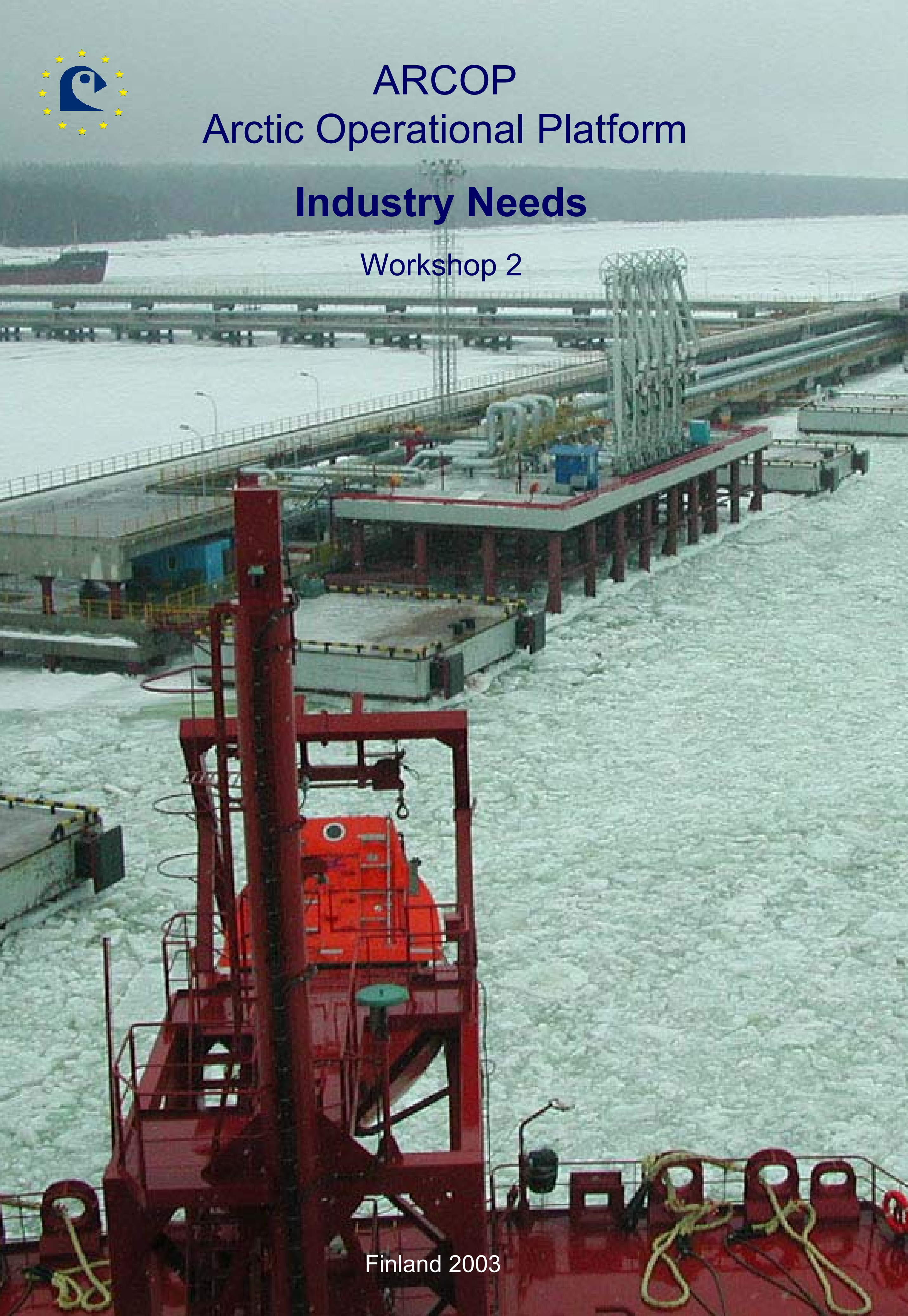
ARCOP
Arctic Operational Platform

Industry Needs

Workshop 2



Finland 2003

The European Commission
Community Research
Competitive and Sustainable Growth

Directorate General TREN

Arctic Operational Platform

ARCOP

The Fifth Framework Programme Project of the European Community

Industry Needs

Workshop Report 2

Ministry of Trade and Industry

Anders Backlund
Liisa Laiho
Britta Jourio

Finland 2003 Deliverable 6.2

CONTENTS

APPENDICES

1. INTRODUCTION

The ARCOP workshops are a continuing activity throughout the project to create the input, to follow the project and to conclude and disseminate the results. The workshops will also serve as an industrial scientific and political reference group.

Participants from industry will be invited to the workshops, governmental bodies and representatives of science and technology. The workshops will discuss and conclude objectives of the project, other relevant problem areas and make recommendations to the steering group to make changes in the project plan, if necessary.

A selected number of representatives from the target groups will be invited to the workshops. This will give them direct access to the planning and the results of ARCOP. On the other hand, in the workshop discussions the Steering Group will get direct contact with industry needs, government policies and possibilities of science in a larger context. The workshops are also serving as a discussion forum for European and Russian decision makers and members of the Arctic Council.

This is a report from the first series of workshops, held in Helsinki on 25-27 March 2003. Clear goals had been set up for all workshops. Generally, these first workshops aimed at describing the state-of-art in the different problem areas.

The first workshop dealing with Legal and Administrative Issues aimed at defining the differences in the interpretation of international law regarding the legal status of the Northern Sea Route. The idea was to create common understanding of the current interpretation of the limits of the Russian economic zone, territorial and national waters and discuss possible disagreements of these interpretations at different parts of the NSR. Within the issues of international trade, the goal was to clarify the influence of international agreements on the terms of commercial activities on the NSR. Regarding rules and regulations, the workshop aimed at defining the Russian national rules that foreign vessels have to obey when operating on the NSR. As for all workshops, a general goal was to define the work on legal issues within ARCOP.

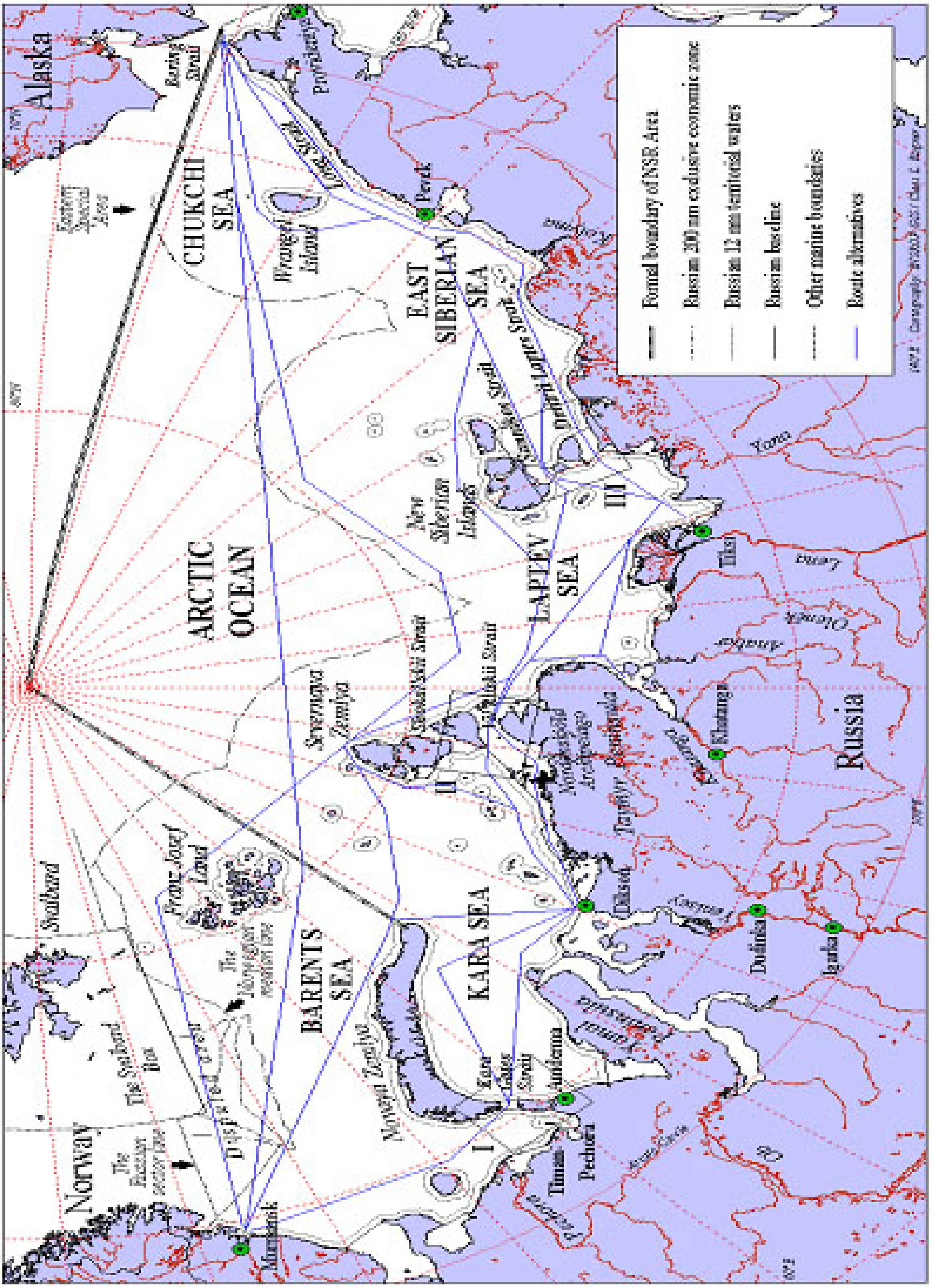
The second workshop in this series was dealing with Industry Needs. It aimed at defining the future transportation needs at the NSR. As marine transportation, in the case of oil and gas transport, has to compete with pipelines, the workshop intended to present the pros and cons of marine transportation compared to pipelines. It is clear that large investments are required for marine transportation from oil and gas fields along the NSR. The workshop aimed at giving an overview of the current marine operations on the NSR as well as of existing development plans. The ARCOP scenario, which is a basis for all activities in the project, was also presented and discussed.

The third workshop was dealing with Technology and Environment. It aimed at defining the integrated transport system and the elements that have influence on the economics. Other goals were related to the infrastructure involved in the transportation system - the ice information services and the traffic management and information system. The workshop also aimed at presenting the state-of-art of other supporting services, such as the satellite communication services and also the possibilities in the future. The need for special crew training was also discussed. Regarding the environmental issues the workshop aimed at giving an understanding of the environmental impact and risk assessment procedures and an overview of the oil spill response readiness in Arctic areas. Industrial development in the Arctic will have a considerable impact on the life of the inhabitants. The workshop also aimed at giving an understanding of the social impact assessment in Arctic activities. As for all workshops, also the Technology and Environment workshop targeted at giving recommendations for the research and development work within ARCOP.

The series of workshops was opened by Finnish Minister of Transport and Communications Kimmo Sasi who pointed out the huge potential for commercial cooperation that the Arctic energy resources present to the European Union and Russia. He also stressed the importance of discussing the safety, reliability and economy issues of oil transport before the large-scale activity in the Arctic starts.

We wish to thank all the chairmen, speakers and commentators for their valuable input to a successful first series of workshops.

The Northern Sea Route



Map from R. Douglas Brubaker, *Environmental Protection of Arctic Waters – Specific Focus the Russian Northern Sea Route,* Stockholm University 2002

PROGRAM	
March 26th 2003	**Industry Needs**
Chairman: Jaakko Ihamuotila, The Finnish Academies of Technology	
Opening remarks	Chairman Jaakko Ihamuotila
Review of the Arctic Oil and Gas reserves	Ministry of Natural Resources of the Russian Federation, Andrei A. Gagelgants *Comment: Fortum Oil and Gas*
Importance of direct marine transportation (cancelled)	Sakhalin Energy, Herbie Battye
Role of marine transportation in Russia's energy export	Ministry of Transport of the Russian Federation, Nikolay I. Matyushenko *Comment: Stena Bulk*
Experience from regular traffic	Murmansk Shipping Company, Nikolay Babich
Experience from loading systems	Murmansk Shipping Company, Vsevolod Garulin Tecnomare SpA, Giovanni Busetto
Proposed ARCOP scenario	Kvaerner Masa-Yards, Kimmo Juurmaa *Comment: Central Marine Research and Design Institute*
Discussion and conclusions	

2. REVIEW OF THE ARCTIC OIL AND GAS RESERVES

2.1 Present status and outlook of subsoil use on the Arctic Shelf of the Russian Federation, Summary

Murzin R.R., Ministry Of Natural Resources Of Russian Federation,Moscow

The Arctic seas of the Russian Federation have the biggest shelf zone in the world Almost the total Arctic shelf is an oil-and-gas perspective. Total initial-in-place resources of the Arctic shelf are estimated today as about 104 bln. TOE, including at least 30 bln. tons of oil.

The by far most promising area is the Western Arctic (Barents-Kara) region, and first and foremost the Barents Sea, as 11 oil and gas fields have been already discovered and a few are still to be further evaluated here.

The Russian shelf of the Barents Sea is the biggest and the best-studied Arctic shelf of Russia. 333.3 th. km of 2D seismic lines and about 500 km^2 of 3D seismics have been shot on the Barents shelf.

The density of seismic observations on the Pechora Sea shelf does not exceed 0.3 km/km^2 on 90% of the area. The most studied areas are the Pechora-Kolva, North PreUral, and Varandey-Adzvinsky oil-and-gas bearing regions.

79,4 th. running km of seismic exploration lines have been shot in the Kara Sea, mostly in the southern region. Marine deep drilling has also been done in the Kara Sea on the Leningradsky (two wells) and Rusanovsky (two wells) areas. Besides, parametric wells were drilled on the islands Belyi (3 wells) and Sverdrup (1 well), 8 th. m in all.

Besides discoveries of oil and gas fields, more than 500 promising traps were detected in the Barents Sea (including its Pechora part) and more than 70 in the Kara Sea. 34 of traps in the Barents Sea are prepared for prospecting drilling and their localized initially-in-place resources amount to 1.1 bln. TOE. 5 fields of the basin belong to the Barents Sea proper, and 5 to the Pechora Sea.

According to Russian classification, 2 discovered fields are unique, 7 fields are large and two more fields are medium.

Hydrocarbon potential

In spite of relatively poor coverage of the Arctic shelf, 14 hydrocarbon-bearing provinces have been discovered, and productivity of western provinces from the Barents Sea to the Laptev Sea is generally proved.

According to today’s estimation, total initial-in-place hydrocarbon resources of the Russian marine periphery come to 135 – 144 bln. TOE, and recoverable resources are about 100-105 bln. TOE (Up to 14,2 bln. TOE oil and about 82,5 trln. m^3 gas).

Analysis of total offshore initially-in-place resources distribution by water areas reveals that the majority (about 66,5 %) lies in the West Arctic seas (the Barents, Pechora and Kara Seas).

When comparing the possible and hypotehtical on one hand and initial on the other, there are considerable differences in the Russian Arctic. In the Barents and Kara Seas this ratio exceeds 35% whereas it is almost zero in the East-Arctic waters.

Present status and outlook on the use of the marine subsoil

Development of the hydrocarbon resources in the Western Arctic began in the 90-ties by competitive and non-competitive distribution of licenses on the background of insufficient legislative base. At that time, distribution of license blocks within the Arctic water bodies turned out to be extremely uneven because of their different covering with studies. 13 licenses are in force now in the West Arctic sector, but no one is granted in the East Arctic. Among the granted licenses, 8 are licenses for geological study and oil-and-gas prospecting and 5 for hydrocarbon exploration and production.

The last tender of licenses for hydrocarbon exploration and production in the Arctic (Barents-1) took place in 1999-2000. Three blocks were suggested for the tender and the FSUE “Arktikmorneftegazrazvedka”(AMNGR) from Murmansk won all the three blocks.

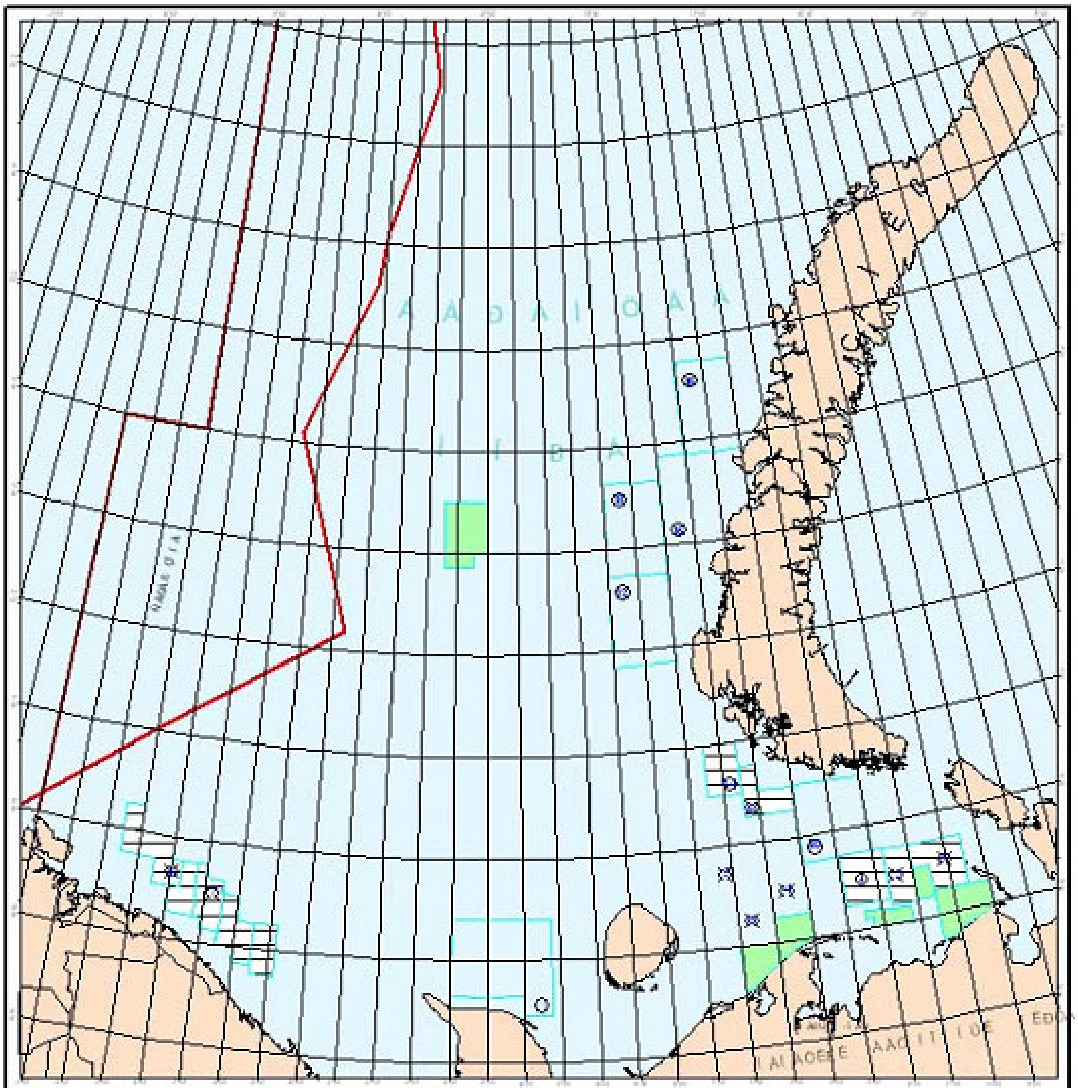
Regular licensing rounds on terms favorable for both the State and the potential investor remains the basis of Russian policy in the sphere of subsoil use on the continental shelf including further prospecting, exploration, and production of hydrocarbons. Unlike the prior period, marine subsoil use should be grounded on well-advertised short-, medium- and long-term (conceptual) programs of subsoil use licensing.

