Atomic icebreaking Fleet development for support Arctic navigation
FSUE «Atomflot» main activities

FUSE «Atomflot» provide:

- Icebreaking services at the Northern Sea Route
- Port fleet services at the Northern Sea Route sea ports
- Cargo delivery services by atomic cargo vessel “Sevmorput”
- Ship repair services
- Radioactive waste materials and spent nuclear fuel processing services
Main Milestones of the Atomic Icebreaking Fleet Development

**Ib Lenin**
November 20, 1953 – the Decree of the Cabinet Council of USSR to commence construction
August, 25, 1956 – the IB is laid at A. Marti Shipyard (from 1957 – «Admiralty Shipyard»)
December, 03, 1959 – accepted by the Ministry of Maritime Fleet
1989 year – decommissioned

**Escorted: 3741 vessels**

The necessity to provide and develop the functioning of Norilsk Industrial Area.

The demand for year-round navigation in the Wester Arctic.

Building of a powerful atomic icebreaking fleet and infrastructure on the coast of the Kara sea and Yenisey river.
August 17, 1977 – atomic IB Arktika reaches the North Pole as the first vessel to do it above surface.

Building of modern atomic icebreaking fleet, including Leader icebreakers, maintenance vessels and port fleet to provide the year-round export of Arctic products to Asian-Pacific and European markets.

**Universal atomic icebreakers**
of 22220 projects (IB60)
Propulsion power – 60 MW;
Water displacement 33530 / 25 540 t;
Draught – 10,5 / 8,5 m;
Icebreaking capability – 2,9 m

**Icebreakers:**
1st IB60 – May 10, 2019
2nd IB60 – November 25, 2020
3rd IB60 – November 24, 2021
Northern Sea Route traffic in the period 1933-2016 (transits included)

Vessels and gross-tonnage under Rosatomflot icebreaking assistance

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total gross tonnage, gt</td>
<td>1,659,207</td>
<td>2,042,522</td>
<td>5,288,284</td>
<td>7,156,577</td>
</tr>
<tr>
<td>Total number vessels piloted</td>
<td>129</td>
<td>195</td>
<td>410</td>
<td>492</td>
</tr>
</tbody>
</table>
# General Information on Nuclear-Powered Vessels of FSUE Atomflot

<table>
<thead>
<tr>
<th>Name</th>
<th>Reactor Model</th>
<th>Thermal Capacity of Reactor</th>
<th>Commissioned</th>
<th>To be decommissioned</th>
</tr>
</thead>
<tbody>
<tr>
<td>ib 50 Let Pobedy</td>
<td>2 reactors KLT 40</td>
<td>2*171 MWt</td>
<td>23.03.2007</td>
<td>2035</td>
</tr>
<tr>
<td>ib Yamal</td>
<td>2 reactors KLT 40</td>
<td>2*171 MWt</td>
<td>28.10.1992</td>
<td>2026</td>
</tr>
<tr>
<td>ib Vaygach</td>
<td>1 reactor KLT 40</td>
<td>171 MWt</td>
<td>30.06.1989</td>
<td>2022</td>
</tr>
<tr>
<td>ib Taimyr</td>
<td>1 reactor KLT 40</td>
<td>171 MWt</td>
<td>25.07.1990</td>
<td>2025</td>
</tr>
<tr>
<td>acc Sevmorput</td>
<td>1 reactor KLT 40</td>
<td>135 MWt</td>
<td>30.12.1988</td>
<td>2023</td>
</tr>
</tbody>
</table>
# Arctic Projects with Rosatomflot Participation

