ARCOP
Arctic Operational Platform

Technology and Environment

Workshop 3

Finland 2003

The European Commission
Community Research
Competitive and Sustainable Growth

TREN Directorate General

Arctic Operational Platform

ARCOP

The Fifth Framework Programme Project of the European Community

Technology and Environment

Workshop Report 3

Ministry of Trade and Industry

Anders Backlund
Liisa Laiho
Britta Jourio

Finland 2003

Deliverable 6.3

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.

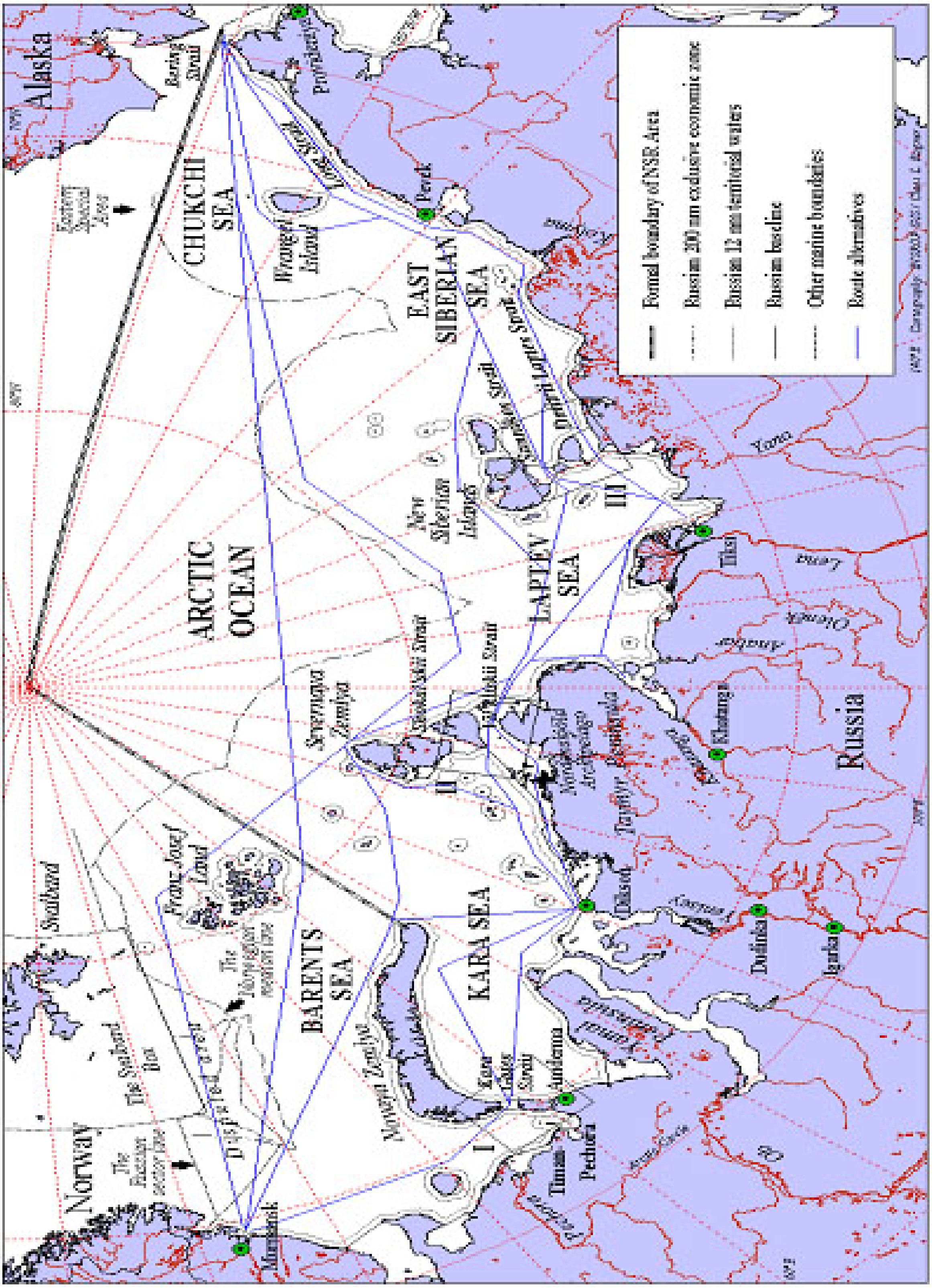
The second workshop in this series was dealing with Industry Needs. It aimed at defining the future transportation needs at the NSR. As marine transportation, in the case of oil and gas transport, has to compete with pipelines, the workshop intended to present the pros and cons of marine transportation 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 27th 2003 Technology & Environment	
Chairman: Joachim Schwarz	
Opening remarks	Chairman Joachim Schwarz
Integrated transportation system	Kvaerner Masa-Yards, Kimmo Juurmaa *Comment: Central Marine Research and Design Institute*
Ice service capabilities	Arctic and Antarctic Research Institute, Vladimir Smirnov *Comment: Finnish Institute of Marine Research*
Use of satellites to serve the traffic	Nansen Environmental and Remote Sensing Center, Sandven *Comment: Arctic and Antarctic Research Institute*
Traffic management systems	Hamburg University of Applied Sciences, Jens Froese *Comment: Central Marine Research and Design Institute*
Training requirements	Wagenborg Shipping, Anniek Platzer *Comment: Central Marine Research and Design Institute*
Environmental impact assessment	Alpha Environmental Consultants, Kjell Moe *Comment: Arctic and Antarctic Research Institute*
Oil spill management	Central Marine Research and Design Institute, Gennady Semanov *Comment: SINTEF*
Social impact	University of Lapland / Arctic Centre, Nina Messthyb *Comment: Arctic and Antarctic Research Institute*
Discussion and conclusions	