Federal laws and other norms have been elaborated resting on the Constitution of the RF and international law that control subsoil use on the continental shelf. These are “On Subsoil”, “On the Continental Shelf of the Russian Federation”, “On Production Sharing Agreements”, regulations “On Procedure of Subsoil Use Licensing”.

On the 22nd of January 1997 State Duma of the Russian Federation passed the law “On Ratification of UN Convention on Maritime Law and Agreement about Implementation of the Part XI of UN Convention on Maritime Law”. In accordance with it, the Russian Federation is a subject of international law at prospecting of mineral and living resources of the continental shelf and the exclusive economic zone.

A new stage of licensing subsoil use on the continental shelf of the RF starts with the Program of Licensing and Geological Study, Prospecting, and Developing of Hydrocarbon Resources on Continental Shelves of North and Far East Seas in 2002-2005 that was elaborated in the middle of 2002 and approved in June 2002.

According to the “Program…”, the auctions and license tenders on blocks in the Arctic region in 2003-2005 will cover only the Barents Sea.



Preliminary layout of licensed blocks in the Barents Sea 2002-2005

In the term under consideration, 22 blocks will be proposed within the Barents Sea. Their total area is 70.6 th. km^2 and total recoverable resources are 2176 mln. TOE. Among these blocks, 16 will be proposed for auctions and the other 6 blocks for geological study tenders.

The Barents-2 tender (I round), 2003, comprises blocks 1, 2, and 3 proposed for hydrocarbon prospecting, exploration, and production on terms that will be defined by the license agreement .

The Barents-2 tender (II round), 2003-2004, comprises blocks 4, 5, and 6 proposed for hydrocarbon prospecting, exploration, and production.

The Barents-3 (Kola) tender is intended to take place in 2003 (I round) and 2004 (2 round).

The first round comprises four blocks situated on the Kola monocline in the zone of supposed structures of reef origin. The blocks are proposed for hydrocarbon prospecting, exploration, and production auction.

The second round comprises blocks proposed for geological study. It is necessary to note that the list of blocks proposed for different kinds of subbottom use as well as their order in the rounds may be changed depending on the number and substance of submitted applications.

The Barents-4 tender, 2004-2005, comprises two areas (blocks) for geological study (12, 13) and two for exploration and production (9, 14).

The Barents-5 tender, 2005, comprises two blocks (15, 16) for geological study according to the preliminary plan.

Preliminary schedule of auctions and license tenders giving rights to subsoil use on the continental shelf areas in 2003-2004 (fig. 16) stipulates the first round of the Barents-2 tender (eastern blocks) in 2003. Three more blocks in the Pechora Sea (the Barents-2 tender, western blocks) and some areas on the Kola shelf will be proposed in 2003-2004.

2.2 Discussion

The question about the future development of the Arctic oil & gas business is not about the size of the reserves. It seems clear that there are ample reserves. There are also indications that the technical issues related to the development can be solved. The question is therefore about making the projects economic. This is where the efforts have to be put. Comparisons can be made to the lessons from ARCDEV, where technical feasibility was not the issue but the cost level. Several factors influence the economic feasibility of the projects and not all are related to the cost of different components.

Among the most important questions in the economic feasibility issue are the fiscal terms. Stability over the long term is needed, so that business is still viable at low oil prices. Lower profits than presently, at high oil prices, can be accepted as a countermeasure. Generally, more of the risk should be moved to the post-discovery phase. The risk should not be related to data existing about the field at the time of the auctions. Risks carried by the commercial companies should be tied to issues that can be influenced by them during the project. As in the telecom sector, profit maximising in the licensing phase may kill the future business.

In addition to the fiscal terms (in relation to the general stability) a predictable tax regime is needed. This adds to the necessary stability of the project.

One should also remember that the time between licensing and production is long. The fields presented, as coming up in the next licensing rounds will not be anywhere close to production when the results from ARCOP are available.

2.3 Conclusions and recommendations

It is obvious, that there are ample hydrocarbon reserves in the Russian Arctic, both onshore and offshore. The volumes are significant both on a European level as well as on a world level. If available at a competitive price, the Russian Arctic oil can be of strategic interest both within the EU and in the US.

The schedule for and fields to be included in the next licensing rounds for the Barents Sea have been decided. This gives a good starting point for planning infrastructure development in the region. It is, however, still a long way from licensing to production.

The fiscal terms of field developments need to be shifted towards risk exposure in the post-discovery phase. Terms must also be shifted towards a more stable condition, where some profit can be made also on lower oil prices, possibly at the same time reducing profits at high oil prices.

Since very large investments in infrastructure for hydrocarbon development are needed in the Russian Arctic, a regional development program needs to be co-ordinated to make the infrastructure investments economical. Single development projects will not be able to carry the investment costs, due to a significant amount of custom developed solutions. The ice conditions will for instance require custom built vessels, which would not be the case in an open water project, where standard vessels operating on the market can be used. A study should be made to determine the export volume required to make the marine transport system competitive.

3. ROLE OF MARINE TRANSPORTATION IN RUSSIA'S ENERGY EXPORT

3.1 Role of the marine transportation of energy resources for the export from the Russian Arctic, Summary

N.I. Matyushenko, Ministry of Transport of Russia

The export of energy resources is the most important source of income of the Russian economy. At present the export of oil and petroleum products is 250 million t and of gas 190 billion m^3 a year.

During last ten years the center of the Russian basic resources industry has shifted to the northern areas. The richest deposits of mineral raw materials, especially energy resources are concentrated here. Rational exploration of these natural resources is the national priority in the economic strategy of Russia.

The Arctic Marine Transportation System (AMTS) provides for all the needs of the country in the arctic freight traffic. It is based on the use of the icebreaker fleet with its powerful nuclear icebreakers. In the past decade, mainly due to a sharp reduction of the cargo traffic in the Arctic, the collected fees have not been sufficient to cover the maintenance costs for the fleet. The deficit is made up (though not in full) by subsidy from the federal budget.

For a very long period all transportation of products (mainly petroleum products) have been transported to the area using the NSR and rivers flowing onto the Arctic seas. Only in the most resent years, as oil and gas deposits seas are being developed, the export transportation of energy resources from the Arctic begins. This export will be made either directly from the deposit or by using a transshipment terminal, where the cargo is offloaded into larger ocean going vessels.

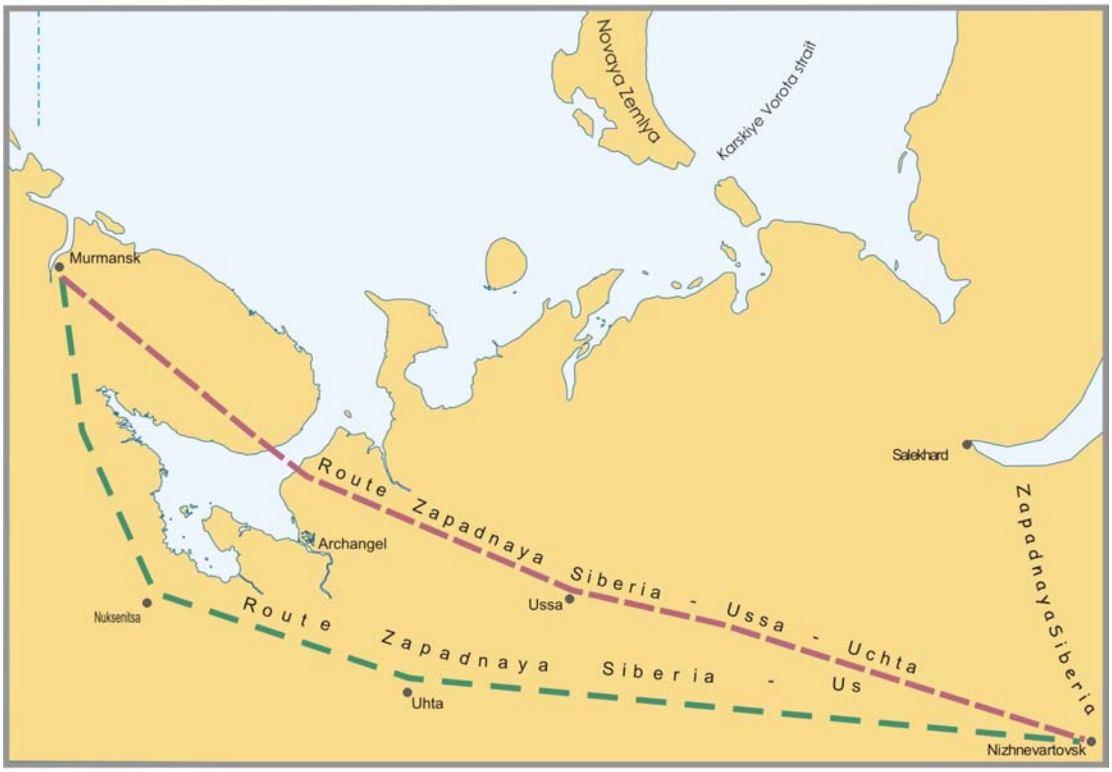
In 2002, 5.3 million t of oil and gas condensate were taken out by sea from the Arctic zone. This volume is expected to increase considerably by 2015. Marine export of oil from the deposits at Varandey will by 2006 reach 5 million tons and by 2015 it may exceed 12 million tons per year. In 2006-2007 the first oil for export will be taken from the Prirazlomnoye deposit, reaching 8-10 million tons by 2015. By 2015 the volume of oil and gas condensate from deposits of the Kolguev Island, Ob, Yenisei and Lena river basins will exceed 1.5 million tons per year. About 6 million tons a year will be shipped for export via Vitino, Arkhangelsk and Belomorsk.

The prospected LNG plant at Kharasevey on the Yamal Peninsula is planned to produce up to 5 million tons of LNG by 2020.

A planned pipeline from the oil fields in Western Siberia to a terminal near Murmansk will provide a significant alternative export route. The terminal is planned to have a yearly capacity of 80 million tons. The terminal is located in a non-freezing area and will provide sufficient water depths to accommodate tankers up to 300,00 dwt in size. This export system is expected to be competitive for export of oil to both Europe and North America, especially compared to the terminals in the Black and Baltic Seas, where draft restrictions limit the maximum ship size.

The most important aspect of the planned pipeline is its favorable route, enabling connections to fields in the area of Ob Tazovskaya Gulfs as well as other areas in the northern Russia. This pipeline also goes through he Timan-Pechora area, which is being intensively developed.

The terminal will be constructed before the pipeline, enabling it to be used as a transshipment terminal for cargo from Varandey and Khylguy areas as well as from the Kolguev Island and other fields in the Barents Sea.



Alternative pipeline routes from Western Siberia to Murmansk

The existing Russian icebreakers have mainly been built in the 1970's and 1980's and coming to the end of its economical lifetime. The Russian Transport Ministry has developed, and will realize in the coming years, a program of the overhaul of the nuclear and arctic diesel icebreakers to extend their lifetime by 8-15 years. Total cost of this operation is about 95 million

USD. It is envisaged that the icebreaker fleet will be further developed with an emphasis on icebreakers with nuclear propulsion plants having high icebreaking capability and unrestricted endurance.

Financing of the construction of icebreakers of the new generation is has not yet been solved. The Government of the Russian Federation has decided to complete the construction of the nuclear icebreaker "50 Let Pobedy". Due to the high cost (80 million USD in 2003-2005), there are no budget funds for the maintenance of the line icebreaker fleet.

Financing of the construction of nuclear icebreakers is to come from the federal budget. There is also a plan to introduce a mandatory fee to oil & gas developers in the Arctic Zone, which would support the construction of new icebreakers. Companies exploring natural resources in the Russian Arctic are to build also diesel-electric icebreakers as universal supply icebreakers and jointly with shipping companies develop the arctic transport fleet and commercial oil and gas transshipment terminals. Minimum state support will be directed to subsidize a part of the interest rate on credits of Russian banks, when building ships at domestic shipyards.

Maintenance of the current icebreaker fleet will be financed though the fees charged for assistance along the NSR. New higher rates have been introduced on January 10, 2003. These higher rates will, however, reduce the competitiveness of the NSR as a transportation route. The Russian Ministry or Transport has declared that the fees will be reduced as the volumes increase. The present rate increase is necessary and hopefully provisional. As the nuclear icebreaker "50 Let Pobedy" has been completed and taken into services and as the lifetime of the other icebreakers has been extended, which is envisaged to happen in 2008, there is a plan to reduce the rates by 35-40% by 2015.

3.2 Discussion

It is evident that marine transportation is central for Russia. Distances from fields to market are long and certain markets (as the US) can be reached by sea only.

There is presently a wide gap between domestic Russian and international oil prices. This is a result of the lack of export routes and the subsequent over supply on the domestic market. More export routes are thus required to enable Russian oil companies to bring their products to the world market.

Specialised ships (such as ice breaking tankers) would be applied on shorter routes, so that they are used only where they are needed. It is therefore expected that icebreaking tankers would be used only in the ice covered area, transhipping the cargo to standard open water tankers close to the maximum ice edge. This is especially the case for shipping to distant markets such as the US. Routes to Europe need to be studied more closely. Total costs of transporting the cargo to the market have to be considered, including transhipment.

Safety has to be the number one issue. Even though the trend in the number of accidents is towards less accidents, there is a lot to do. The world expects zero accidents, which may seem impossible to achieve, but this must be the goal. At the present world average, a reliability level of 99.97%, there are 3 accidents out of 10,000 trips. This will give a significant amount of accidents already from the planned and existing terminals in the Baltic. Market perception of accidents will influence the decisions, as will the risk for oil spill coverage claims. Work has to be done both to reduce the risk for accidents as well as to increase the accident preparedness and thus the consequences of possible accidents.

3.3 Conclusions and recommendations

It is clear, that marine transportation has a central role in Russian hydrocarbon business. The export volumes are large and the market global, so cargo has to be transported also by other means than pipeline.

Safety and environmental issues are central in the development of a transportation system for the Russian Arctic. In the development of this system, 0 damages has to be the goal, even if it is understood that this absolute level cannot be reached in reality.

With large volumes (and large numbers of trips), even very low accident rates will lead to a significant number of accidents.

As shown already in the ARCDEV project, the technology exists for marine transportation of oil from Arctic Russia. The level of development varies between the different components of the system, but there are working solutions for all components.

The price gap between domestic and export market is wide due to oversupply on the domestic market, which leads to a growing demand for export routes.

One of the lessons learned from the ARCDEV project was that the cost of transportation was too high. It is therefore necessary to further develop the system from a technically feasible to an economically viable solution.

Safety and environmentally sustainable development are two key issues. Both issues have to be closely followed up and co-ordinated in all work packages in ARCOP.

4. EXPERIENCE FROM REGULAR TRAFFIC

4.1 Discussion

There have been four transits with non ice class vessels through the whole NSR. It is thus possible, but involves risks regarding ice condition forecasting. Northerly winds can bring ice to almost any part of the NSR at almost any time of the year.

MSCO has extensive experience of operating vessels in ice. Regular traffic at high volumes has taken place from the Yenisey river west. Main cargo here has been products from the Norilsk mines.

The present Russian view is that year round operations in the Arctic can be achieved only with icebreaker assistance. This is the only way to provide sufficient reliability and safety to the operations.

One of the critical operational questions relates to convoy size (i.e. number of vessels that one icebreaker can assist at a time). Present practice is to have 1-4 vessels in the convoy, depending on the severity of the ice conditions. This is a question about operational efficiency, balancing the speed of the convoy with the frequency of convoys and required number of icebreakers.

4.2 Conclusions and recommendations

Regular traffic has taken place in the Russian Arctic for an extensive period of time. It is clear that there is a significant accumulated experience of marine operations in Arctic Russia. Year round regular traffic has provided basics for operating both cargo vessels and the assisting icebreakers.
Data on the ice conditions along the NSR shows that ice free sailing along the total NSR is possible during approximately two months per year. This period is significantly longer in each end of the NSR.
During the seasons when the route is covered with ice, far all operations have so far relied on the use of icebreakers as assistance for the cargo vessels. Almost all cargo vessels have had a beam less than that of the largest (widest) icebreaker. Only one vessel (the Sevmorput) has a beam slightly wider than the Rossyia class icebreakers. Vessels have been assisted in convoys, the size of the convoy varying, depending on the ice conditions, varying form 1-4 ships.
It is important that the experience from traffic along the NSR is considered in the work of all Work Packages.
The experience gained should also be presented to increase the confidence and reduce risk perception, especially within the insurance industry.

5. EXPERIENCE FROM LOADING SYSTEMS

5.1 Experience from loading systems, Summary

Vsevolod Garulin, Murmansk Shipping Company, Russian Federation

Hydrocarbon exploration activities have started in the Timan Pechora region, however with still limited volumes. Some fields in the area are connected to a pipeline system using this for export of oil form the area, both to domestic markets in Russia and foreign markets.

However, not all fields have been connected to the pipeline system and export of cargo from these fields has been done using marine transportation.

Murmansk Shipping Company has, being the most experienced operator in Arctic Russia, transported oil from a terminal in the Varandey area since September 2002.

Arctic Submerged Loading Terminal (ASLT) at Varandey

The terminal is of a type called Arctic Submerged Loading Terminal (ASLT) and is installed in a water depth of 12 meters. In the future, when the cargo volumes increase, it is planned to move the terminal to a water depth of 20 meters.

The pipeline from shore is buried 2 meters in the ground to give protection against scouring. This pipeline is connected to the Pipeline End Manifold (PLEM), from which oil is led through a flexible hose to the ship. The PLEM itself is located below the level of the sea floor. This hose is not protected in any manner when submerged. It is specially reinforced in the ice contact area to protect it from excessive wear. It has not been seen necessary to protect the hose on the sea floor, since the risk for accounting ridges with keels of more than 12 meters is less than 0.1 %. The PLEM is also the connecting point for the mooring line, which in this case is an integrated part of the hose.

All vessels using the terminal are equipped with bow loading equipment. Up till now two tankers, the Saratov and the Usinsk, have been fitted with a bow loading system. The connection is fully rotatable at the PLEM, so the ships can be weather waning in open water. In ice conditions, the icebreakers assist in breaking up the ice around the terminal to allow for the tankers to move, at the same time reducing the loads on the mooring connection.