## Contracts Signed or in Finalization Stage

<table>
<thead>
<tr>
<th>№</th>
<th>Project &amp; Operator</th>
<th>Project Capacity per year</th>
<th>Life Span</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.1 Yamal Trade LLC, LNG tankers</td>
<td>18,0 mln. tons*</td>
<td>До 2040</td>
<td>contract</td>
</tr>
<tr>
<td></td>
<td>1.2 Yamal LNG, Port Fleet</td>
<td>16,5 mln. tons LNG</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,5 mln. tons of gas condensate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Novoport Oil Deposit</td>
<td>8,5 mln. tons Crude oil</td>
<td>До 2040</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Norilsk Nickel, p. Dudinka</td>
<td>1,5 mln tons nonferrous &amp; precious metals</td>
<td>До 2040</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Arctic LNG-2**</td>
<td>20 mln. tons LNG and gas condensate</td>
<td>2023 – 2045</td>
<td>adjustment</td>
</tr>
<tr>
<td>5</td>
<td>Coal from Taimyr (VostokCoal)**</td>
<td>3 mln. tons coal</td>
<td>2020 – 2025</td>
<td>adjustment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 mln. tons coal</td>
<td>2025 – 2040</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Payahskoie Oil Deposit**</td>
<td>10 mln. tons Crude oil</td>
<td>2023-2040</td>
<td>adjustment</td>
</tr>
</tbody>
</table>

* Possible increase up to 20 mln. tons.

** One icebreaker is needed for each one project
Yamal LNG

Operated by JSC Yamal LNG, a joint-venture of NOVATEK (50.1%), TOTAL (20%), CNPC (20%) and Silk Road Fund (9.9%), the Project is based on the Yamal Peninsula, above the Arctic Circle, and utilizes the resources of the South Tambey Field.

The Yamal LNG Project will be utilizing the resources of the South Tambey field. Located in the northeastern part of the Yamal Peninsula, the field was discovered in 1974. The South Tambey Field Development License, held by Yamal LNG, is valid until December 31st, 2045. The field’s proven and probable PRMS natural gas reserves are estimated at 926 BCM.

The LNG Plant will be built in three phases which are scheduled for start-up in 2017, 2018, and 2019, respectively. The Project will be producing 16.5 MTPA of LNG and up to 1.2 MTPA of gas condensate annually which will be shipped to Asia-Pacific and European markets. As of December 31st, 2014, PRMS proven and probable natural gas reserves of the South Tambey Field are estimated at 926 BCM. The field production potential exceeds 27 BCMPA of natural gas.

Construction of a multifunctional Port of Sabetta in the scope of the Yamal LNG Project has been a public-private undertaking.

Federal facilities (built by Federal Agency, ROSMORPORT) include ice barriers, the harbor’s operational aquatic area, the approach channels, the vessel navigation management and traffic control systems, and some buildings housing marine service companies.

Yamal LNG facilities include jetties for liquefied natural gas and gas condensate offloading, RO-RO berths, material off-loading facilities, harbor fleet berths, warehousing facilities, administrative buildings and utilities.
Liquefied Natural Gas from Yamal LNG is performed by the Fleet of 15 LNG tankers escorted by Atomic Icebreakers

Main specifications of the ARC7 tanker:

• Holding capacity - 170,000 cbm of LNG
• Output capacity of propulsion unit – 45 MW
• Speed in open water – 19.5 knots
• Speed in 1.5 m thick ice – 5.5 knots
• Length overall – 299 m
• Breadth mld – 50 m
• Draught – 11.7 m

• Primary fuel – LNG, with a dual fuel diesel-electric propulsion system equipped with three “Azipod” units
• Vessel design is based on the double – action concept: the bow has been adjusted for navigation in open water and thin ice, while the stern has been optimized to enable navigation in severe ice conditions.
LNG Factories Construction Project on Yamal and Gydan*

* Provided by Siberian Science and Analysis Centre
Global gas consumption growth

Rise of LNG share in global volume of traded gas

Maritime LNG transportation is growing
Pipe gas transportation is dropping
Gas transportation routes from Obskaya Bay (Yamal Peninsula)

Sabetta – Kobe = 57,83 USD/t*
Sabetta – Yantyan = 64,27 USD/t*

Sabetta - Zeebrugge - Kobe = 96,06 USD/t*
Sabetta - Zeebrugge - Yantyan = 91,46 USD/t*

* price per round voyage
The project is aimed at rendering port fleet services to LNG tankers in harder ice conditions.

