ICEBREAKERS IN THE FAR EAST OF RUSSIA AND IN THE ARCTIC

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The article summarizes the experience of icebreaking ships use in the Russian Arctic as well as shows the main issues of Norther Sea Route support in order to maintain all year around navigation from East Asian ports to the Europe.

Keywords: icebreakers fleet, active ice navigation, icebreaking vessel, Arctic transportation support, Northern Sea Route, icebreaking cargo ships.

The Arctic exploration is impossible without appropriate technical support, the most important component of which was, and should once again become an operational fleet of icebreakers and icebreaking cargo ships (vessels of active ice navigation). After nearly two decades of stagnation icebreakers in the Arctic and the Far East of Russia fall into decay.

In Soviet times the Russian Far East icebreaking fleet numbered more than twenty ships including diesel-electric icebreakers of such classes as “Ermak”, “Moscow”, “Kapitan Khlebnikov” and “Ivan Moskvitin”. And only one icebreaker “Magadan” with a diesel power plant of relatively small power and controllable pitch propeller (CPP) did not have electric propulsion.

Transportation to the North and to the Antarctic was carried out by 15 vessels of active ice navigation type with diesel-electric propulsion system such as “Lena”, “Amguema” and «Vitus Bering”). There also was used a group of active ice navigation vessels including enhanced

ice-class CA-15 one (so called "carrots") with diesel power plants and CPP. The other cargo ships with reinforced hull for ice navigation operated in the Arctic, accompanied by ice breakers.

Traffic flows to the "North" began to form in April and May, and icebreakers returned to Vladivostok in November. In production delivery to the Far North regions from ports of Primorye great number of vessels of different Far Eastern shipping companies took part. A lot of goods were delivered in the eastern sector of the Arctic by vessels of Western shipping companies. Summer navigation in the Arctic sector of Russia (about 20% of the country's territory is located above the Arctic Circle) was quite intense.

For many years of active development of the North, a group of highly qualified captains and navigators was being formed; they had extensive experience in the most sophisticated polar conditions. On the ships the crews worked as one team including skilled engineers, electricians, radio operators as well as other employees like sailors, enginemen, divers, etc. On icebreakers there were helicopters for ice fields air reconnaissance operations, an extensive network of weather stations and beacons also existed.

Currently, much of the above mentioned achievements are irretrievably lost. But mission to revive the intensive use of the Northern Sea Route (NSR) as the shortest way from the eastern ports to Europe is important. The urgency of a new stage of development of NSR is clear from the Federal program of development of the Russian Arctic for the period up to 2020. But any program cannot be realized without adequate logistical support.

Despite opinions of some experts about "the Arctic warming" and possibility of navigation through NSR without icebreaker escort, the government must pay high attention to the icebreaking ships because the relatively warm periods are always replaced by colder ones, and then the lack of the effective icebreaking fleet can lead to transport collapse. All Russian Far East ports are to freeze; even the La Perouse Strait during harsh winters is inaccessible even for powerful icebreakers. Possibility of long-term navigation in polar and sub polar waters of Russia has not only economic but also a strategic importance. With critical lack of port icebreakers it is possible now that the whole domes-

tic fleet including commercial, fishing and naval ships will be blocked in the Far Eastern ports of Russia during winter periods.

Over the last twenty years in the global shipbuilding industry the new trends, allowing creating high-power vessel propulsion systems, appear. During construction of new icebreakers such the international experience should be taken into account, especially the experience of the most advanced countries in this field like Finland. Within the period from 1954 to 1986 Finnish shipbuilders built 32 diesel-electric icebreaking ships and 3 diesel-powered icebreakers with CPP for Russia. The use of the CPP in icebreakers construction is undesirable because the ships with CPP are worse than electric-powered icebreakers in maneuverability almost twice and in heavy ice conditions, especially when reversing, CPP is generally ineffective.

A good example, which highlights the advantage of icebreaker with electrical power plant and fixed propeller blades in compare with even the electric ship, but with the CPP, is a recent cruise of MV "Krasin" in the Antarctic, where in the same conditions the U.S. icebreaker "Polar Sea" has not completed her mission in full scope being equipped with a combined power plant significantly more powerful than the "Krasin"'s one - boosting gas turbine plant of 40 thousand kW and diesel-electric propulsion system of about 10 kW. Moreover, the joint work of both these plants is not possible. The disadvantages of «Polar Sea» are her CPP and high fuel consumption when gas turbine plant operates. Only the electric boat with fixed propeller blades can use ice milling mode, which eliminates the possibility of propellers damage.

Currently the most efficient propulsion system for cargo ships and icebreakers in active ice navigation is the main power plant on alternating current with the medium-speed diesel generators. These power plants are the most economical as well as the most ecological that is very important during work in the North. Such engines are possible to use due to advances in power converter technology. Almost all modern electric ships use static frequency thyristor converters i.e. cyclo-converters on the nuclear icebreaker "Taimyr" and "Vaygach" or transistor ones with microprocessor control i.e. sync converters on supply icebreakers "Sakhalin" and "Polar Pevek" of the SCF Group.

On all domestic nuclear icebreakers there is electric propulsion. For

example, icebreaker “Lenin” was equipped with a DC power plant of 44000 horsepower (hp); ships like “Arctic” have AC/DC main electric propulsion of 75000 horsepower and on icebreaking ships “Taimyr” and “Vaygach”, built in collaboration with the Finland, there are AC power plants of 44000 hp each.

As a propulsion system for ships and icebreakers of active ice navigation it is reasonable to use marine propulsion units with azimuth thrusters “Azipod”. Originally the system was tested on the Finnish Polar tankers “Uyku” and “Lunni” in 1993 and 1995 respectively. The power of single “Azipod” module reaches 11-14 MW or more.

In last years of the Soviet union the shipbuilding industry was ready for construction of nuclear-powered icebreaking ships with a three-shaft propulsion system with power of 150 000 hp. The current fleet of nuclear-powered icebreakers operates in service life limit. Even relatively new low-draught nuclear icebreakers “Taimyr” and “Vaygach” will be out of service life limit by 2016. Approved Project 22220 of all-purpose nuclear-powered variable-draught icebreaker construction has been suspended since 2010. Due to this situation so called “the Arctic pause” will be inevitable in the nearest future, which will have a negative impact on the traffic potential of the NSR.

In recent years the Arctic and Antarctic researches have been started by such non-northern countries as Japan, South Korea and China who are guided evidently not only by scientific purposes. In the Polar Regions there are enormous reserves of hydrocarbon fuel. Recently all of the above countries have built icebreaking ships for research purposes at this time. Japanese icebreaker “Fuji” equipped with a traditional electrical propulsion system. Technical data about the Chinese and South Korean ice-breakers are very poor. It is known only that the South Korean ship “Araon” can move at a speed of three knots through a meter depth ice, and she is equipped with two azimuth thrusters with capacity of 5 MW each. Application of rudder-propeller units on Arctic icebreakers is controversial because their construction includes reduction gears.

The same propulsion system with power of 8 MW is mounted on new Baltic Sea icebreakers “Moscow” and “Saint-Petersburg”, which are able to overcome a one-year ice up to one meter depth. Other Russian diesel-electric icebreaking ships with a traditional power plant such

as “Ermak” and “Capitan Sorokin” have significantly more power and correspondingly larger ice crossing ability, but their service life limits are almost exhausted.

Lack of adequate number of domestic icebreakers and icebreaking cargo ships, auxiliary vessels, providing navigation along the NSR may lead to significant economic and geopolitical losses.

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