Icebreakers are used to assist the loading in ice conditions. The icebreaker reduces the load on the mooring system (today designed to take a 125 ton load) and assists in establishing the contact between the tanker and the hose. The icebreaker is placed above the PLEM to enable the tanker to be located in almost ice free conditions. The hose is submerged in ice conditions and a diver is used to pick up the hose for connection with the ship. In open water conditions there is a floating messenger line that can be picked up with the assistance of a tug.

Up till now, loading operations have taken place approximately once a month since September 2002. Loading in ice conditions has been performed successfully four times (??).

5.2 Discussion

The pipeline connecting the onshore tankage and PLEM is buried 2 meters into the ground to be safe against scouring. The hose at the PLEM is not protected, since the probability of ridges with a keel depth of more than 12 meters is approximately 0.1%, which is considered to be small enough risk for keeping the hose without any protection.

Tecnomare presented their view, that the dimensioning load used for the loading arrangement today (125 tons) is low. Model tests performed with Technomare’s equipment have indicated much higher loads. The question is, if the icebreaker assistance can reduce the loads enough.

Divers were shown to be used in the present loading arrangement. There was some discussion regarding the safety of using divers in heavy ice conditions with large ridges.

5.3 Conclusions and recommendations

Tankers have been loaded at the Varandey terminal since September last year. The present system, the Arctic Submerged Loading Terminal, uses several assisting vessels to reduce mooring loads and to keep the loading area as clear from ice as possible. All loading events have been successful.

Although the loading events at the present terminal have been successful so far, further development is needed for loading of oil in severe ice conditions. The role of the assisting fleet (icebreakers, supply vessels) needs to be clarified considering the optimal use.

Safety and risk for pollution need to be key issues when developing the loading system.

6. PROPOSED ARCOP SCENARIO

6.1 ARCOP scenario, Summary

Kimmo Juurmaa, Kvaerner Masa-Yards Inc., Finland

Background

The basic idea of the ARCOP project is to continue the work that was performed within INSROP and ARCDEV projects. Thus also the scenario is selected to reflect the open questions after these projects.

ARCDEV resulted in the finding that the economics of the transportation were low, the transport cost being 70 EUR / ton. Several reasons were found to cause this result, both technical and administrative. One of the main reasons was that the transported cargo volume was low. To overcome this limitation the scenario should be based on a transportation task where the cargo basis is large and the use of bigger transportation units is physically possible.

Suggested scenario

The suggested transportation task is transportation of crude oil from Timan Pechora area to the European market. Since ARCOP deals mainly with problems related to ice, the main focus will be on the transportation between the loading terminal in the Pechora Sea and the transhipment terminal in Murmansk area. Direct transportation from the loading terminal to the market will also be considered as an option.

Bathymetry at loading terminal

The offshore loading terminal is located offshore Varanday in water depth of 22 meters to allow tankers of up to 120.000 DWT to approach the terminal.

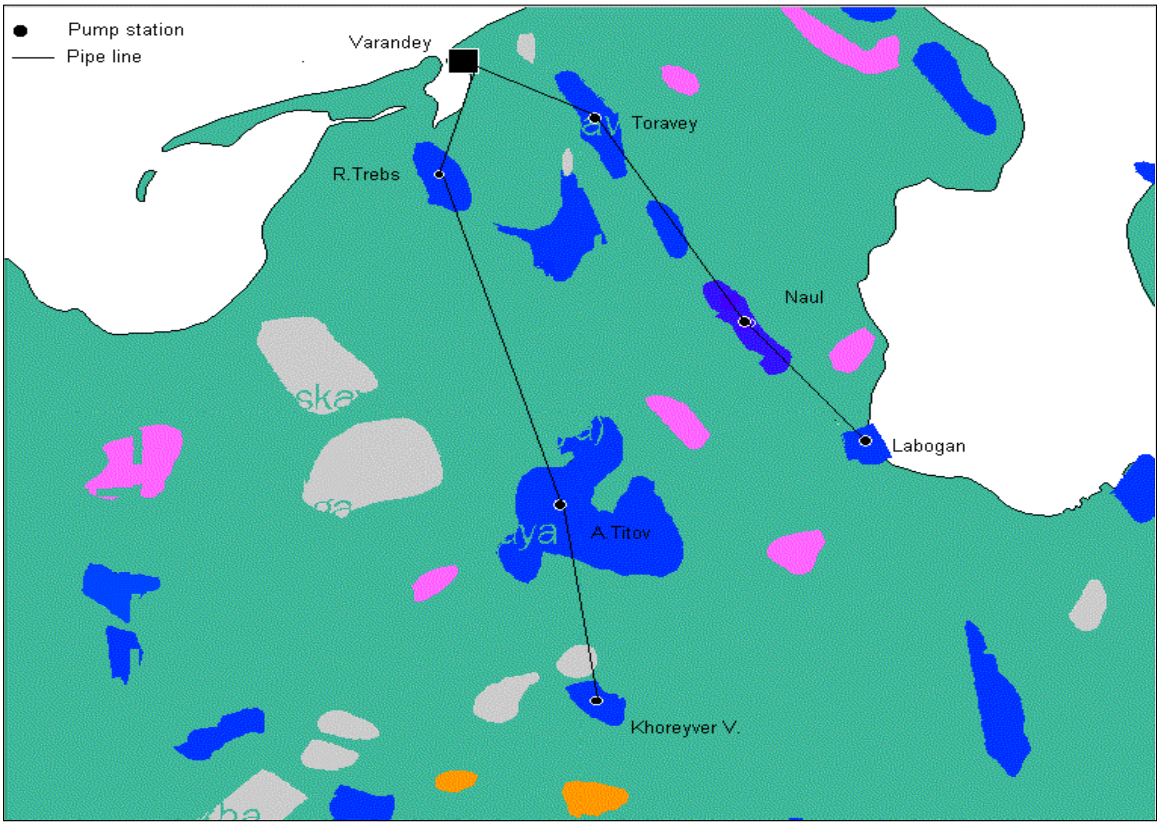
Hydro-meteorological conditions

The ice conditions that will be used as input values have been determined using existing statistics as well as actual field data from the area collected during several years' expedition program.

Selected fields

In the Timan Pechora region the potential oil fields are located in two major areas, one in the Varanday region and the other in area some 150 km to the west. From these areas following fields were selected for the study:

- Roman Trebs
- Varandey
- A. Titov
- Central Khoreiver
- Toravey
- Naul
- Labogan



Oil fields considered in the ARCOP scenario

Production profiles

All the oil fields have their specific production profile and related time schedule. When combining several fields together one can reach almost any peak value and length of plateau production. To simplify the problem we will just assume a plateau that can be considered longer than the economic lifetime of the transportation system and design all the systems for that volume. With this principal the production volume is 328.000 barrels per day.

6.2 Discussion

A comparison to the cost of pipeline transportation needs to consider the limited export pipeline capacity. Presently, the limited pipeline capacity is the biggest hurdle for oil exports.

The Northern Gateway project required 600,000 BOPD to achieve economy, compared to a pipeline system. Will the volume used in the scenario be enough? The present scenario is based on the lower end of the expected production volumes. There is, however, a significant lack of reliability in the production volumes and schedules that have been published. Using the higher volumes would make the reliability of the total production profile low and can therefore not be considered.

One should also remember, that already the production volumes used in the scenario will require significant investments. Increasing the volumes would make the whole scenario questionable.

6.3 Conclusions and recommendations

The Northern gateway Study, performed in the mid 1990's, used 600,000 BOPD as production rate to achieve feasibility in the marine transportation system. This is significantly more than the present 328,000 BOPD.

The selected scenario is realistic and needs no changes, although the selected terminal location it is not within the official definition of the NSR. However, as indicated by the NSR Administration, there is a clear wish to include the Pechora Sea into the area of the NSR Rules.

The present scenario is based on a route to Europe. To complete the study, the transportation costs for going east along the NSR need to be clarified. The costs can be based on the costs for transport to the west.

The terminal in the present scenario is located reasonably far from the coastline to allow tankers up to 120,000 dwt. Due to the open questions regarding applicable laws and regulations, the terminal location needs to be checked, ie. is it within 12 nm distance from the shore. This may have serious consequences and is therefore of importance.

7. CONCLUSIONS AND RECOMMENDATIONS OF THE WORKSHOP

It seems clear that there are sufficient reserves and that the technology and experience exists to transport the product to the market. What the industry now is looking for is economic feasibility through technology development.

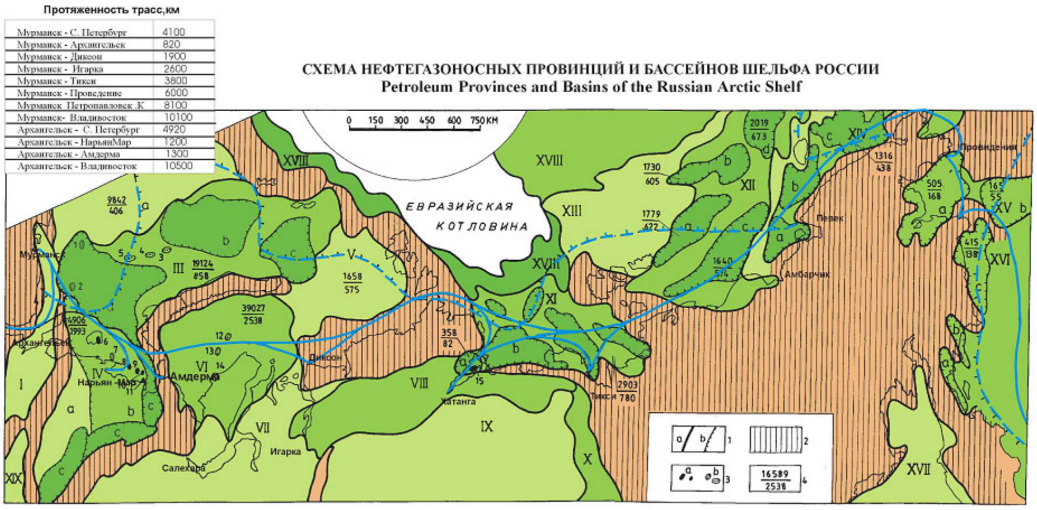
The workshops also acted as a good starting point for the project, where scientists and government representatives met with representatives from the industry, both oil & gas companies and shipping companies. The discussion was active and fruitful and valuable contacts could be made, contacts that can help the researchers to focus their work on the demands of the industry, thus securing the success of the total project.

This first workshop was very broad in its nature, dealing with a magnitude of different topics. To be able to achieve practical results, it seems clear that the future workshops have to be more focussed in nature. By bringing in more specialists on a narrower topic there is a greater chance that concrete actions and decisions can be taken.

MODERN STATUS AND OUTLOOKS OF SUBSOIL USE ON THE ARCTIC SHELF OF THE RUSSIAN FEDERATION

Murzin R.R.,
Head of department of Ministry of Natural Resources of Russian Federation,
Moscow

Arctic seas of the Russian Federation have the world biggest shelf zone. It's area exceeds two thirds of the entire Russian underwater margin or about 4,3 mln. km^2. Actually the whole Russian arctic shelf excluding relatively small areas of metamorphic and folded basement outcrops is oil-and-gas perspective (fig.1).



1- границы провинций(а) и бассейнов (b); 2 -неперспективные области; 3 - месторождения нефти (а), газа и конденсата(b); 4 - суммарные ресурсы УВ, млн.т всего/нефть.
Нефтегазоносные провинции (бассейны): I- Мезенская; II- Западно-Баренцевская; III- Восточно - Баренцевская (а- Южно -. Баренцевский; b- Северо - Баренцевский; с - Восточно - Баренцевский; IV - Тимано - Печорская (а - Ижма-Печорский; b-Печорский; с- Приуральский);V - Северо-Карская; VI- Южно-Карская; VII- Западно - Сибирская; VIII-Енисей-Анабарская; IX- Лено-Тунгусская; X-Лено-Вилюйская; XI- Лаптевская (а-Хатангский; b-Южно - Лаптевский; XI - Новосибирско - Северо - Аляскинская или Восточно - Сибирская (а - Новосибирский; b - Вилькицкого; с - Благовещенский; d - Северо - Чукотский); XIII - Новосибирских островов; XIV - Чукотская, или Южно - Чукотская (а - Чаунский; b - Лонга; с-Южно-Чукотский); XV-Анадырско -Наваринская (а-Анадырский; b- Наваринский);XV I- Ильпино-Хатырская (а - Ильпинский; б - Олюторский; с-Хатырский); XVII- Охотоморская;XVIII- Континентального склона; XIX-Волго-Уральская.
Месторождения: 1 - Северо - Кильдинское; 2 - Мурманское; 3 - Лудловское; 4 - Ледовое; 5 - Штокманское; 6 - Песчаноозерское; 7- Поморское; 8 - Северо-Гуляевское; 9 - Приразломное; 10 - Медынское - море;11- Варандей - море; 12- Русановское; 13- Ленинградское; 14- Харасавей; 15- Нордвиг.
Сплошная линия- трасса Северного морского пути; пунктир - зимняя и летняя границы плавучих льдов (бергштрих в направлении ледовых полей)

Fig. 1

Total initial resources of the Arctic shelf are estimated today as about 104 bln. t of standard fuel (SF), including 30 bln. t of oil at the least.

But considering real outlooks of hydrocarbon developing on the Arctic shelf one should mean the West-Arctic (Barents-Kara) region, and the Barents Sea first of all as 11 oil and gas fields have been already discovered here, and some hydrocarbon manifestations detected in wells demand further studies.

Arctic seas of the Russian Federation: covering with studies

The Barents Sea Russian shelf is the biggest (1136.3 th. km^2) and the best-studied Arctic shelf of Russia. Its geological and geophysical study began in early 60-ties, and it has been lasting yet. 333.3 th. km of 2D seismic lines and about 500 km^2 of 3D seismics have been shot on the Barents self including 92.3 th. km of regional, 165 th. km of prospecting, and 76 th. km of detailed lines (compare with more than 1.7 mln. km of seismic lines shot on Norwegian shelves). Density of seismic profiling within the waters under consideration is 0,293 km/km^2 (fig. 2).

BARENTS SEA EAST PART: SEISMIC AND DRILLING COVERAGE

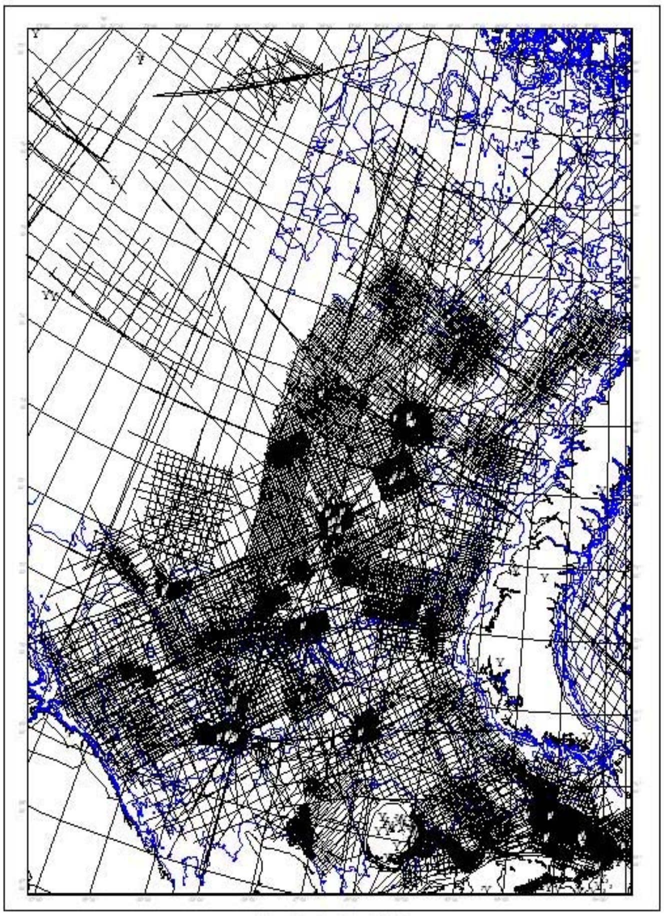


Fig. 2

Seismic observations on the Pechora Sea shelf are most dense within the Pechora-Kolva, North PreUral, and Varandey-Adzvinsky oil-and-gas bearing region (OGR); on the Barents Sea shelf proper – within the limits of local highs in the South Barents and Shtokman-Luninsky OGR. But on the whole the density does not exceed 0.3 km/km^2 on 90% of the area (fig. 3).

Table

SEISMIC STUDIES OF THE BARENTS SEA, STATUS OF 01.01.2002 *)

Region, object of zoning	Area, km^2	Total length of seismic lines, running km.	Density of seismic lines, km/km^2	Total volume of seismic profiling	
				2D, run. km	3D, sq. km
Barents Sea	1136300	333 300	0,293	333 300	437

Table

DEEP DRILLING STUDIES OF THE BARENTS SEA, STATUS OF 01.01.2002 *)

Region, object of zoning	Object area, km^2	Total volume of deep drilling, km	Rate of study m/km^2	Number of drilled wells				Rate of study, km^2/well			
				Total	Bottom at			Total	Depth < 2,0 km	Depth < 5,0 km	Depth > 5,0 km
					< 2,0 km	< 5,0 km	> 5,0 km				
Barents Sea	1 136 300	146,3	0,129	51	26	25	-	22 274,5	43 703,8	45 452,0	-

*) Studies fulfilled at the expense of subsoil users' own funds are considered partly.

Fig. 3

APPENDIX 1

The Kara Sea shelf is 889,9 th. km^2 large. It is also one of the biggest water bodies of the Russian Federation. 79,4 th. running km of seismic exploration lines have been shot here including 24,6 th. km of regional works (fig.4).