**Yamal LNG**: 16.5 mln tons LNG/year in the period 2018-2045  
**LNG export**: 15 LNG tankers of YamalMax type of 172 600 m3 capacity  
**Port calls/year at Sabetta**: 220 = 1 tanker each 40 hours

The port fleet is built at Russian shipyards:
1. Ice class tug (commissioned April 15, 2016)  
2. Ice class tug (commissioned May 26, 2016)  
3. Icebreaking tug (commissioned September 20, 2017)  
4. Icebreaking tug (commissioned May 25, 2018)  
5. Port icebreaker (to be commissioned 2nd quarter, 2019)

**Project cost:**  
$205.51 mln $ between 2015 – 2018 years.  
45.03 mln $ - Rosatomflot internal funds  
160.48 mln $ - Debt financing  
**Contractual period**: 11.2014 – 12.2040

**November 28, 2014** – the Contract for Port Fleet Services between Rosatomflot and Yamal LNG is signed with option for prolongation +5 and +5 years
Seaport tugs FSUE «Atomflot»

Tugs with ice class (project T3150A), ice class - Arc4

«Tambey»  «Pur»
Seaport tugs FSUE «Atomflot»

Icebreaking tug «Nadym» (project T3687), ice class ARC6

Icebreaking tug «Yuribey» (project T40105), ice class ARC6
Icebreaker supporting transportation of crude oil from Novoportovskoe oilfield PJSC Gazprom Neft

- Is base project PJSC Gazprom Neft in Yamal
- Is located in the Yamalo-Neneckiy administrative district, at 30 km from Obskaya bay offshore and at 250 from Nadym city.
- Field reserves by C1+C2 category — more than 250 mln. tons of crude oil and gas condensate, and more than 320 bln. cubic meter of gas.
- The project unique features: year-round transportation of crude oil by sea in Arctic climate.
- Commercial operation start in 2016.

### Transportation volumes of crude oil (per year), mln. tons

<table>
<thead>
<tr>
<th></th>
<th>2018</th>
<th>2019</th>
<th>2020-2033</th>
<th>2034</th>
<th>2035+</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>6,85</td>
<td>7,85</td>
<td>8,6</td>
<td>6,6</td>
<td>3,6</td>
</tr>
<tr>
<td>2019</td>
<td></td>
<td></td>
<td>6,6</td>
<td>3,6</td>
<td></td>
</tr>
<tr>
<td>2020-2033</td>
<td></td>
<td></td>
<td>6,6</td>
<td>3,6</td>
<td></td>
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<tr>
<td>2034</td>
<td></td>
<td></td>
<td>6,6</td>
<td>3,6</td>
<td></td>
</tr>
<tr>
<td>2035+</td>
<td></td>
<td></td>
<td>6,6</td>
<td>3,6</td>
<td></td>
</tr>
</tbody>
</table>
Icebreaker supporting transportation of end production (metals)  
PJSC «MMC «Norilsk Nickel»

PJSC “MMC “Norilsk Nickel”:
- Is the largest manufacture of nickel and palladium in the world;
- Is one of the largest manufacture of platinum and copper in the world.
Company also produce cobalt, rhodium, silver, gold, iridium, ruthenium, selenium, tellurium and sulfur.

Zapolyarniy branch of PJSC “MMC “Norilsk Nickel” is located in Russia, in the Taimyr Peninsula, at 69-ой parallel. Branch transport communications are carried out with other regions of country by Enisey river, by sea via Northern Sea Route and by air transport.
Primary point for transportation end production and supply materials and resources is port Dudinka, which is located in lower reaches of the river Enisey. Sea navigation in the port Dudinka is year-round (with atomic icebreakers support in winter-spring period of navigation).

Allover volume of the end production, materials and resources are transporting via port Dudinka by sea come up to 1,5 mln. tons per year.
Export of the hydrocarbon products from Russian Arctic is projected to be increased in the nearest future, together with the development of Arctic sea ports. Three stages of export were analyzed in accordance with the plans of the Arctic Projects Operators.

