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ARICE: Arctic Research Icebreaker Consortium:

A strategy for meeting the needs for marine-based research in the Arctic

Deliverable 1.2. Guidelines on the conditions to access European PRVs

Submission of Deliverable

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1. The European Arctic Research Vessel Fleet

According to the International Maritime Organization (IMO), polar research vessels (PRVs) are vessels that are capable of carrying out marine research in polar waters. This is a very broad definition that encompasses a wide range of vessels from those capable of breaking sea ice to those that can work in open polar waters where the presence of ice is residual.

Following from the breadth of the IMO definition, the European PRV fleet includes and wide array of vessels from research icebreakers to a large number of vessels capable of working only in ice-free waters. Recent IMO regulations on safety and technical requirements for ships working in polar waters might even expand the number of available European "polar" vessels, because with the appropriate modifications, many research vessels could have the capacity to become a Polar Class C vessel (ones that can work only in ice-free waters). In the requirements of the IMO Polar Code, polar waters are defined by the boundaries of Figure 1.

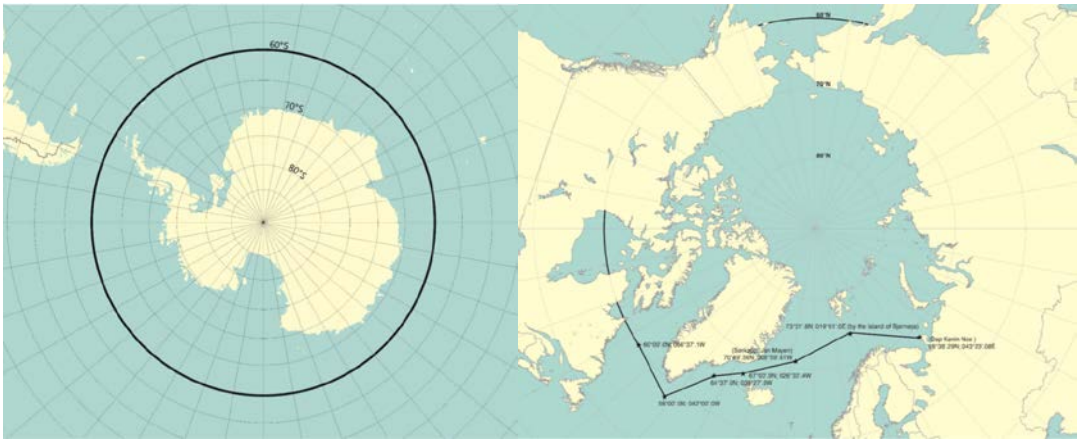

Figure 1: IMO Polar Code boundaries (MEPC 68/21/Add.1)

The operation of European PRVs is tightly connected to national polar research programs. Some of these programs are very strong with stable scientific activity in both the Arctic and the Antarctic. The Antarctic activities, however, often constrain research capabilities in both Polar Regions because the long round trips to Antarctica and the resupply of the national research stations there reduces PRVs availability to carry out marine based research activities. This constraint on research capacity is especially prominent with the most powerful and ice breaking capable, Polar Class A, European PRVs that have a long tradition of being involved in supporting operations and science in Antarctica.

Table 1 shows the list of European PRVs operating in the Arctic and the Antarctic. It illustrates how 90% of the ships work in both poles, and how most of them have a high logistics role supporting the Antarctic stations. This is especially true for countries that supply more than one Antarctic station.

Region	Polar Code Category	IACS Class	Ship Name	Picture	Country	Length	Built year	Operator	Ice Class	Research Equipment	Operating area		Major Refit	Supply Station
EUROPE	A	PC1 to PC3	Polarstern		Germany	118	1982	AWI	100 A5	100/100	Antarctic	Arctic	2002	Yes
			Oden		Sweden	108	1988	SMA	DNV-Polar 20	60/100	Antarctic	Arctic		Yes
			Kronpins Hakoon		Norway	100	2017	IMR	PC3	100/100	Antarctic	Arctic		
			Sir David Attenborough (In construction)		UK	129	2019	BAS/NERC	PC3	100/100	Antarctic	Arctic		Yes
EUROPE	A	PC4 to PC5	James Clark Ross		UK	99	1990	BAS	Lloyds IAS	100/100	Antarctic	Arctic		No
			L'Astrolabe		France	72	2017	IPEV/Frenhc Navy	BV 5	50/100	Antarctic			Yes
EUROPE	B	PC6 to PC7	Aranda		Finland	59,2	1989	Finnish Env. Insti.	1A Super	100/100		Arctic		No
			Helmer Hanssen		Norway	64	1988	Tromsoffshore/University of Tromso	Dnv 1A	100/100		Arctic	1992	No
			Maria S Merian		Germany	95	2005	IOW_Warnemunde	PC 7	100/100	Antarctic	Arctic		No
			Sanna		Greenland	32,3	2012	GINR	Ice 1A	100/100		Arctic		No
EUROPE	C	ICE CLASSIFIED	Arni Fridriksson		Iceland	69,9	2000	MRI	1B	100/100		Arctic		No
			Dana		Denmark	78	1981	DTU Aqua	1C	100/100		Arctic	1992	No
			Ernest Shackleton		UK	80	1995	BAS	DNV; ICE05	25/100	Antarctic		2001	Yes
			G.O. Sars		Norway	77,5	2003	UiB	Ice 1C	100/100	Antarctic	Arctic		No
			Hesperides		Spain	82,5	1991	Spain Navy/UTM	Ice 1C	100/100	Antarctic	Arctic		Yes