ÊARA SEA: SEISMIC AND DRILLING COVERAGE

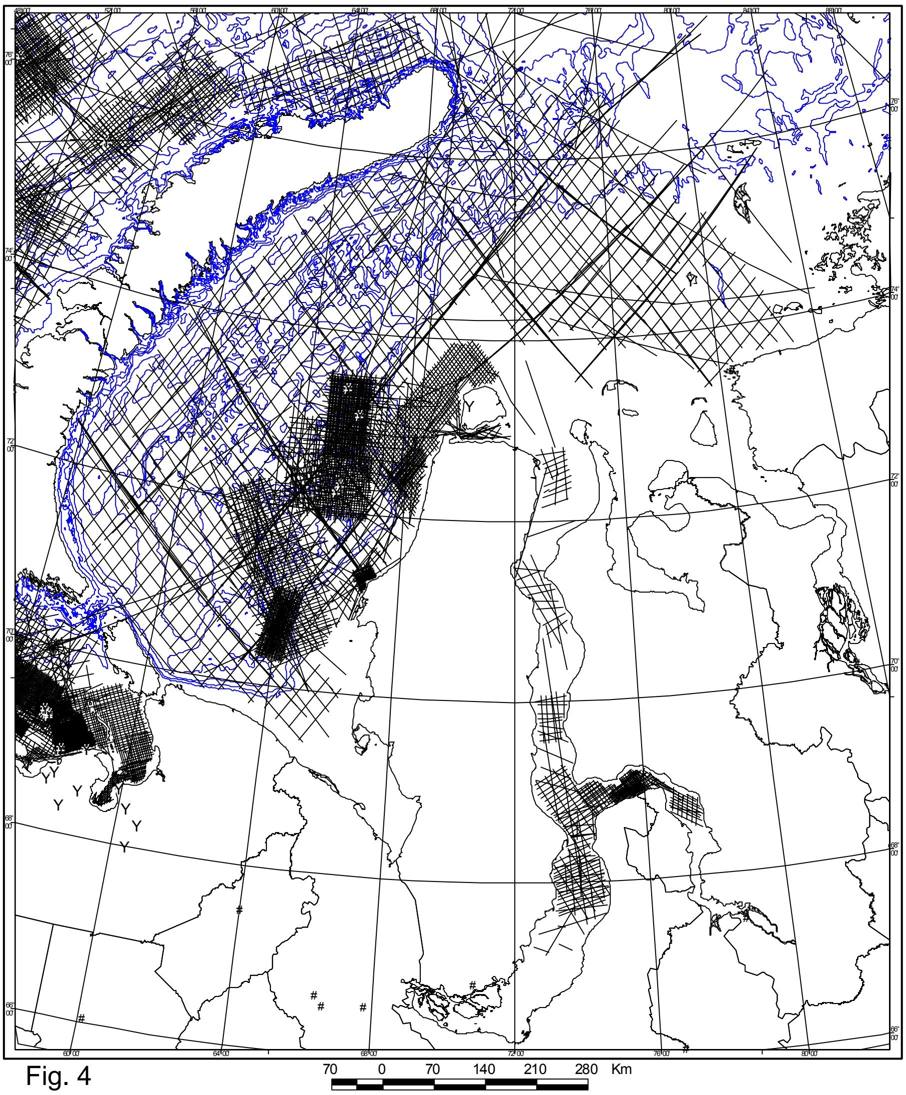


Fig. 4

The Kara Sea is studied non-uniformly. Seismic exploration density is maximal in the south part of the sea within the Leningradsky arch and the Obrutchev swell. Average density of CDP studies in the Kara Sea amounts 0,09 km/km^2 (fig. 5). At the same time, the sea part northwards of the Gydansky Peninsula and Belyi Island, between Taimyr and the north end of Novaya Zemliya is almost unstudied. Density of seismic studies there is less 0,01 km/km^2. Only several regional profiles cross the northmost part of the Kara Sea.

Table

SEISMIC STUDIES OF THE KARA SEA, STATUS OF 01.01.2002

Region, object of zonning	Area, km	Totallength of seismic lines, running km.	Density of seismic lines, km/km²
Kara Sea	889 900	79 400	0,09

Table

DEEP DRILLING STUDIES OF THE KARA SEA, STATUS OF 01.01.2002 *)

Region, object of zonning	Object area, km²	Total volume of deep drilling, km	Rate of study m/km²	Number of drilled wells				Rate of study, km²/well			
				Total	Bottom at the depth < 3,0 km	Bottom at the depth < 5,0 km	Bottom at the depth > 5,0 km	Total	Depth < 3,0 km	Depth < 5,0 km	Depth > 5,0 км
Kara Sea	889 900	9,9	0,011	4	4	-	-	0,011	0,011	-	-

Fig. 5

Marine deep drilling in the Kara Sea is fulfilled on the Leningradsky (two wells) and Rusanovsky (two wells) areas, 9.9 th. m in all. Besides, parametric wells were drilled on the islands Belyi (3 wells) and Sverdrup (1 well), 8 th. m in all. Drilling studies of the West-Siberian platform north offshore part are extremely scanty – not more than 0,05 m/km^2.

Besides discoveries of oil and gas fields, fulfilled studies resulted in detection of more than 500 promising traps in the Barents Sea (including its Pechora part) and more than 70 ones – in the Kara Sea (fig. 6). 34 traps among ones revealed in the Barents Sea are prepared for prospecting drilling and their localized initially-in-place resources amount to 1.1 bln. t of standard fuel. 5 fields of the basin belong to the Barents Sea proper, and 5 – to the Pechora Sea.

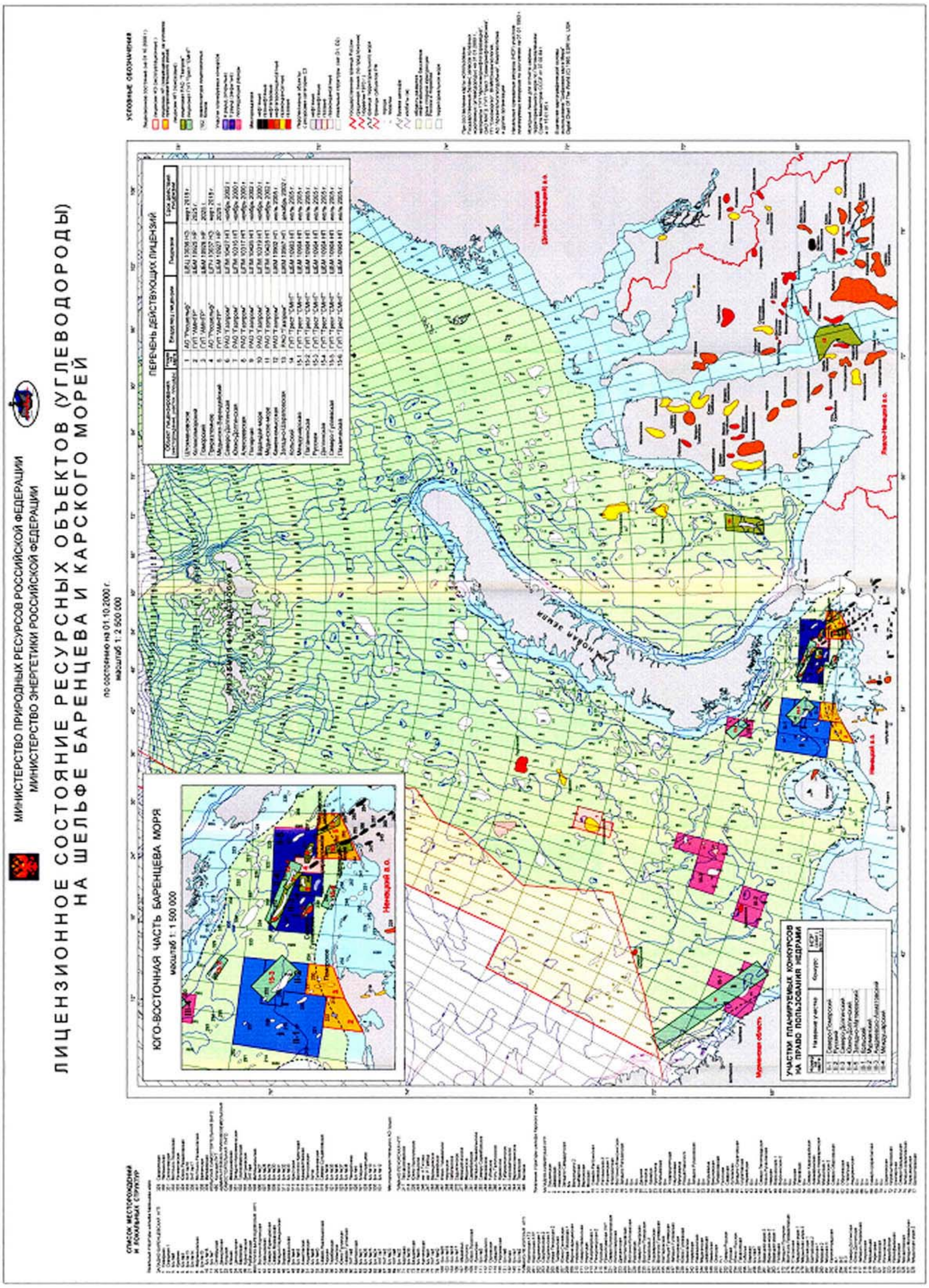


Fig. 6

APPENDIX 1

According to Russian classification, 2 discovered fields (the Shtokman and the Ledovy ones) are unique (more than 500 bln. m^3), 7 fields (the Prirazlomny, North-Gulyaev, Ludlovsky, Murmansky, North Varandey, Medynsky-more ones) are large (more than 30 mln. t of recoverable SF resources), and two more fields are medium.

Hydrocarbon potential

In spite of relatively poor covering of the Arctic shelf with studies, 14 hydrocarbon-bearing provinces have been discovered within its limits, and productivity of western provinces – from the Barents Sea to the Laptev Sea is generally proved.

According to today's estimation, total initial hydrocarbon resources of the Russian marine periphery come to 135 – 144 bln. t. of SF (in oil equivalent), and recoverable resources are about 100-105 bln. t. of SF. Up to 14,2 bln. t. fall at oil and about 82,5 trln. m^3 - at gas.

Analysis of total initially-in-place resources distribution by water areas reveals that its greatest share – about 66,5 % -- falls at the West Arctic seas (the Barents, Pechora, and Kara Seas) (fig. 7).

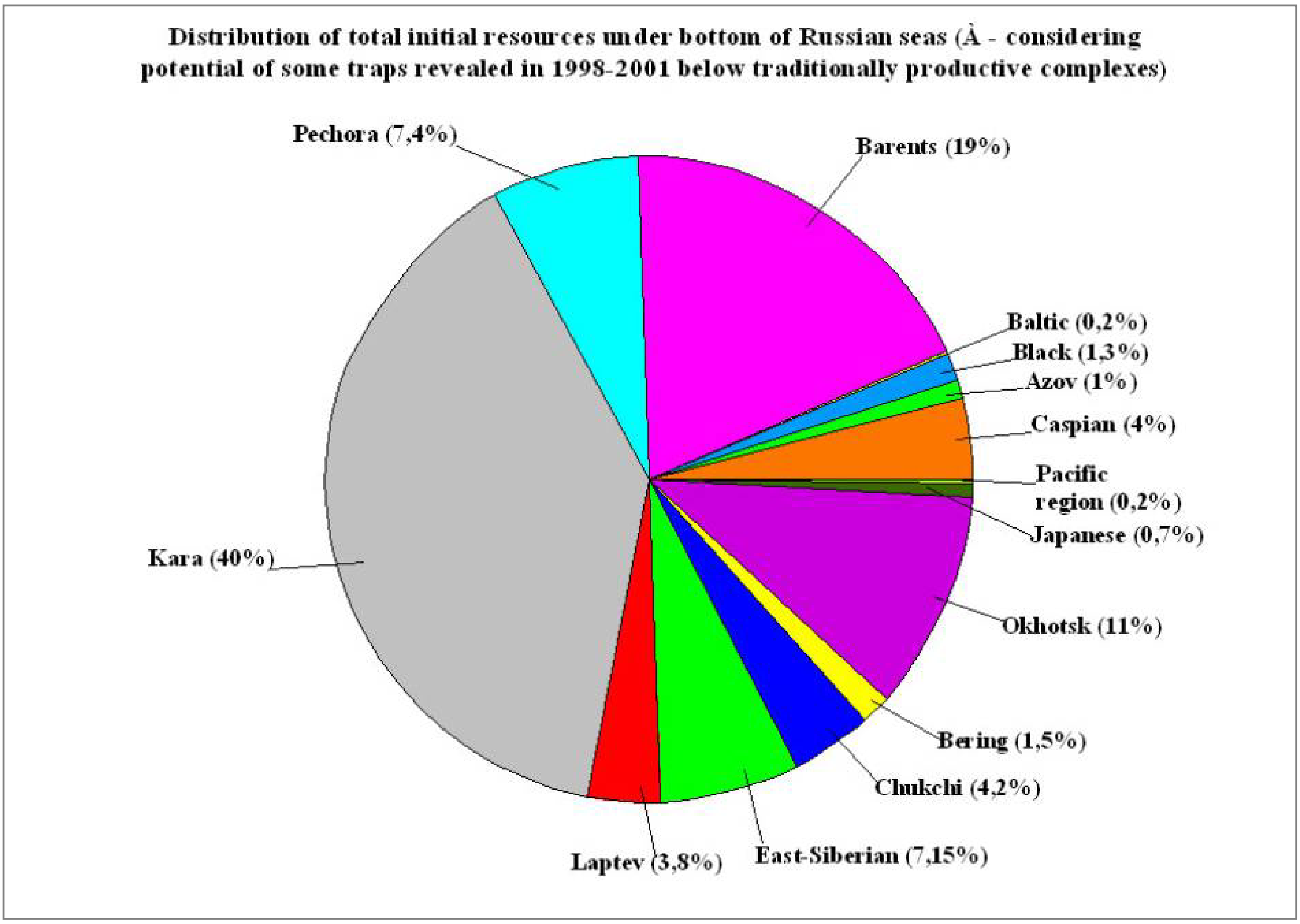


Fig. 7

Considering the ratio of total initial resources (fig. 8) and its part estimated as perspective or localized resources (C_3-D_1 categories of the Russian classification, possible and hypothetical resources of the American and European classifications) one may note that the share of high categories in the Barents and Kara Seas exceeds 35% whereas it is almost zero in the East-Arctic waters. It confirms once more top priority of hydrocarbon developing in the West Arctic water bodies, in the Barents Sea first of all.

APPENDIX 1

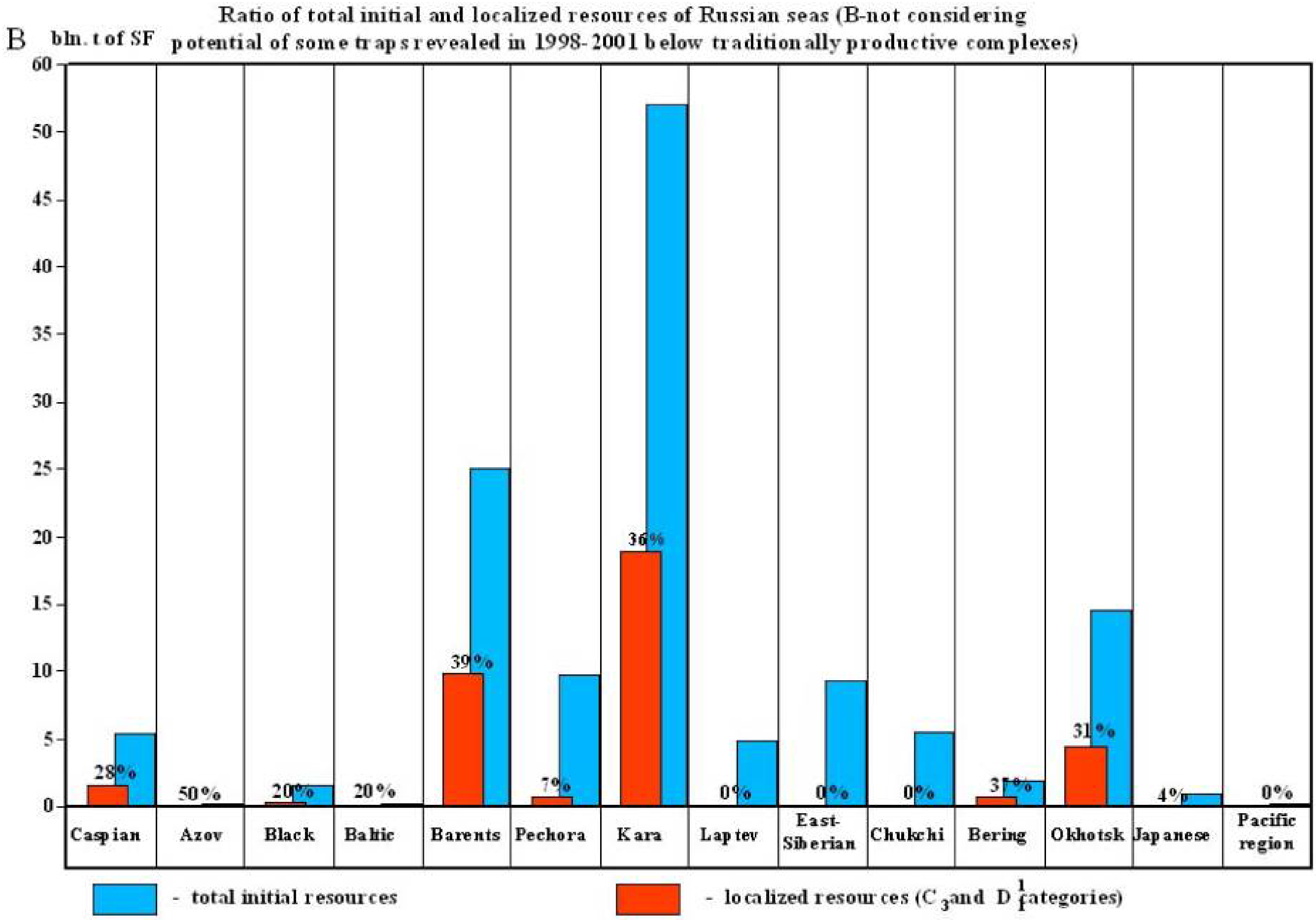


Fig. 8

Modern status and outlooks of marine subsoil use

They began to solve this task in 90-ties by competitive and non-competitive distribution of licenses on the background of insufficient legislative base. At that, distribution of license blocks within the Arctic water bodies turned out to be extremely uneven because of their different covering with studies. 13 licenses are in force now in the West Arctic sector, but no one is granted in the East Arctic. Among the granted licenses, 8 are licenses for geological study and oil-and-gas prospecting (6 – in the Barents Sea, 2 – in the Kara Sea), and 5 – for hydrocarbon exploration and production (all of them – in the south-east part of the Barents Sea, on the Pechora shelf).

The last tender of licenses for hydrocarbon exploration and production in the Arctic (Barents-1) took place in 1999-2000 in accordance with the Russian Government regulation of 03.11.99. Three blocks were suggested for the tender – the Kolokolomorsky, Pomorsky, and Varandei-Medynsky ones. According to the tender committee decision, the FSUE "Arktikmorneftegazrazvedka" won all the three blocks. This decision was approved by the Government of the Russian Federation in May 2000.

Regular holding of licensing rounds on terms favorable for both the State and the potential investor remains the basis of Russian policy in the sphere of subsoil use on the continental shelf including further prospecting, exploration, and production of hydrocarbons. Unlike the prior period, the modern stage of marine subsoil use should be grounded on well-advertised short-medium- and long-term (conceptual) programs of subsoil use licensing.

Analysis of covering with studies, register of valid licenses and other data form the basis for program elaboration subject to international and state norms concerning practical activity in the field of resource study and developing on the continental shelf.

In accordance with these statements, the Russian Federation has sovereign rights upon its continental shelf and exercises its jurisdiction via protection and status definition.

Federal lows and other norms have been elaborated resting on the Constitution of the RF and international law, that control subsoil use on the continental shelf. These are “On Subsoil”, “On the Continental Shelf of the Russian Federation”, “On Production Sharing Agreements”, regulations “On Procedure of Subsoil Use Licensing”.

On the 22nd of January 1997 State Duma of the Russian Federation passed the law “On Ratification of UN Convention on Maritime Law and Agreement about Implementation of the Part XI of UN Convention on Maritime Law”. In accordance with it, the Russian Federation is a subject of international law at prospecting of mineral and living resources of the continental shelf and the exclusive economic zone.