Projected Cargo Volume via the Northern Sea Route

![Graph showing projected cargo volume via the Northern Sea Route from 2016 to 2040, with stages marked as Basic (license secured), Projected, and Forecasted. The graph includes data for Oil, Coal, LNG, and Metal.]
State Policy in the Sphere of Arctic Development

We are facing ambitious tasks of the Arctic and the Northern Sea Route development. This does not mean mineral resources production and creation of such gas liquefaction enterprises only, it means further development of nuclear shipbuilding. Development of the icebreaking fleet and the Northern Sea Route will make it possible to perform shipments from the Yamal LNG to all parts of the globe and all year round”.

President of the Russian Federation Vladimir Putin
Sabetta, December 08, 2017

I already mentioned this but I would like to repeat – rephrasing the great Lomonosov who said that Russia will expand through Siberia. Now Russia should expand through the Arctc, since there we have our main supply of mineral resources.

President of the Russian Federation Vladimir Putin
major press-conference December 14, 2017
The Order of the Government of Russian Federation on the Complex Plan of LNG development on Yamal Peninsula

dd. October 11, 2010 # 1713-r

1. Uтвердить прилагаемый комплексный план по развитию производства сжиженного природного газа на полуострове Ямал (далее - комплексный план).

2. Федеральным органам исполнительной власти с участием заинтересованных организаций обеспечить реализацию мероприятий, предусмотренных комплексным планом, и ежеквартально представлять в Правительство Российской Федерации соответствующий доклад.

3. Минэнерго России обеспечить координацию работ федеральных органов исполнительной власти, органов исполнительной власти субъектов Российской Федерации и заинтересованных организаций по выполнению комплексного плана.

4. Мингортуправление России обеспечить определение границ морского порта в районе пос. Совета Ямальского района Ямало-Ненецкого автономного округа.

5. Минэнерго России, Минэкономразвития России совместно с Минэнерго России до 31 декабря 2010 г. внести проект нормативного правового акта, направленного на стимулирование разработки нефтегазопромысловых месторождений на полуострове Ямал и предусматривающего установление налоговой ставки по налогу на добычу полезных ископаемых в размере 0 рублей на тонну газового конденсата, добываемого на участках недр, расположенных на территории полуострова Ямал, до достижения накопленного объема добычи газового конденсата в размере 20 млн. тонн и при условии, что срок разработки запасов участка недр не превышает 12 лет с даты начала производства сжиженного природного газа.

установление налоговой ставки по налогу на добычу полезных ископаемых в размере 0 рублей на тонну газового конденсата, добываемый на участках недр, расположенных на территории полуострова Ямал, до достижения накопленного объема добычи газового конденсата в размере 20 млн. тонн и при условии, что срок разработки запасов участка недр не превышает 12 лет с даты начала производства сжиженного природного газа.

6. Минэкономразвития России, Минэнерго России, Манфуну России и ФТС России совместно с заинтересованными федеральными органами исполнительной власти до 31 декабря 2010 г. внести в Правительство Российской Федерации проект нормативного правового акта, предусматривающего установление налоговой ставки налога с оборота транспортных средств, на танкерах, перевозящих сжиженный природный газ, до 30 коп. за 1 тонну газа.

7. Правительственной комиссии по вопросам топливно-энергетического комплекса, составленной на ресурсной базе и в пределах энергетической эффективности экономии, обеспечить в установленном порядке реализацию мероприятий, направленных на расширение ресурсной базы формируемого центра производства сжиженного природного газа на полуострове Ямал, в том числе путем лицензирования необходимого фундамента.

8. Рекомендовать органам государственной власти и органам местного самоуправления Ямало-Ненецкого автономного округа рассмотреть вопрос о предоставлении налоговых льгот по региональным и местным налогам, а также федеральным налогом в части налогов, включенных в бюджет субъектов Российской Федерации, для организаций, осуществляющих добычу и сжигание природного газа на полуострове Ямал.