Table 1. European polar research vessels (modified from EUROFLEETS2 D3.1)

When it comes to the capabilities of these European PRVs, as can be seen in Table 1, only four ships are of Polar Cass A, which means that they are able to work in almost any condition of ice, even in the wintertime. In sum, one of the most remarkable characteristics of European PRV capabilities is that although there is an extensive fleet, with many vessels with ice class, only few of them are large icebreakers with full capacity as a research vessel.

2. The access procedure

a. Principal Investigators (PIs) and their teams accessing vessels in national fleets

The access procedure to PRVs is similar in most European countries. As they are national facilities, access to PRVs is governed by different national calls for projects that only encompass research connected to the countries' own research institutions. This leads to access to PRVs being only available to the scientists from nations that operate PRVs.

In most countries, once the PI has been granted with a project that involves the use of a PRV, the time of use is fixed to build a coherent vessel schedule with other funded projects. This process takes into account requirements such as the seasonality of the project and the availability of complementary equipment. In some countries, special calls are opened to fill specific schedule gaps and long transits between ports, necessary to connect projects in different areas. Usually these calls have restricted on-board equipment and may only involve ongoing measurements.

Funding for research can also be gained through the European Union (EU) calls for proposals. They, however, do not include vessel time among their eligible items. In some cases, this can cause problems when accessing national vessels, since the science to be carried out has been highly valued at the European level, but it does not include associated funding for ship time. In some countries this

problem has been solved by granting PIs with projects financed by EU direct access to national research vessels without the need to go through the national access procedure. Access to the facilities remains, however, available only to PIs connected to national research institutions.

Figure 2. illustrates the general process from the request for funding to the post cruise assessment through which a PI can gain access to a vessel from her national fleet.

Figure 2. General process of PIs accessing vessel time in their national fleets in Europe

b. PIs and their teams accessing vessels in foreign fleets

There is no standard procedure for researchers to gain access to vessel time from countries different to the one where they are based. It can be obtained through scientific collaborations with partners in countries with access to a PRV through national calls. In these cases, the foreign researcher is, however, not leading the research or expedition.

Chartering is one possibility to gain access to a foreign PRV. If we do not consider this option because of the specificities in the procedures and requirements, there are only three mechanisms through which a PI can access a vessel that is not in their national fleet.

1. **TransNational Access (TNA) in the framework of EU funded projects**, such as EUROFLEETS and ARICE, grant ship-time as transnational access onboard associated vessels to successful applicants, with the condition that the PI is based in a different country that the infrastructure. The application process goes as follows: Applicants submit a proposal to projects offering TNA and after a successful evaluation ship-time is granted. Cruise schedules follow the period where the EU funded project is active and are fitted to the schedule of the requested research vessel. The problem with this model of access is that EU projects have limited durations in time and limited budgets. This means that calls are not opened at regular intervals and that vessels are often offered only once in a period of four years.

2. **Ocean Facilities Exchange Group (OFEG)** provides access to vessels and research equipment to researchers in its member countries. It is based on an agreement among institutions operating research vessels in Norway, Germany, Netherlands, United Kingdom, France and Spain to form a common barter system through which ship time and equipment are shared by points exchange. The institutions have calculated the points based on the capabilities of each vessel, research equipment and technical support provided during the oceanographic campaigns. The application process goes as follows: Applicants request ship time through their national contact points in regular

calls. The operators then make a request through OFEG for the vessel or equipment necessary to perform the requested research. In practice, the PIs often explore already in advance with the national operators about the feasibility of their projects before they submit a proposal to the national call. OFEG has been active now for years and has provided an increasing number of ship days exchanged between the partners. However, not the full European research vessel fleet is using this exchange model (Table 2.).