A new stage of licensing subsoil use on the continental shelf of the RF starts with the Program of Licensing and Geological Study, Prospecting, and Developing of Hydrocarbon Resources on Continental Shelves of North and Far East Seas in 2002-2005 that was elaborated in the middle of 2002 and approved in June 2002.

According to the “Program…”, the auctions and license tenders on blocks in the Arctic region in 2003-2005 will cover only the Barents Sea.

In the term under consideration, 22 blocks will be proposed within the Barents Sea. Their total area is 70.6 th. km^2 (about 1% of the Russian shelf area), and total recoverable resources are 2176 mln. t. of SF (~ 2% of the Russian shelf resources). Among these blocks, 16 will be proposed for auctions (28.6 th. km^2 in all; total recoverable resources – 1206 mln. t. of SF, average density of resources – 42 ths. t. / km^2), and the other 6 blocks – for geological study tenders (42 ths km^2 in all; total recoverable resources 970 mln. t. of SF, average density of resources – 23 ths. t. / km^2). Average area is 1.8 ths km^2 for the auction blocks, and 6.9 ths km^2 for the tender blocks.

Fig. 9

It is proposed to carry out tenders from 2003 till 2005 embracing all these blocks.

APPENDIX 1

The Barents-2 tender (I round), 2003, comprises blocks 1, 2, and 3 proposed for hydrocarbon prospecting, exploration, and production on terms that will be defined by the license agreement (fig. 9).

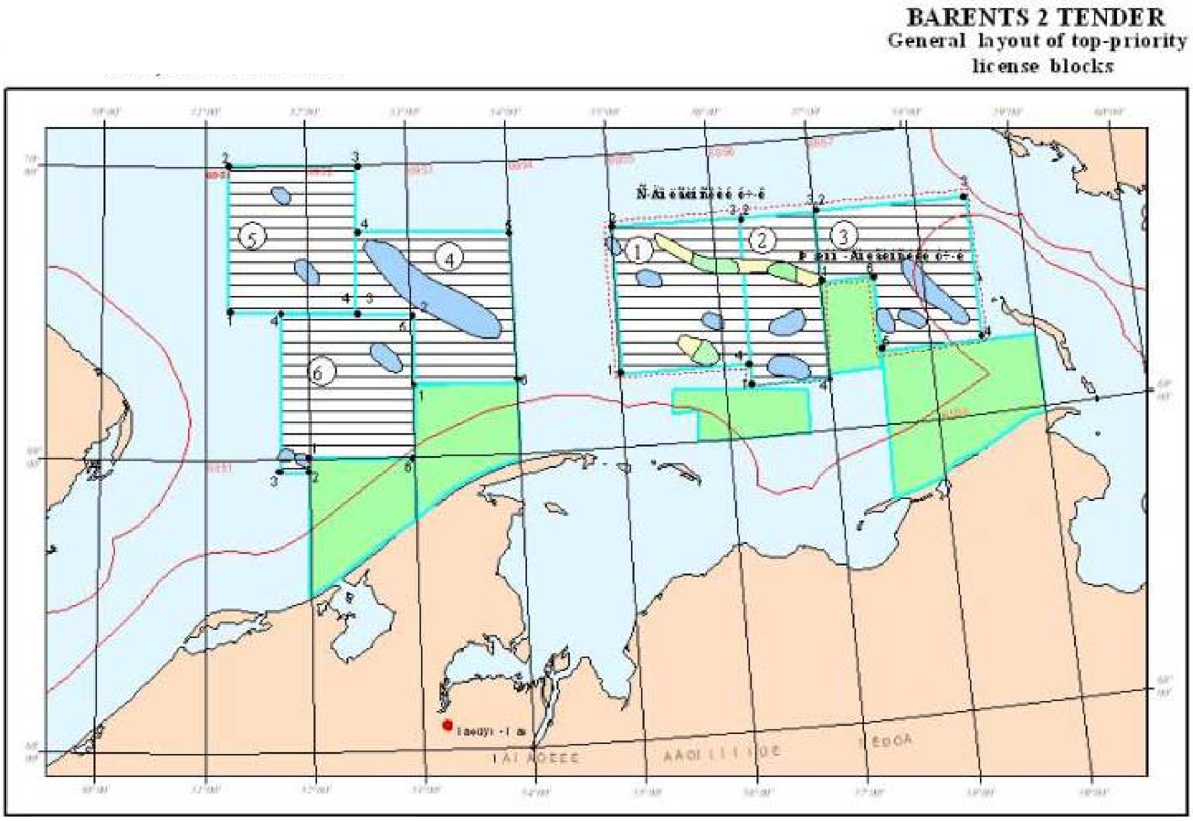


Fig. 9

Block 1 (North-Dolginsky) comprises the Bolshe-Gulyaevsky, West-Gylyaevsky, North-Gulyaevsky, Nesterovsky structures, and the North-Dolginsky structure (possible fielfd). Their dimensions vary from 2x4 to 50x9 km, and amplitudes – from 25 to 270 m. Productive horizons (Silurian-Permian) occur at the depth 2000-4500 m. Probable recoverable hydrocarbon resources amount to 360 mln. t. of SF.

Block 2 (South-Dolginsky) comprises the East-Gulyaevsky, Alekseevsky, and South-Dolginsky (field) structures. Their dimensions vary from 4x8 to 25x14 km, and amplitudes – from 40 to 400 m. Productive horizons (Silurian-Permian) occur at the depth 2200-5500 m. Probable recoverable hydrocarbon resources amount to 260 mln. t. of SF.

Block 3 (West-Matveevsky) comprises the Polyarny, West-Polyarny structures and folders of the West-Matveevsky anticlinal zone. Probable recoverable hydrocarbon resources amount to about 180 mln. t. of SF.

The Barents-2 tender (II round), 2003-2004, comprises blocks 4, 5, and 6 proposed for hydrocarbon prospecting, exploration, and production.

Block 4 (Russky) comprises the Russky structure. Its dimensions within the block run up to 90x20 km at the average amplitude 450 m. Perspective interval of the section is Silurian-Carboniferous (S-C); probable recoverable hydrocarbon resources exceed 107 mln. t. of SF.

Block 5 (North-Pomorsky-1) comprises the East-Kolguev and Razlomny structures. Their dimensions vary from 4x5 to 15x7 km, and amplitudes – from 45 to 200 m. Perspective interval of the section is Permian-Carboniferous (P-C), may be Triassic (T?). Probable recoverable hydrocarbon resources amount to about 30 mln. t. of SF.

Block 6 (North-Pomorsky-2) comprises the North-Pomorsky and North-Kolokolomorsky 3 and 4 structures. Their dimensions vary from 1x1 to 14x5 km, and amplitudes – from 10 to 50 m and more. Productive interval is formed by Ordovician-Triassic (O-T) rocks. Probable recoverable hydrocarbon resources amount to about 40 mln. t. of SF.

The Barents-3 (Kola) tender is intended to take place in 2003 (I round) and 2004 (2 round) (fig. 10).

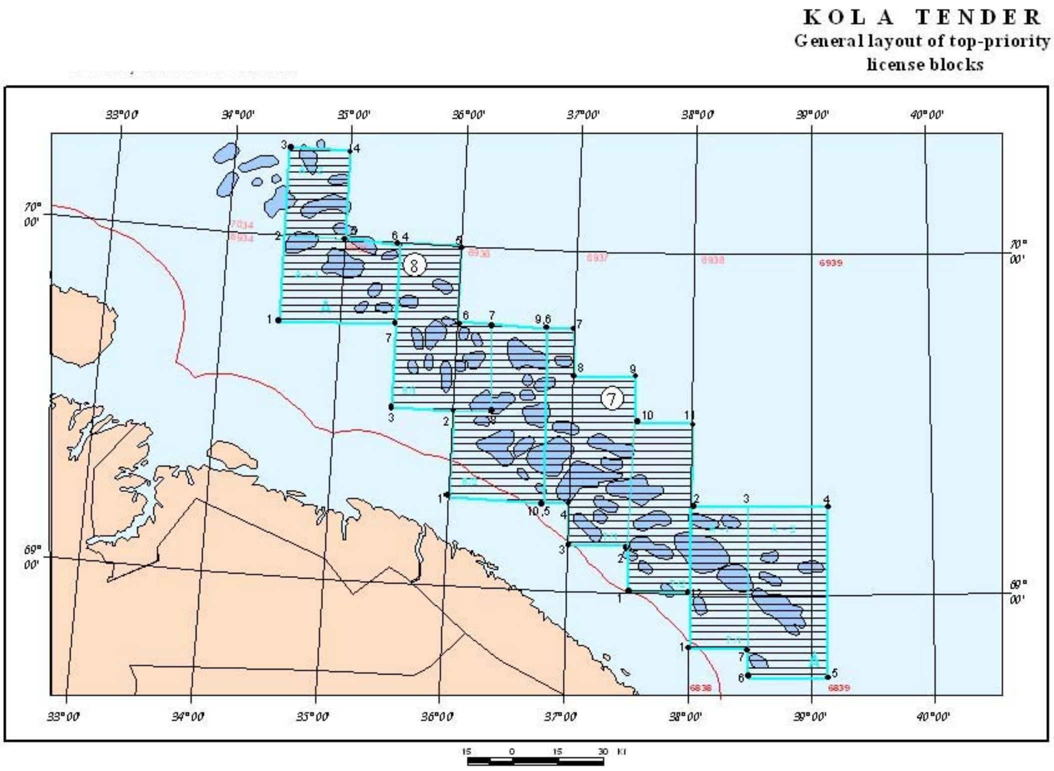


Fig. 10

The first round comprises four blocks situated on the Kola monocline in the zone of supposed structures of reef origin. The blocks are proposed for hydrocarbon prospecting, exploration, and production auction.

The second round comprises blocks proposed for geological study. It is necessary to note that the list of blocks proposed for different kinds of subbottom use as well as their order in the rounds may be changed depending on the number and substance of submitted applications.

Blocks 7/1 and 7/2 have the area 1.5 and 1.0 th. km^2, and their recoverable resources amount to 27.0 and 18.0 mln. t of standard fuel (SF) correspondingly. The blocks may be united into one (Kola-1) for the auction if necessary considering relatively small amount of their recoverable resources.

Blocks 8/1 and 8/2 have the area 1.6 and 1.3 th km^2, and their recoverable resources amount to 20.0 and 18.0 mln. t of SF correspondingly. The blocks may also be united into one (Kola-2) for the auction if necessary considering relatively small amount of their recoverable resources.

Blocks A-1 and A-2 in the zone of supposed reefs have the area 0.9 and 1.4 th. km^2, and their recoverable resources amount to 18.0 and 10.0 mln. t of standard fuel (SF) correspondingly. The blocks may be united into one (Kola-3) for the auction if necessary considering low expert appraisal of their recoverable resources.

Blocks B-1 and B-2 in the zone of supposed reefs have the area 1.0 and 0.6 th. km^2, and their recoverable resources amount to 20.0 and 13.0 mln. t of SF correspondingly. The blocks may also be united into one (Kola-4) for the auction.
Enlarged areas 10 and 11 are proposed for geological study tenders (fig. 11).

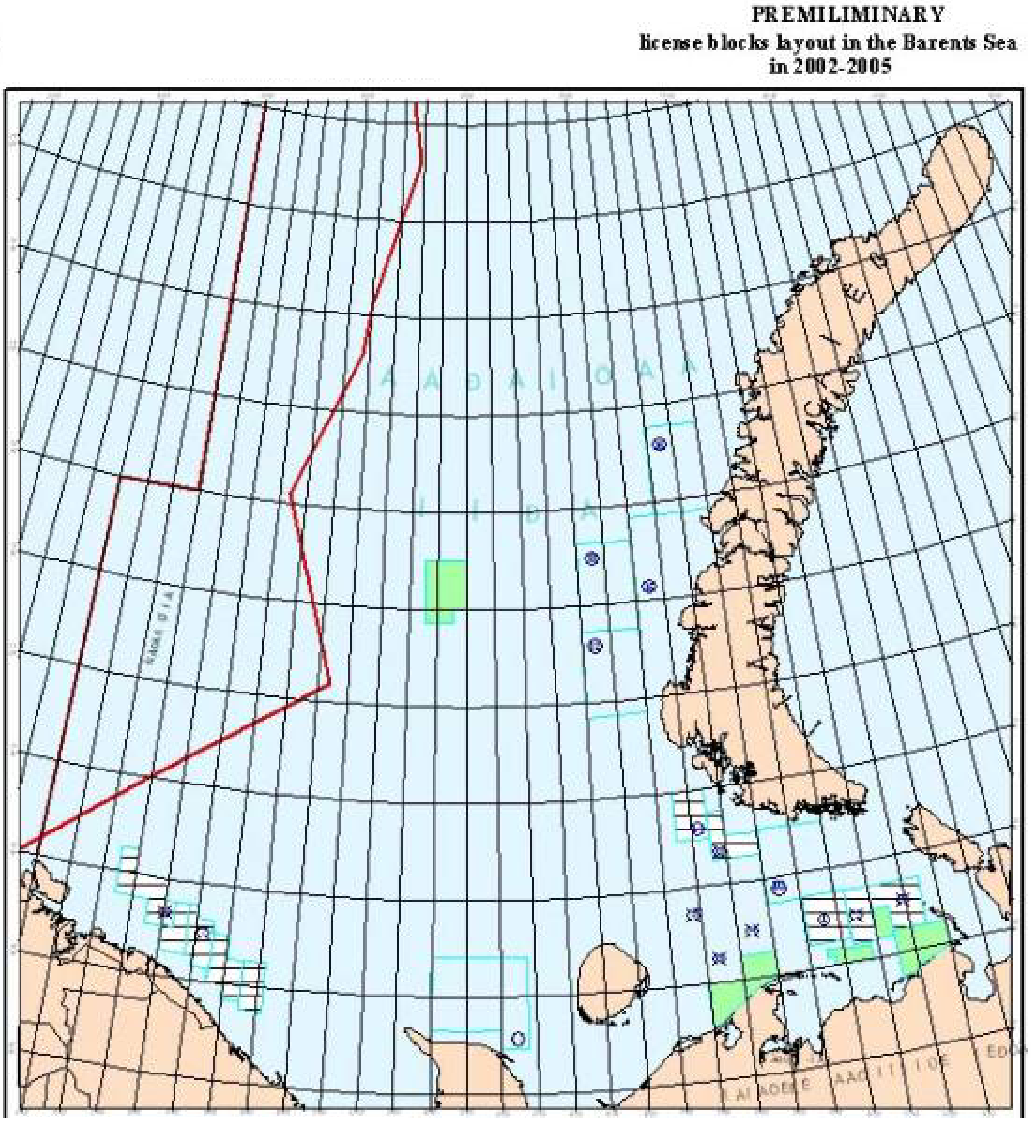


Fig. 11

Area (block) 10 (East Mezhdusharsky) comprises up to 10 structures of different size. The South-Rakhmanovsky structure is the biggest of them. Probable recoverable resources of the block are not estimated. Total initial-in-place resources may amount to about 300 mln. t. of SF starting from specific density data of 1993.

Area (block) 11 (Korginsky) comprises two promising traps – the Korginsky anomaly of the "pool" type and the Korginsky anomaly of the "reef" type. Probable recoverable resources of the traps are not estimated. Total initial-in-place resources of the block amount to 300 mln. t. of SF according to the estimation made in 1993.

The Barents-4 tender, 2004-2005, comprises two areas (blocks) for geological study (12, 13) and two – for exploration and production (9, 14).

Block 9 comprises the Papanin structure. Its dimensions are 37x4 km at the amplitude 150 m. Productive horizons (Silurian-Permian) occur at the depth 3500-4500 m. The structure is located in the most well-studied part of the Prednovozemelsky dislocation zone. Probable recoverable hydrocarbon resources are from 50 to 60 mln. t. of SF.

Area (block) 12 (Dmitrievsky) comprises the large Dmitrievsky structure and a series of non-structural traps. Probable recoverable resources are not estimated. Total initial-in-place resources of the block amount to 650 mln. t. of SF according to the estimation made in 1993.

Area (block) 13 (West-Mityushikhinsky) comprises a group of non-structural traps. The traps №3, №4, and №7 are the largest of them. Probable recoverable resources are not estimated. Total initial-in-place resources of the block may run up to 500 mln. t. of SF according to the estimation made in 1993.

Block 14 (Mezhdusharsky) comprises the Mezhdusharsky structure situated in the Prednovozemelsky dislocation zone. Probable hydrocarbon resources amount to 50 - 60 mln. t. of SF.

The Barents-5 tender, 2005, comprises two blocks (15, 16) for geological study according to the preliminary plan. Total initial-in-place resources of the area (block) *15 (Mityushikhinsky)* and the area (block) *16 (Krestovy)* are about 1250 mln. t. of SF according to the estimation made in 1993.

Preliminary schedule of auctions and license tenders giving rights to subsoil use on the continental shelf areas in 2003-2004 (fig. 16) stipulates the first round of the Barents-2 tender (eastern blocks)
in 2003. Three more blocks in the Pechora Sea (the Barents-2 tender, western blocks) and some areas on the Kola shelf will be proposed in 2003-2004.