9. Рекомендовать федеральным органам исполнительной власти, органам исполнительной власти субъектов Российской Федерации и органам местного самоуправления Ямало-Ненецкого автономного округа рассмотреть вопрос о создании специальных налоговых каникулах, связанных с введением новых элементов, связанных с переводом налоговых льгот по региональным и местным налогам, а также федеральным налогам в части налогов, включенных в бюджет субъектов Российской Федерации.
The Order of the Government of Russian Federation on the Amendment to the Complex Plan of LNG Production Development on Yamal Peninsula
dd. December 19, 2013 # 2413-r

1. The Order of the Government of Russian Federation on the Amendment to the Complex Plan of LNG Production Development on Yamal Peninsula, dd. December 19, 2013 # 2413-r

2. Located in its entirety or in part on the territory of the Peninsula, Yamal-Nenets Autonomous Okrug, to achieve an annual production volume of liquefied natural gas of 20 million tons per year, with a production rate of at least 12 thousand tons per month, within a period of 10 years, starting from the date of this order, and the conditions under which the period is not exceeded, and the volume of gas production is achieved, confirmed by a group of core members, with the exception of the government's decision on the amendment to the plan of LNG production development.

3. The Ministry of Energy of Russia, the Ministry of Industry and Trade of Russia, and the FAS of Russia, along with the relevant federal executive bodies, under the guidance of the President of Russia, in the context of the implementation of the Federal Law on the amendment to the Complex Plan of LNG Production Development on Yamal Peninsula, signed a Memorandum of Understanding on the development of the Yamal Peninsula, with the participation of the Russian Federation, the Yamalo-Nenets Autonomous Okrug, and the municipal authorities of the Yamalo-Nenets Autonomous Okrug.

4. In the context of the implementation of the amendment to the plan of LNG production development on the Peninsula, the predicted volume of production of liquefied natural gas at the site of the Yamal Peninsula, as confirmed by the government's decision on the amendment to the plan of LNG production development.

5. The Minister of Energy, the Minister of Industry and Trade, and the FAS of Russia, in their capacity as federal executive bodies, have signed a Memorandum of Understanding on the development of the Yamal Peninsula, with the participation of the Russian Federation, the Yamalo-Nenets Autonomous Okrug, and the municipal authorities of the Yamalo-Nenets Autonomous Okrug.

6. The execution of the amendment to the plan of LNG production development on the Peninsula, in the context of the implementation of the Federal Law on the amendment to the Complex Plan of LNG Production Development on Yamal Peninsula, is a joint venture that includes the Ministry of Energy, the Ministry of Industry and Trade, and the FAS of Russia, in their capacity as federal executive bodies, along with the relevant federal executive bodies, under the guidance of the President of Russia, in the context of the implementation of the Federal Law on the amendment to the Complex Plan of LNG Production Development on Yamal Peninsula.

7. The execution of the amendment to the plan of LNG production development on the Peninsula, in the context of the implementation of the Federal Law on the amendment to the Complex Plan of LNG Production Development on Yamal Peninsula, is a joint venture that includes the Ministry of Energy, the Ministry of Industry and Trade, and the FAS of Russia, in their capacity as federal executive bodies, along with the relevant federal executive bodies, under the guidance of the President of Russia, in the context of the implementation of the Federal Law on the amendment to the Complex Plan of LNG Production Development on Yamal Peninsula.

8. The execution of the amendment to the plan of LNG production development on the Peninsula, in the context of the implementation of the Federal Law on the amendment to the Complex Plan of LNG Production Development on Yamal Peninsula, is a joint venture that includes the Ministry of Energy, the Ministry of Industry and Trade, and the FAS of Russia, in their capacity as federal executive bodies, along with the relevant federal executive bodies, under the guidance of the President of Russia, in the context of the implementation of the Federal Law on the amendment to the Complex Plan of LNG Production Development on Yamal Peninsula.
New Generation Icebreakers is the Basis for Year-round Navigation along the Northern Sea Route

Universal atomic icebreaker Project 22220 (IB60) with the propulsion power of 60 MW