2. INTEGRATED TRANSPORTATION SYSTEM

2.1 Integrated transportation system, Summary

Kimmo Juurmaa, Kvaerner Masa-Yards Inc., Finland

System components

In the ARCOP context the transportation system is understood very widely. The system does not consist only of ships and cargo handling but also from other factors which are needed to make the transportation possible. These other factors consist of all what a shipping company needs to be able to practice shipping in ice conditions. And also of all those things that are required from the home country the waterways which are used for the transportation. All these will be discussed under the different work packages of ARCOP. The economic evaluation will however consider only those parts that are directly connected to a specific transportation task that is the transportation vessels, assisting fleet and loading terminal. The more general factors like the VTMIS in the area, the required training, the administrative infrastructure and the measures for environmental protection are discussed and analyzed, but the costs originating from these are assumed to be included in the waterway fee system.

Transportation vessels

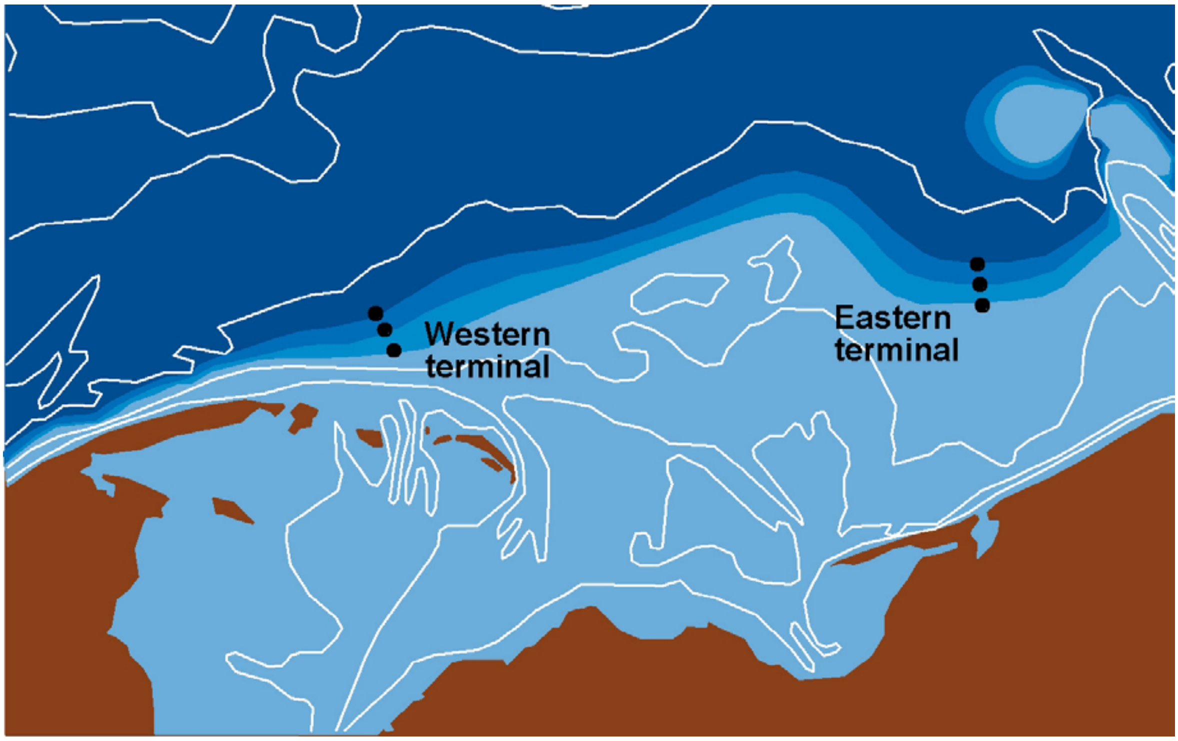
Based on the selected ARCOP scenario, the vessels to be studied will be crude carriers of size up to 120.000 tdw. For the economic comparison three different sizes will be analyzed. For each size, two different basic designs will be selected. One will be more conventional and designed to operate mainly with the assistance from icebreakers. The other type will be designed to operate mainly independently with only minimum use of assistance from supporting vessels.