Provisional schedule of top-priority tenders and license rounds (2002-2003)

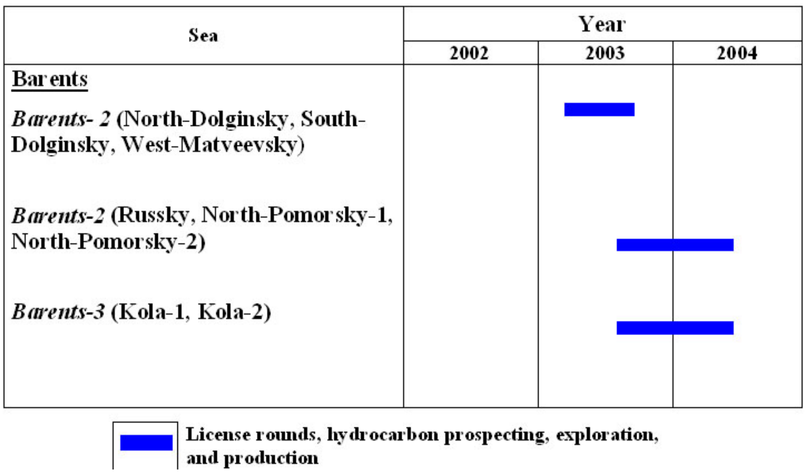
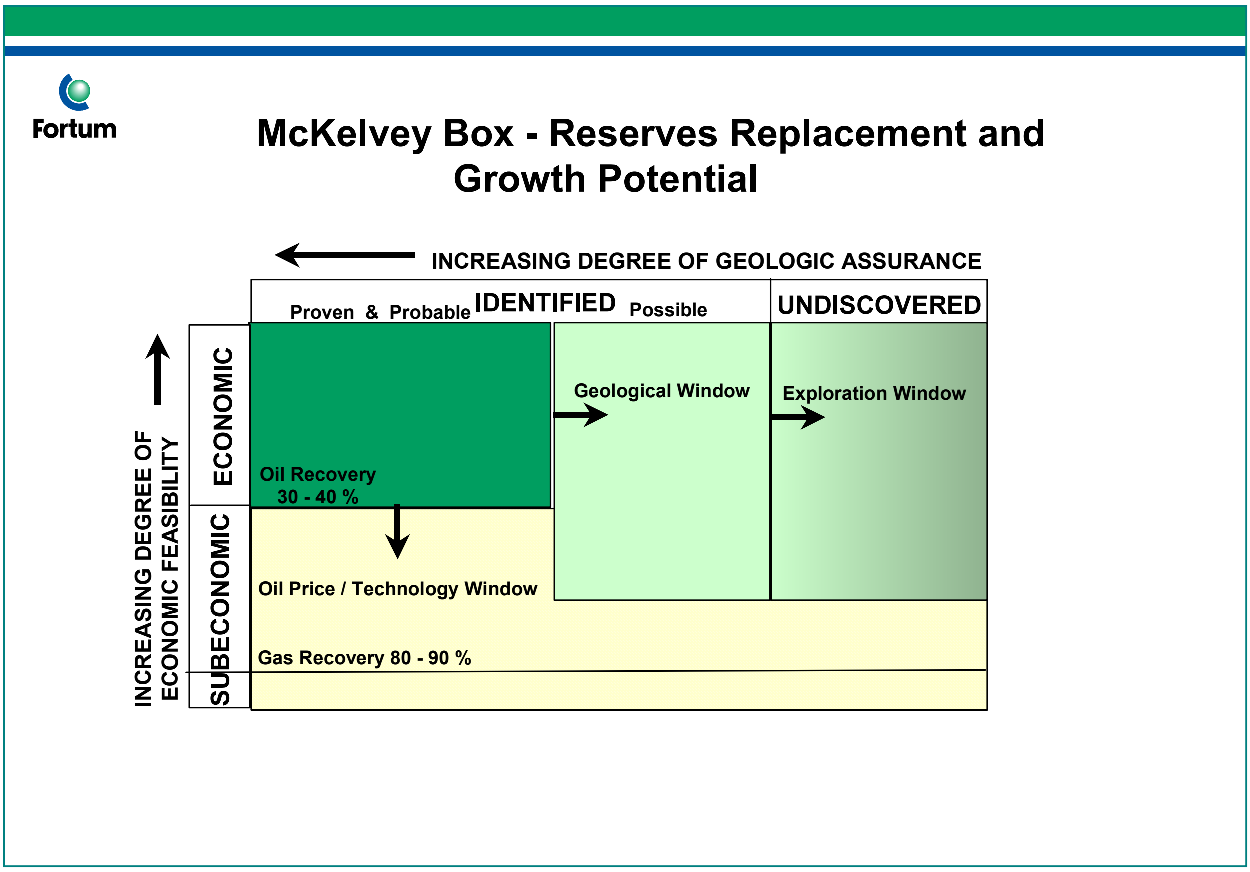
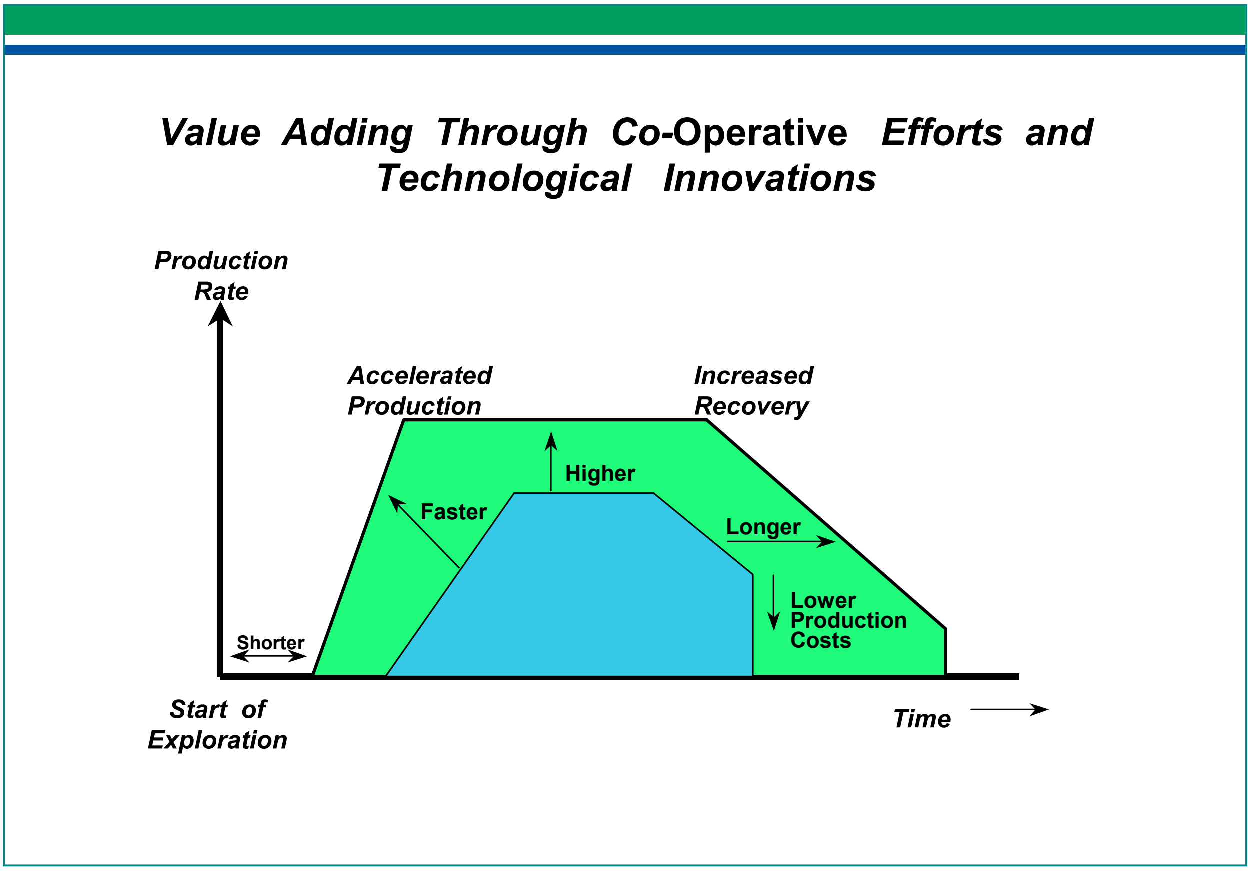
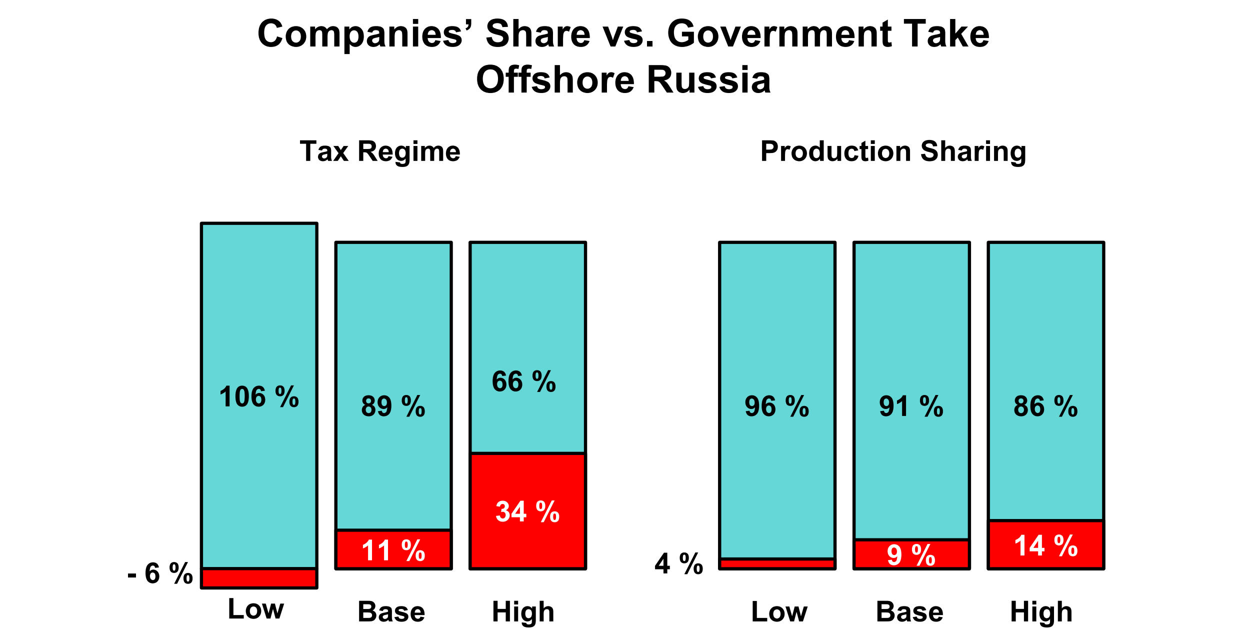


Fig. 12


Fortum
McKelvey Box - Reserves Replacement and Growth Potential
INCREASING DEGREE OF GEOLOGIC ASSURANCE
IDENTIFIED
Proven & Probable
Possible
UNDISCOVERED
INCREASING DEGREE OF ECONOMIC FEASIBILITY
ECONOMIC
SUBECONOMIC
Oil Recovery 30 - 40 %
Geological Window
Exploration Window
Oil Price / Technology Window
Gas Recovery 80 - 90 %


Value Adding Through Co-Operative Efforts and Technological Innovations
Production Rate
Accelerated Production
Increased Recovery
Higher
Faster
Longer
Lower Production Costs
Shorter
Start of Exploration
Time



Arctic Oil and Gas Reserves

- **The Arctic region is poised to become a substantial new supplier of oil and gas.**
- **This promise will only be fulfilled if Arctic hydrocarbons can be tapped and transported in a *commercially attractive* way, yet safely and securely, i.e. *environmentally sound* way.**
- **The investment rate in the Arctic depends on how the mineral owners of those regions succeed in their licensing policies to increase *investors' confidence*.**
- **We need to shift away from the concept of oil and gas resources as something finite and exhaustible to a wider concept, that acknowledges the presence of those qualities, but views reserve dimensions largely to a *function of economics, i.e. extraction cost*.**
- **The supportive government policies should move from pre-discovery risks to more *capital intensive post-discovery risks*.**

ROLE OF THE MARINE TRANSPORTATION OF ENERGY RESOURCES FOR THE EXPORT FROM THE RUSSIAN ARCTIC

N.I. Matyushenko,
Head of the International Cooperation Department under the Ministry of Transport of Russia

The export of energy resources is the most important source of income of the Russian economy. At present the export of oil and petroleum products reached 250 million t, of gas – 190 billion m^3 a year.

During last ten year periods the extractive industry of Russia has shifted to the zone of the Far North. The richest deposits of mineral raw materials, first of all of energy resources are concentrated here. Rational exploration of these natural resources is the national priority in the economic strategy of Russia.

The Arctic Marine Transportation System (AMTS) provides for all the needs of the country in the arctic freight traffic. It is based on the icebreaker fleet the impact power of which is determined by nuclear icebreakers.

In the past decade, in connection with sharp reduction of the cargo traffic in the Arctic, incomes from the operation of fleet with rates of payment for the services of the escorting of ships on the NSR in force during these years do not cover its maintenance costs. The deficit is made up (though not in full) by subsidy from the federal budget.

During the whole previous period of the exploration of the Arctic the energy resources, primarily petroleum products, were brought to the Arctic to meet requirements of the local industrial enterprises, transport and satisfy social needs. Such delivery was made mainly by water through the Northern Sea Route and northern rivers flowing into arctic seas.

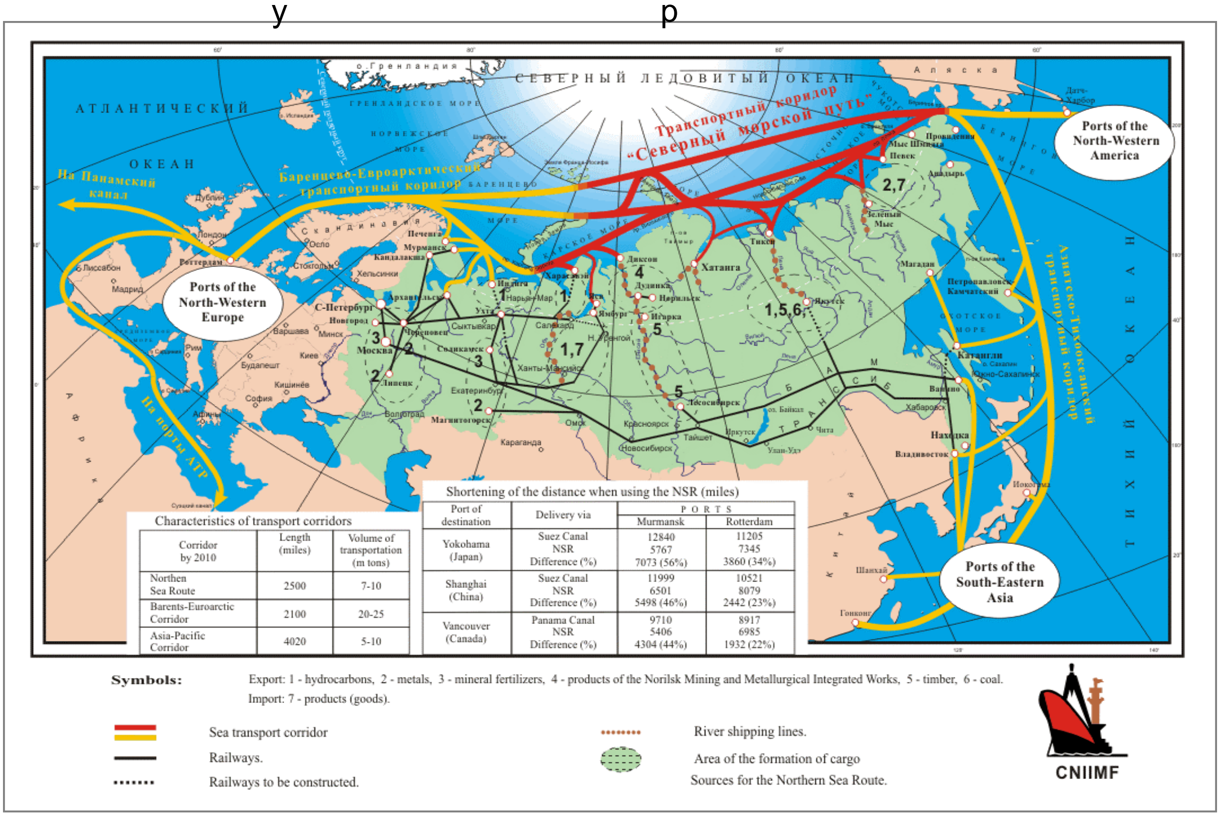
And only now, as oil and gas deposits in the arctic zone including shelf of arctic seas are being developed the export transportation of energy resources from the Arctic begins.

Export transportation of oil and gas condensate will be carried out predominantly by sea both directly from deposits and with preliminary delivery to terminals by pipelines or river vessels (by railway) for subsequent transshipment to sea ships.

Liquefied or compressed natural gas will be transported from the Arctic for export by special sea gas carriers.

In 2002, 5.3 million t of oil and gas condensate were taken out by sea from the Arctic zone this amount including (fig. 1):

- from the Varandey terminal - 240 thousand t
- from the Kolguev Island - 120 thousand t
- from the Ob Gulf - 100 thousand t
- from the port of Tiksi (estuary of the Lena river) - 50 thousand t
- from the port of Vitino (Kandalaksha) - 2 800 thousand t
- from the port of Arkhangelsk (Talaghi) - 2 000 thousand t



Characteristics of transport corridors

Corridor by 2010	Length (miles)	Volume of transportation (m tons)
Northen Sea Route	2500	7-10
Barents-Euroarctic Corridor	2100	20-25
Asia-Pacific Corridor	4020	5-10

Shortening of the distance when using the NSR (miles)

Port of destination	Delivery via	PORTS	
		Murmansk	Rotterdam
Yokohama (Japan)	Suez Canal NSR Difference (%)	12840 5767 7073 (56%)	11205 7345 3860 (34%)
Shanghai (China)	Suez Canal NSR Difference (%)	11999 6501 5498 (46%)	10521 8079 2442 (23%)
Vancouver (Canada)	Panama Canal NSR Difference (%)	9710 5406 4304 (44%)	8917 6985 1932 (22%)

Fig. 1. Russian transport corridor "Northern Sea Route" within the system of international transport corridors West-East-West

Besides, 700 thousand t of oil were overloaded via the roadstead terminal in the Kola Gulf (near the port of Murmansk) from small tankers to large-capacity ones for the delivery to ports of Europe and USA; in 2003, it is intended to bring this volume to 3 million t.

Marine transportation of oil for export from deposits of the Varandey group by 2006 will reach 5 million t and by 2015 may exceed 12 million t per year. In 2006-2007 the first oil for export will be taken from the Prirazlomnoye deposit by 2015 reaching 8-10 million t.

By 2015, volume of oil and gas condsensate from deposits of the Kolguev Island, Ob, Yenisei and Lena river basins will exceed 1.5 million t per year.

About 6 million t a year will be shipped for export via Vitino, Arkhangelsk, Belomorsk.

When plans of the construction of factory for the liquefaction of natural gas near cape Kharasavey on the Yamal Peninsula are implemented, by 2020 up to 5 million t of liquefied gas from the Yamal deposits will be exported to the world market.

Substantial changes in the geography of the export of oil may be introduced with the construction of the northern export pipeline West Siberia-Murmansk (fig.2) and of a powerful oil terminal near Murmansk thus providing for the export of 80 million t of oil a year. It will be a non-freezing terminal in an enclosed bay with depths sufficient for the year round shipment of oil by tankers with a deadweight of 300 000 t this being an important advantage ensuring profitable economic conditions for the delivery of oil to the world market including the North American one. This terminal will have substantial advantages in comparison with ports of the Baltic and Black Seas, as ships operating here will be not concerned with the necessity of passing through international Baltic and Black Sea straits with their serious restrictions.