Barter exchange valuations for ships

Points	France	Germany	United Kingdom	Netherlands	Spain	Norway
12	Pourquoi Pas?		James Clark Ross James Cook Discovery			Kronprins Haakon
11	L'Atalante	Sonne			Hespérides	G. O. Sars
10				Sarmineto de Gamboa		
9		Maria S. Merian		Pelagia		
8	Thalassa	Meteor				
7						Johan Hjort Kristine Bonnevie
5		Poseidon				
4		Heincke Alkor			Garcia del Cid	

* Polarstern is currently available for joint cruises but not for exhange of ship time.

Global Class Research Ship
Ocean Class Research Ship
Regional Class Research Ship

Table 2. Barter exchange evaluations for vessels in OFEG (www.ofeg.org)

3. **An international consortium that jointly funds operational ship-time in the high Arctic.** The main goal of ARICE is to work towards cooperation agreements at the international level to implement an International Arctic Research Icebreaker Consortium. This consortium would work either by sharing a number of dedicated berths to international expeditions, with a common evaluation system, or by means of a quota contribution (such as the Integrated Ocean Drilling Program) and the chartering of international vessels. This joint coordination of ship operations in the Arctic would improve the efficiency of the use of PRVs and increase the better resource management vessel-based research. This would, in turn, foster international cooperation, increase the total available ship time for winter observations and research, through the sharing of existing resources.

Conclusions

The European PRV fleet is extensive and very well endowed. There are, however, only a few research vessels capable of working and doing science in the polar regions in all conditions. Arctic components of European polar research programs that have a two-poles perspective also see their capacities reduced due to the resupply duties of European PRVs to Antarctic research stations: The length of the round-trip transits and the Antarctic research stations logistics support reduces the research ship-time in Arctic waters during the summer in the northern hemisphere. They also impede the conduct of marine research in the Arctic in the wintertime as the PRVs are working in the austral summer in Antarctica.

The process to access ship-time for nationals of countries that operate their own PRVs seems to be well structured. There is, however, a clear deficiency for access of researchers from other countries to these vessels: In most cases they can only be accessed through collaboration with researchers belonging to a research institution in the country of that operates the PRV. Besides chartering, we have identified three possibilities to gain ship gain ship-time on board a vessel that is operated by another nation than the one where the PI is based:

1) Through the transnational access offered in the frame of EU funded projects such as **ARICE and EUROFLEETS**. These projects have been proven to be excellent platforms to foster international cooperation and research and to develop mechanisms to access international infrastructures in regions, which otherwise would be inaccessible for European researchers.
2) The **OFEG Barter system**. The experience from this system during the last decade has shown its capacity to; increase and diversify national resources; allow the use of vessels in other countries; and to facilitate access to large equipment not available at the national level.
3) Through the creation of an **Arctic Research Icebreaker consortium** that would jointly fund ship time in the high Arctic. By means of international agreements, the chartering of research, and industry icebreakers to perform research in the Arctic Ocean, the consortium could contribute to the better use of existing infrastructures and foster international cooperation and sharing of costs and resources.

To increase the accessibility of European PRVs, none of the three above mentioned options can be excluded as all of them foster marine research activity in the Arctic. However, greater coordination and agreements between European countries with large polar programs are needed to facilitate the better use of the cost-intensive infrastructures, and to improve access to the Arctic Ocean, especially during the winter when the use of Polar Class A icebreakers is necessary.

ANNEX

The following tables shows the differences in the procedures of accessing ship-time in countries operating Polar Research Vessels in Europe:

	Founding		Proposal Review		Cost covered	
	National Calls	EU Projects	National	International	Complete by time	Per day payment
Denmark	X	X	X	X		X
Finland	X	X	X	X		X
France	X	X	X	X	X	
Greenland	X		X		X	
Germany	X	X	X	X	X	
Iceland	X	X	X			X
Norway	X	X	X	X	X	
Spain	X	X	X	X	X	
Sweden	X	X	X	X	X	
UK	X	X	X	X	X	

	Technical support team		Open to barter	Open to chartering	Post cruise assessment
	Special dedicated team	Scientific team			
Denmark	X				
Finland	X				
France	X		X	X	X
Greenland		X		X	
Germany		X	X		X
Iceland		X		X	
Norway	X		X		X
Spain	X		X		
Sweden	X		X		X
UK	X		X		X

