their use, ensure the efficient deployment of large sea-going equipment and make cooperation with European partners easier. Lastly, the Council advocates installing a “National Centre for Underwater Technologies” that coordinates large sea-going equipment and makes it accessible to scientific users nationally and internationally. It should be established at an institute of marine science and managed by a scientific-technical team. The Council considers that its responsibilities would involve the scientific and technical, logistical and financial preparation, handling and support of equipment usage.