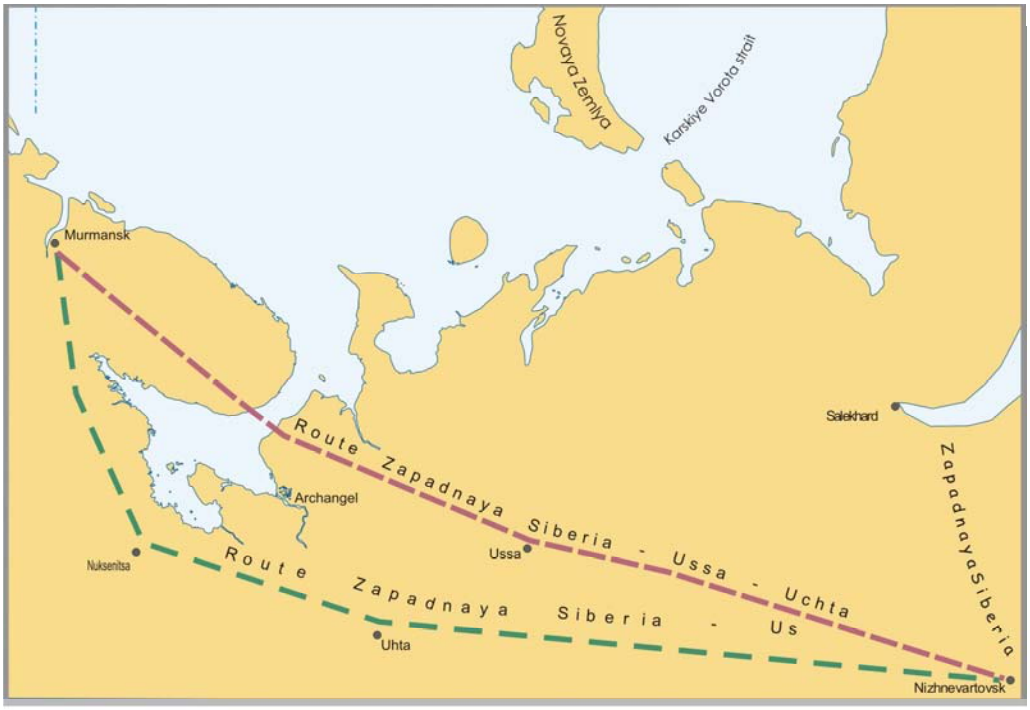


Fig. 2. Pipeline Western Siberia – Murmansk (project)

The most important aspect substantiating the advisability of the construction of an oil-trunk pipeline in this direction is the possibility of connecting this pipeline to new perspective deposits situated in the West Siberia in the area of Ob and Tazovskaya Gulfs, on the Yamal Peninsula as well as in the European North of the Russian Federation. Route of the oil pipeline runs also through the Timan-Pechora oil and gas province to be intensively developed.

As a result, the marine transportation of considerable volumes of export energy resources may by switched over from deposit areas to the Kola Gulf terminal.

At the first stage it is intended to select a location and build an oil transshipment system (sea terminal) in the area of Murmansk enabling still before the construction of the oil-trunk pipeline to carry out the transfer of oil to supertankers with ice class delivering oil from the Varandey and Khylguy groups of deposits, from those of the Kolguev Island and from other deposits of the shelf of the Barents Sea as well as the railway delivery of oil to the terminal.

Existing Russian icebreakers mainly built in seventies-eighties of the last century are now obsolete and subject to taking out of service.

The Russian Transport Ministry has developed and will realize in coming years the programs of the overhaul-period renewal and prolongation of service time of nuclear and arctic diesel icebreakers for 8-15 years. Total cost of these works is about 95 million USD.

It is envisaged to further develop the icebreaker fleet the emphasis being laid on icebreakers with nuclear propulsion plants having high icebreaking capability and unrestricted endurance (fig. 3).

Fig. 3 Nuclear icebreaker Rossija

Financing of the construction of icebreakers of new generation is a special and so far almost insoluble problem. To complete the construction of nuclear icebreaker "50 Let Pobedy" since this year in accordance with the decree of the Government of the Russian Federation there will be no budget subsidy for the maintenance of the linear icebreaker fleet. Budget funds meant for the support and maintenance of the icebreaker fleet are assigned for the completion of icebreaker "50 Let Pobedy" (80 million USD in 2003-2005).

Nuclear icebreakers are to be built at the expense of the federal budget. Possible is the share participation of users of icebreaker services, mainly of commercial companies which cannot export their products and carry out the production activity without the icebreaker assistance. We are considering the possibility for the construction of icebreakers of the mandatory drawing in of financial resources of oil and gas companies having got licenses for the development of oil and gas fields in the arctic zone.

Commercial enterprises exploring natural resources of the Arctic should build also diesel-electric icebreakers as universal supply icebreakers and jointly with shipping companies develop the arctic transport fleet and oil-gas transshipment terminals at the expense of their own and drawn in funds. Minimum state support will be directed to subsidize a part of the interest rate on credits of Russian banks, when building ships at domestic shipyards.

To ensure the transportation of energy resources from the Arctic zone the oil and shipping company now place orders for the construction of ice class tankers with a deadweight of 70-80 thousand t (fig. 4).

Financing of current expenses for the maintenance of the icebreaker fleet including works on the overhaul-period renewal and prolongation of service time of icebreakers will be provided for at the expense of earnings from the payments for icebreaker services at rates regulated by the Ministry of the Economic Development of Russia. Order dated 10.01.2003 approves new higher rates for the icebreaker fleet services on the NSR (Annex 1).

It should be noted unfortunately that the rise in rates of per ton dues will adversely affect the attractiveness to use the Northern Sea Route for transit as well as for export transportation, especially since the Russian Transport Ministry always declared that as cargo transported along the NSR increases in volumes payment for the escorting of ships would reduce. This measure is certainly forced and provisional. On the completion of the construction and putting into operation of nuclear icebreaker "50 Let Pobedy" and also after finishing works on the prolongation of service time of icebreakers it is envisaged since 2008 to smoothly reduce rates this reduction reaching 35-40% by 2015.

Undoubtedly of greatest importance is the economic efficiency of the marine transportation of energy resources for export from the Arctic zone. It follows from table 1 that the per ton due rate for services of escorting tank ships on the NSR is 15.02 USD. Proceeding from this rate all the calculations have to be made. One can assume, however, that for the transportation of energy resources from deposits of the coast and shelf of the Barents Sea the per ton rates will be substantially reduced.

Fig.4. Tanker Primorye in the ice of Tatar Strait

ANNEX 1

Order of the Ministry of Economic Development and Trade of the Russian Federation
10 January, 2003, Moscow

On the change of rates for services of the icebreaker fleet on the Northern Sea Route

With a view to ensure financial balancing of work of the icebreaker fleet on territory of the Russian Federation and on the Northern Sea Route I am ordering:

1.To fix rates for services on the escorting of ships along the Northern Sea Route in accordance with the annex.

First Deputy Ministry
I.Materov

Rates for services on the escorting of ships on the Northern Sea Route to ensure the transportation of cargo

Table 1

№	Nomenclature of cargo	Unity	Rate in roubles	USD at the exchange rate 1 USD=31.5 roubles.
1.	General cargo			
1.1	Cargo transported in standard containers	1 t of nominal gross mass of container	936.00	29.71
1.2	Non-ferrous metal	ton	1530.00	48.57
1.3	Converter matte	ton	1422.00	45.14
1.4	Products of mechanical engineering and instrument-making including equipment and parts thereof	ton	2200.00	69.84
1.5	Vehicles, cars and their parts	ton	2300.00	73.02
1.6	Articles out of metals of industrial purpose	ton	1560.00	49.52
1.7	Others	ton	936.00	29.71
2.	Bulk cargo	ton	631.00	20.03
3.	Bulk liquid cargo	ton	473.00	15.02
4.	Timber cargo			
4.1	Round lumber	ton	105.00	3.33
4.2	Saw-timber and other products of timber, woodworking, pulp and paper industry	ton	132.00	4.19

Note: The above rates do not apply to the transportation of cargo to the Far North areas and equated regions with restricted time of delivery the purchase and supply of this cargo being carried out at the expense of the federal budget and regional funds of the state financial support of the preschedule delivery of products (goods) to the Far North areas and equated regions.

APPENDIX 2

Rates for services on the escorting of ships along the Northern Sea Route collected from transport ships sailing in ballast, towing, technical, auxiliary (including research) and other floating vehicles not intended for cargo transportation

Table 2

№	Area of escorting	Unity	Rate in roubles	USD at the exchange rate 1 USD=31.5 roubles.
1	Transit along the waterways of the Northern Sea Route	ton of full displacement	800.00	25.40
2	To ports of the Laptev Sea from west or from east, to ports of the East Siberian Sea from west or from east	ton of full displacement	550.00	17.46
3	To ports of the Kara Sea and to ports situated on Ob and Yenisei rivers from west	ton of full displacement	160.00	5.08

Note: When ships are sailing in ballast to ports (places of loading) situated within the Northern Sea Route, for the loading of cargo or when sailing in ballast from ports (places of unloading) after unloading of cargo the rates of the above table do not apply.

Rates for services on the escorting of ships along the Northern Sea Route to ensure the transportation of cargo to the Far North areas and equated regions with restricted time of delivery the purchase and supply of this cargo being carried out at the expense of the federal budget and regional funds of the state financial support of the preschedule delivery of products (goods) to the Far North areas

Table 3

№	Nomenclature of cargo	Rate in roubles	USD at the exchange rate 1 USD=31.5 roubles.
1	Bulk liquid cargo	230.00	10.16
2	Other cargoes	450.00	14.29

APPENDIX 2

Stena Bulk

Role of Marine Transportation in Russia's Energy Export

A Shipping Company's Perspective

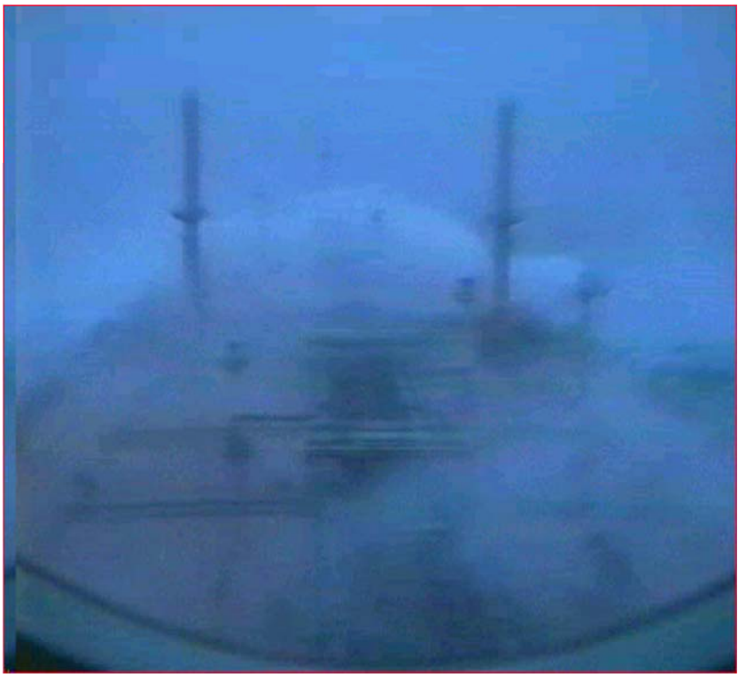
Åke Rohlén
Vice President
Stena Bulk AB
Head of CIS Representative Office
Moscow

Tanker images… sunshine

Stena Vision
- 312,000 dwt
- Twin-skeg
- Shallow draft
- Redundant

Stena Bulk

Reality…



Oil shipments Trans-Atlantic in reality.

"Stena Constellation"
273,000 dwt
337 m LOA

Voyage from Norway to Canada.

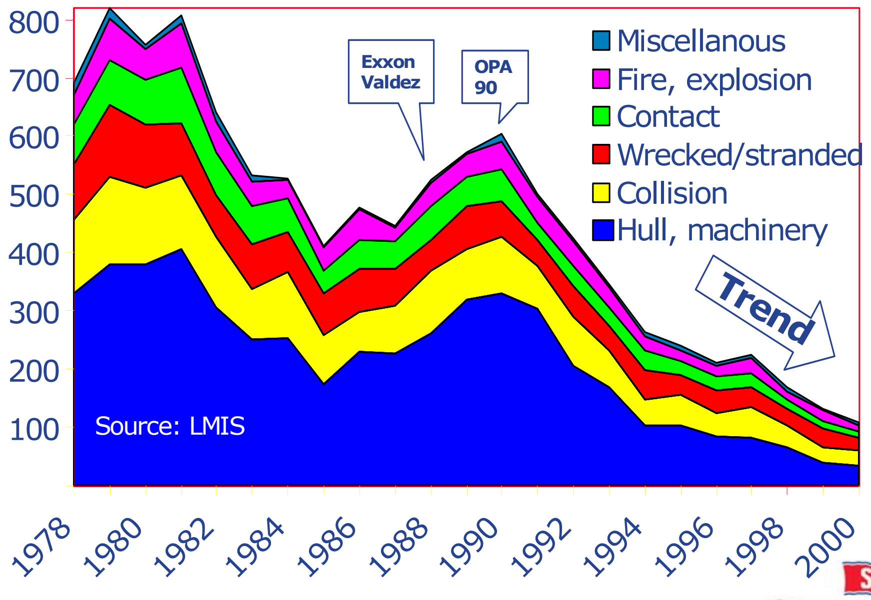
Russian exports trans Atlantic?

Stena Bulk

Stena Bulk

Stena Bulk

Tankers: Safer and of higher quality than ever….



Stena Bulk

But, the world expects us to have 0 accidents

"99.97% safe transportation means that out of 1,000 tanker liftings, 3 will have some problems."

"This is not good enough to safeguard an uninterupted oil flow from Russia"

Stena Bulk

99.97% Safety – Not good enough

Primorsk* (BPS)
(Crude Oil)

30 milion mt/year (2004)

If average cargo = 90,000 mt
330 cargoes/year
= one accident per year

Vysotsk*
(Products)

9 million mt/year (2005)

If average cargo = 50,000 mt
180 cargoes/year
= one accident every 5.5 years

High Safety is required:

- **To safeguard oil income**
- **To protect the environment**
- **To be a "responsable neighbour"**

*NB: Examples only.
Both terminals are expected to profile vessels of higher than "average" standard.

Stena Bulk

Sensitive areas - definition

- Confined waters
- Intense traffic
- Vulnerable ecology

➡ probability

X

➡ consequence

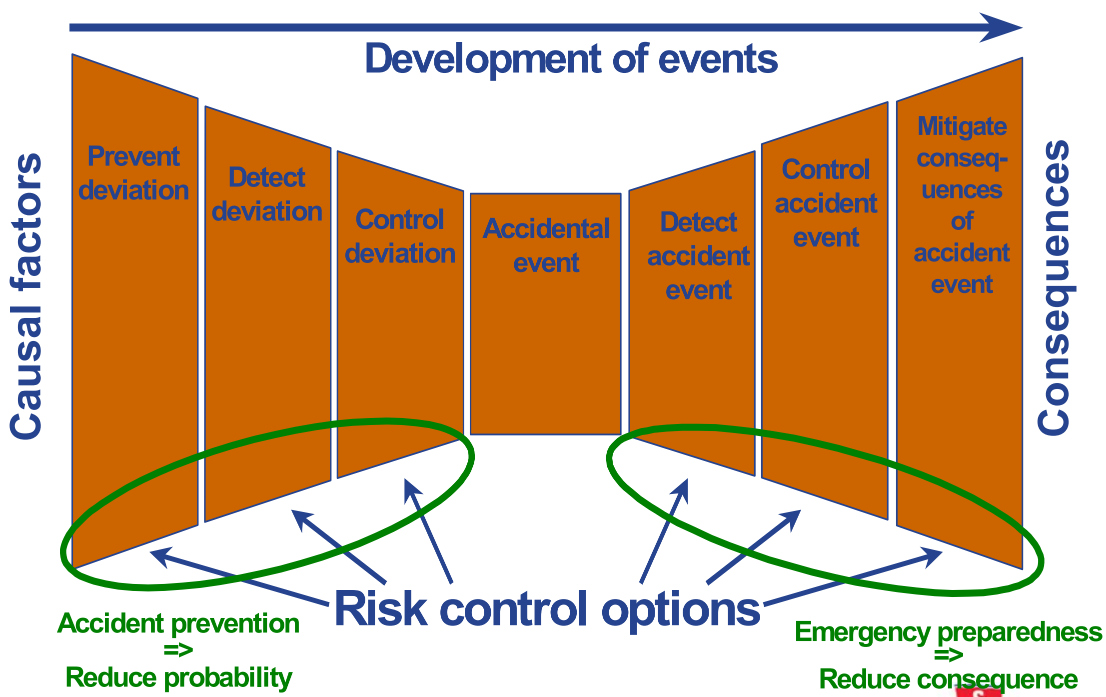
=

Risk

Russian Exports from:
- Baltic
- Black Sea
- Murmansk/White Sea
- Sakhalin/Far East

Stena Bulk

The concept of risk reduction



Stena Bulk

Shipowner

- Suitable tonnage
  - Cargo
  - Trade
  - Environment
- Operation
  - Well trained crews
  - Risk analysis
  - Risk prevention
- Innovation
  - Developing more suitable ships
  - Developing safer methods of operation

Stena Bulk

Cargo Owners

- Look for cost effective solutions
  - Consider total cost - Not just Freight rate
- Owners will provide quality transporation
  - But there are no free lunches
- Long-term quality
  - Only for long-term cargo committment
- Take control of shipping quality
  - CIF vs FOB

Stena Bulk

Shipowner - Business

A business for Stena?
Yes, we will provide vessels with better

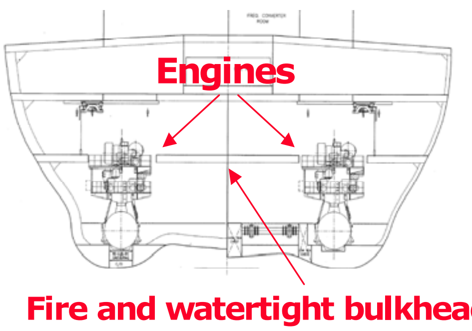
- **Lifting capacity** (economy of scale + less risk)
- **Redundancy** (for safer passage)
- **Manoeuvrability** (safer in confined waters)
- **Containment** (complet double hull)
- **Navigation control** (training + latest technology)

Our Wide Body Concept – The Stena MAX Series

Stena Bulk

Safety: Complete Redundancy

- Double engines, propeller shafts, propellers, steering gear and rudders
- Two engine rooms divided by a fire and water tight bulkhead
- All control systems are independent and redundant
- Separate fuel supply systems to each engine



Stena Bulk

Cargo Intake pays for Safety

- **Stena V-MAX** (265,000 dwt on 16.76 m – best in class)
  - Two Stena V-MAX on long-term charter to Sunoco, Philadelphia
- **Stena C-MAX** (10,000 dwt on 6.5 m – best in class)
  - Two Stena C-MAX on long-term charter to ChevronTexaco
- **Stena P-MAX** (54,500 dwt on 11.3 m – best in class)
  - Specially developed for the Baltic Product Trade
  - Manouverability, Redundancy, Ice-class
  - At design stage

All with a unique level of safety – paid for by the 30-40% higher cargo intake compared to standard new vessels.

Stena Bulk

Conclusion

- **Oil exports**
  - growing
- **Need protection –**
  - shipping disruptions
- **Safer technology /know-how**
  - available
- **Safety does not cost more**
  - over time

Stena Bulk

Conclusion

- Russian oil exports are growing
- Protect them from shipping disruptions
- Safer technology and know-how is available
- Safety does not cost more – over time

If you want quality, say so, and do so!

Oil should always travel First Class!

Thank you.