Atomic turbo-electric icebreaker Project 105010 (IB Leader) with the propulsion power of 120 MW

Line Icebreaker Aker ARC 123 (LNG-IB), propulsion power 40 MW
Number of Icebreakers will have to be increased from 4 to 13 Vessels to Ensure Cargo Volume Growth and Year-Round Navigation via the Northern Sea Route

<table>
<thead>
<tr>
<th>Icebreaker</th>
<th>Overhaul Period</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taimyr</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaygach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yamal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 Let Pobedy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arktika (IB60-1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sibir (IB60-2)</td>
<td></td>
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</tr>
<tr>
<td>Ural (IB60-3)</td>
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<tr>
<td>IB60-4</td>
<td></td>
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<td>IB60-5</td>
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<tr>
<td>LNG IB-1</td>
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<tr>
<td>LNG IB-2</td>
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<td>LNG IB-3</td>
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<tr>
<td>LNG IB-4</td>
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<tr>
<td>Leader 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leader 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leader 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Contract signed
- Commissioning
- Decision about overhaul-period renewal
- Decommissioning

50 Let Pobedy + 5 IB60 + 4 LNG IB + 3 Leaders = year-round navigation
Building Universal atomic icebreaker Project 22220 (IB60)
New generation icebreakers – basis of year-round navigation along Northern Sea Route - Project 22220 (IB-60).

**Universal atomic icebreaker** Project 22220 (IB60) with the propulsion power of 60 MW
Length - 173,3 м
Beam - 34 м
Minimum operating draught - 8,55 м. Water displacement – 33 540 тонн.

IB60 is equipped with dual-reactor nuclear power plant RITM-200 with the overall power of 175 MW.

**Icebreaking capability:**
The icebreaker navigates with even speed of 1,5-2 kn at full draught and power through flat solid ice with maximum thickness of 2,9 – 3,0 м.
Building atomic icebreaker «Leader» Project 10510
overall power 120 MW with reactor RITM-400

Atomic turbo-electric icebreaker Project 105010 (IB Leader) with the propulsion power of 120 MW

Length – 209,0 m
Beam – 47,5 m
Maximum draught – 13,0 m
Water displacement - 70 600 tons
IB Leader is equipped with dual-reactor nuclear power plant RITM-400 with the overall power of 315 MW.

Icebreaking capability:
The icebreaker navigates with even speed of 1,5-2 kn at full draught and power through flat solid ice with maximum thickness of 4,3 m. Ice with thickness of 2 m. Icebreaker navigates with even speed 12-13 kn.

Operation zone
West and East sectors of Arctic year-round navigation.

Overarching aims:
Icebreaker support large-capacity vessels,
Icebreaker support convoy of vessels year round in Arctic.

Class RMRS
KM ✶ Icebreaker9 [2] AUT2-ICS EPP
SDS<60 HELIDEEK-H Special purpose ship «Atom»

Sea endurance
By provision – 8 month
Interval between nuclear reactor core replacing – 8-9 years
Linear icebreaker project Aker ARC 123 (LNG-IB, IB-40)

Low draught ice breaker, meant for support year-round navigation at the west sector of Arctic and for support navigation along Northern Sea Route at summer-autumn period.

Class RMRS
KM ✪, Icebreaker8, [1], AUT1-ICS, OMBO, EPP, GFS, HELIDECK

Main parameters:
- Length overall ...........................................165,2 m
- Beam ..........................................................31,5 m
- Draught max ..............................................9,5 m
- Propulsion power .........................................40 MW
- Icebreaking capability , at speed of 2 kn ..............2,85 m
- Speed at sea without ice ...................................18 kn
- Main fuel type ..............................................LNG

Overarching aims:
- Icebreaker support at ambouchure siberian revers;
- Icebreaker support along Northern Sea Route.

Secondary aims:
- tow-out operations;
- oil spill up operations;
- fire fighting operations at vessels and port buildings;
- accident and rescue works at sea;
- Small batch cargo delivery services at the icebreaker deck.
Thank you for your attention!