Stena Bulk

Arctic Submerged Loading Terminal (ASLT)

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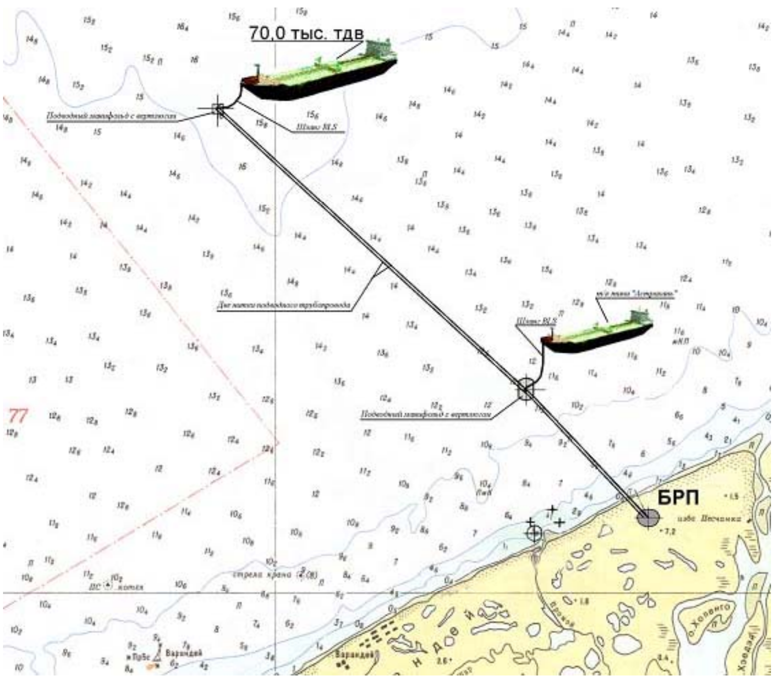
Arctic Submerged Loading Terminal (ASLT)



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Arctic Submerged Loading Terminal (ASLT)

Computer image

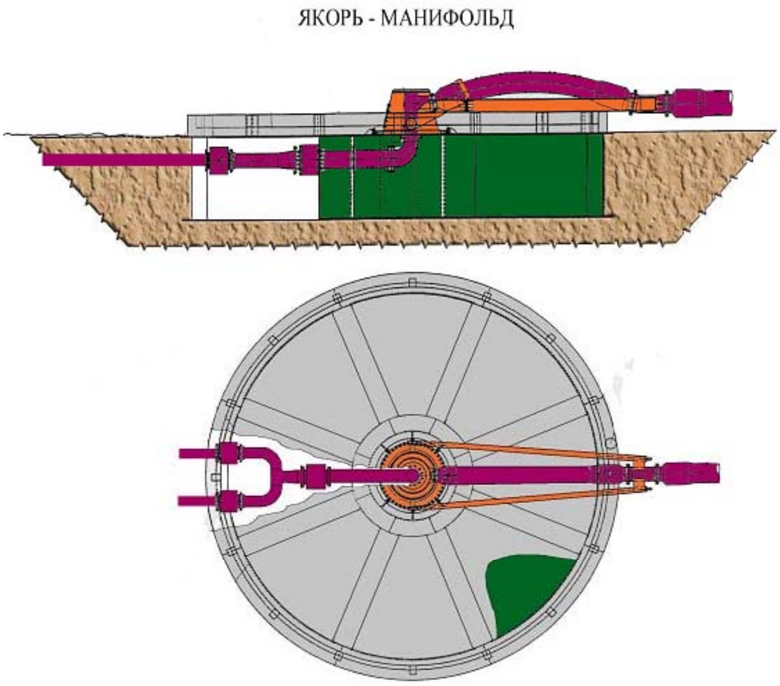
Arctic Submerged Loading Terminal (ASLT)

Design Criteria

- The arctic terminal system is designed to withstand a maximum tanker mooring force of 125 tons.
- The arctic submerged loading terminal is suitable for a wide range of applications and locations, in shallow waters and drifting ice conditions. In ice conditions the tanker is assisted by icebreaker.
- The design pressure for the cargo system on the arctic terminal including valves, flanges, etc. is 300 psi.
- The ASLT is designed and built according to class requirements as DNV and international standards as OCIMF and IMO.

Arctic Submerged Loading Terminal (ASLT)

PLEM Side-view and Planform



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Arctic Submerged Loading Terminal (ASLT)

PLEM Loading on board of special carrier for delivery at the site

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Arctic Submerged Loading Terminal (ASLT)

PLEM – as last seen prior to be submerged and installed at the place

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Arctic Submerged Loading Terminal (ASLT)

On-deck assembling of flexible connection between existing pipeline and PLEM

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Arctic Submerged Loading Terminal (ASLT)

Heaving the messenger line during first loading on board mt "Saratov"

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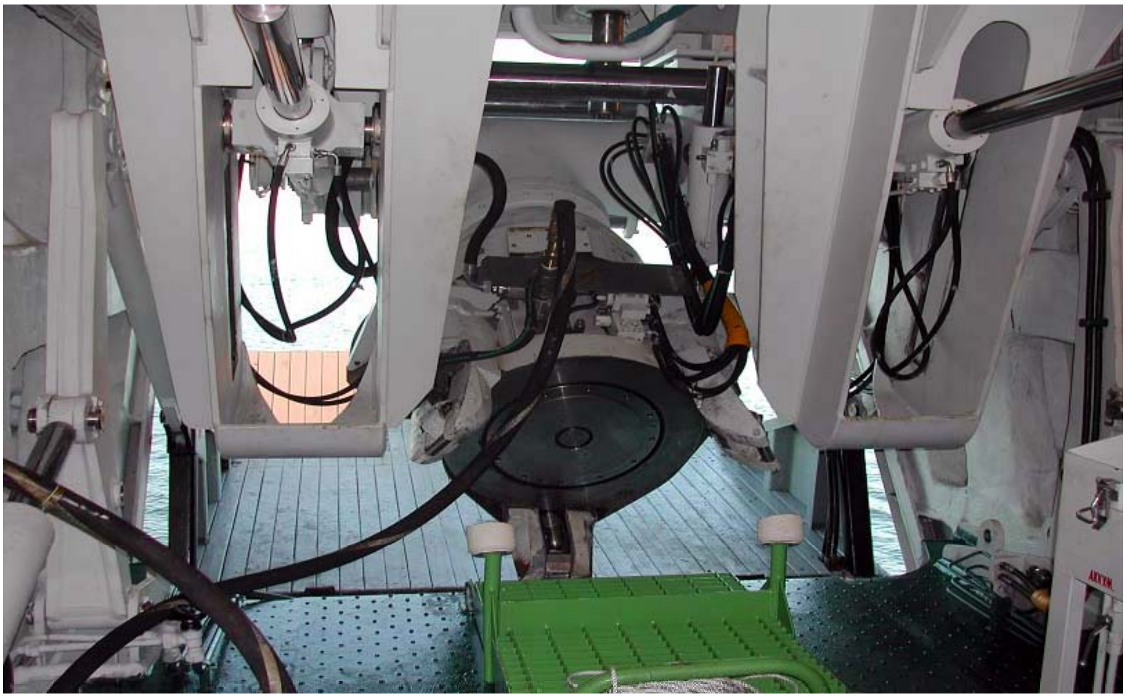
Arctic Submerged Loading Terminal (ASLT)



MT "Saratov" – Bow Loading System manifold

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Arctic Submerged Loading Terminal (ASLT)

Heaving in Mooring Hose

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Arctic Submerged Loading Terminal (ASLT)

Connecting Mooring Hose to Bow Loading System

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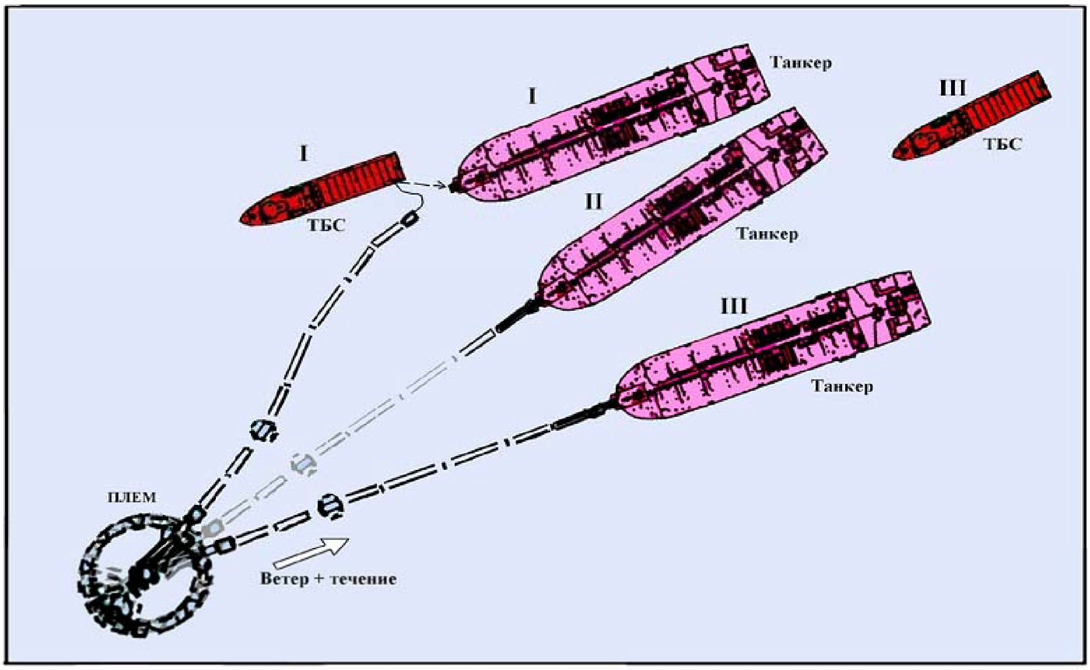
Arctic Submerged Loading Terminal (ASLT)



Mooring to the terminal

Murmansk Shipping Company

Address:

15, Kominterna str.
183038 Murmansk, Russia

Murmansk Shipping Company

Tel (8152) 481-049
Fax (8152) 481-148
TLX 126113
E-mail: postmaster@msco.ru

ARCOP SCENARIO

By Kimmo Juurmaa
Kvaerner Masa-Yards Inc.

Background

The basic idea of the ARCOP project is to continue the work that was performed within INSROP and ARCDEV projects. Thus also the scenario is selected to reflect the open questions after these projects.

ARCOP will also discuss the justification for marine transportation. For this purpose the scenario should be selected so, that there is also an alternative way for the transportation.

ARCDEV resulted in the finding that the economics of the transportation were low, the transport cost being 70 EUR / ton. Several reasons were found to cause this result, both technical and administrative. One of the main reasons was that the transported cargo volume was low. To overcome this limitation the scenario should be based on a transportation task where the cargo basis is large and the use of bigger transportation units is physically possible.

Suggested scenario

The suggested transportation task is transportation of crude oil from Timan Pechora area to the European market. Since ARCOP deals mainly with problems related to ice, the main focus will be on the transportation between the loading terminal in the Pechora Sea and the transhipment terminal in Murmansk area. Direct transportation from the loading terminal to the market will also be considered as an option.

Design basis

The more detailed design basis data will be presented in the actual ARCOP deliverables. Below only the basic data to describe the area will be presented.

Bathymetry

The offshore loading terminal is located offshore Varanday in water depth of 22 meters to allow tankers of up to 120.000 DWT to approach the terminal. The selected location and some considered alternatives are shown in fig. 1.

Hydro-meteorological conditions

The ice conditions that will be used as input values have been determined using existing statistics as well as actual field data from the area collected during several years' expedition program. Some of the basic parameters are shown in table 1.

Selected fields

In the Timan Pechora region the potential oil fields are located in two major areas, one in the Varanday region and the other in area some 150 km to the west. From these areas following fields were selected for the study:

- Roman Trebs
- Varandey
- A. Titov
- Central Khoreiver
- Toravey
- Naul
- Labogan

The location and suggested pipelines to connect the fields are shown on picture 2.

Production profiles

All the oil fields have their specific production profile and related time schedule. When combining several fields together one can reach almost any peak value and length of plateau production. To simplify the problem we will just assume a plateau that can be considered longer than the economic lifetime of the transportation system and design all the systems for that volume. With this principal the production volume is 328.000 barrels per day.

Discussion

The suggested scenario fulfils the requirements from the background. The required transportation capacity calls for a large-scale transportation system. The sea area has enough water depth to allow the use of large size vessels. The ice conditions in the area are sufficient to reveal the influence of different technological solutions. And the need for this transportation is real and should be realized within a reasonable time.

The only problem with the suggested scenario is that it is not located in the area, which is officially defined as the Northern Sea Route. This means that those rules and regulations that are today in force in the Northern Sea Route need not necessarily be followed in the scenario. However, the area of the selected scenario is in fact under discussion to be included in the Northern Sea Route area. For this discussion ARCOP will give valuable information on the influence of extending the Northern Route also to the Pechora Sea. On the other hand, if this area will remain outside the Northern Sea Route, it will be interesting to see what the relevant rules and practices will be. In any case the studies and the discussion within ARCOP will be done on a wider base so that all the questions related to the Northern Sea Route will be touched.

The potential alternatives for the transportation of the scenario oil are the pipelines either to the Baltic or to Murmansk for transhipment. These alternatives will be evaluated to the level of available data. No actual costing of these alternatives will be done within ARCOP.

ARCOP scenario

By
Kimmo Juurmaa
Kvaerner Masa-Yards Inc.

www.arcop.fi 5th FP project/DGTREN

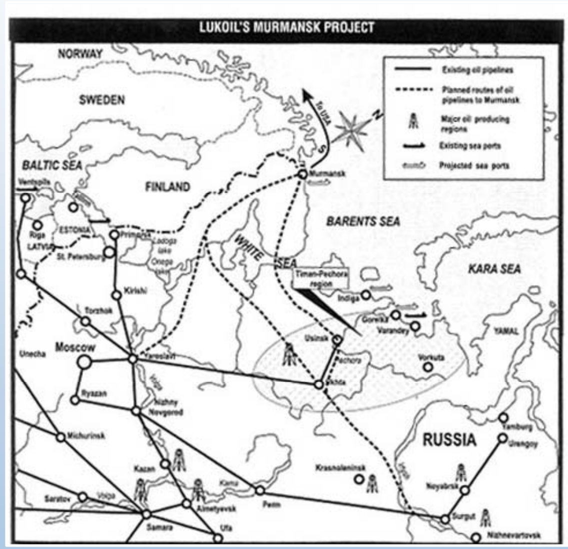
Background

- ARCDEV and INSROP results
- Low volumes and high costs
- No alternatives for rules
- No alternatives for transportation means

www.arcop.fi 5th FP project/DGTREN

Suggested scenario

- Production from the onshore fields at Timon Pechora area
- Transportation directly to Europe or via transhipment in Murmansk
- Alternative pipelines to the Baltic or to Murmansk



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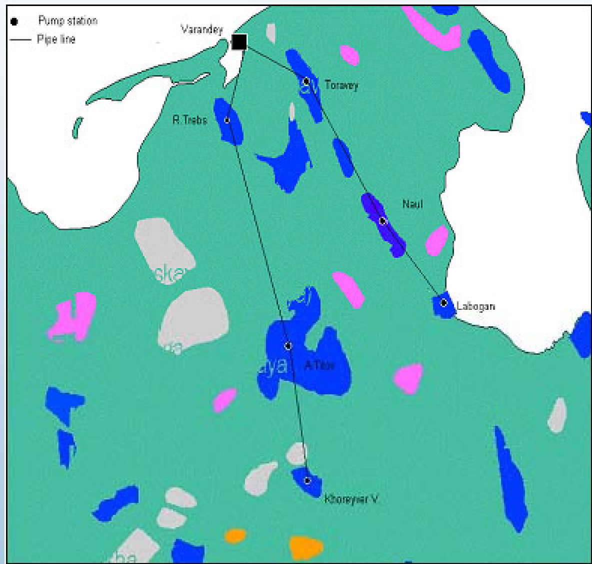
Selected fields

- Roman Trebs
- Varandey
- A. Titov
- Central Khoreiver
- Toravey
- Naul
- Labogan



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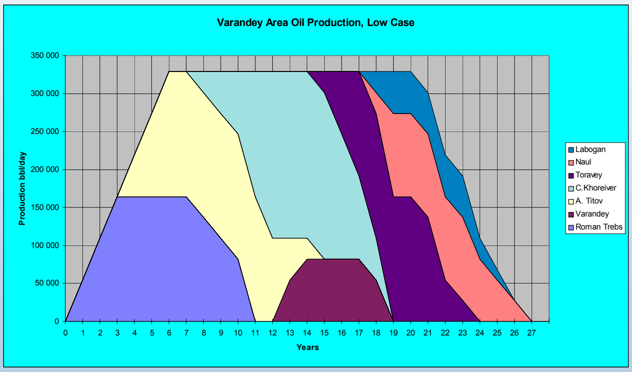
Production profiles

- Plateu production to be reached within 5 years
- Plateu will last more than 20 years
- Production will be 328.000 barrels per day



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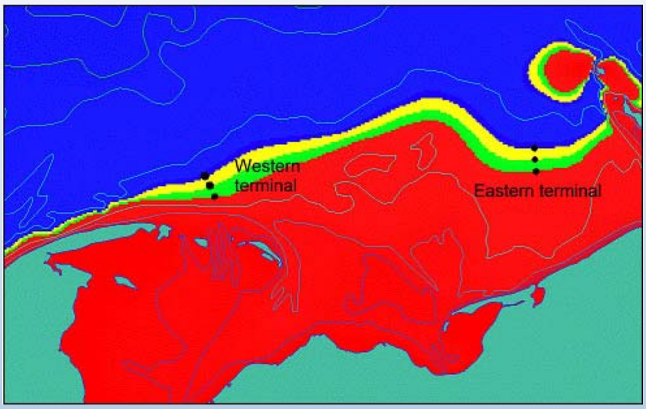
Bathymetry

- Shallow shore line
- Water depth selected to allow use of 120.000 tdw vessels (22.0 m)
- Smaller vessels need shorter subsea pipeline and smaller loading terminal



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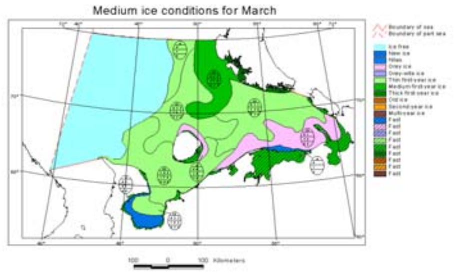
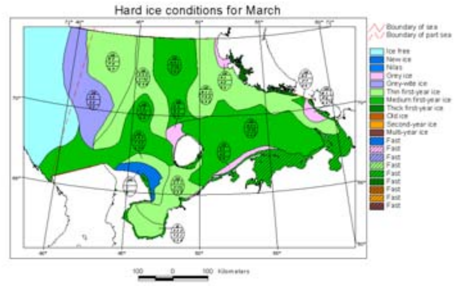
Ice conditions

Maximum level ice thickness	1,6 m
Maximum rafted ice thickness	2,4 m
Maximum ridge sail height	4,0 m
Maximum ridge keel depth	20,0 m
Maximum ice drifting speed	0,75 m/s





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Discussion

- Suggested scenario is realistic
- The development should take place in close future
- The volumes are sufficient
- Use of large size vessels is possible
- Potential for alternative means of transportation exists
- Rules to be adopted for the area are under discussion
- Ice conditions are challenging

www.arcop.fi 5th FP project/DGTREN