Assisting fleet

The main task for the assisting fleet is assisting the cargo vessels on the route and at the terminal. In addition the vessels in the assisting fleet may have tasks related to search and rescue operations and environmental protection.

Loading terminal

The main task of the loading terminal is to transfer the oil from the storage to the ship. The terminal must also be able to hold the tanker in position during the loading phase. The terminal may have storage capacity or the storage can be located onshore. The size of the storage is dependent on the size of the tankers. The terminal must be so designed that the tanker can approach the terminal to connect the loading hoses.



Varandey terminal location

VTMIS

The safety of transportation at any area calls for a system that can provide information on vessels and cargoes at any time. The system must also be capable to give instructions to the vessels in the area. In the Arctic areas the system must contain the information on sailing conditions and the assistance available.

Training

Training of seamen has long traditions. The sailing in the Arctic areas is however a new area for most of the ship operators. The training for Arctic navigation is not widely available today. Each operator must find the skillful crew for his fleet.

Infrastructure for administrative measures

The custom and immigration procedures in remote Arctic areas need new infrastructure so the required procedures can be carried out.

Environmental protection

Environmental protection in the sensitive Arctic areas calls for special attention.

2.2 Discussion

As discussed in the Russian marine transport session, safety and environmental impact has to be seriously considered in all part of the transportation system. For instance, if the loading towers are manned, there needs to be transportation and evacuation systems for the personnel. These systems will also have to be safe and environmentally sound.
For the assistance of wide tankers, work has to be done to develop the assistance methodology. Resent tests by CNIIMF have shown that a wide tanker (42 m) could be assisted in only 33 cm thick ice by one ice breaker. Other relevant experience is from assisting the nuclear LASH-carrier Sevmorput. This ship has operated along the NSR for more than 15 years.

2.3 Conclusions and recommendations

All aspects of the transportation system have to be considered on an equal basis, both the human, the physical and the environmental infrastructure.
It is clear, that the costs for infrastructure will be enormous. It is therefore clear that they have to be divided between this and future projects to achieve economy. How this split will be done is part of the study.
Piloting to and from the terminal will be required. Several practical issues need to be solved. These issues may have an impact on the design of tankers, icebreakers and other supply vessels.

When developing the complete system, safety and environmental impact must have top priority. The environmental impact will be evaluated in the EIA process, but there also needs to be a clear focus on safety. This should also be co-ordinated by one WP.
To be justified as a system for transport of oil to Europe, the marine transportation system has to be cost-wise competitive with the alternative, pipeline transportation.

3. ICE SERVICE CAPABILITIES

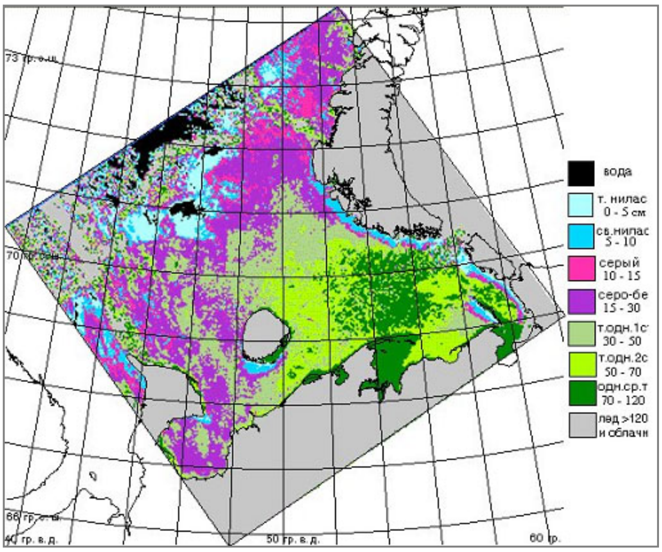
3.1 Ice service capabilities, Summary

Vladimir Smirnov, Arctic and Antarctic Institute, Russian Federation

An important piece of information for all vessels operating in ice conditions, either independently or assisted by icebreakers, is the data on the prevailing ice conditions. This information is needed both for different time periods (present, short term and long term forecasts) and with different levels of resolution. In addition to the ships, also other users are interested in the information provided regarding the ice conditions (Scientists, on-land users, political decision-makers, etc.). This influences the collection and presentation of the data.

Today, the most important means for collecting information on ice conditions are different satellites. The amount of information collected and the coverage, especially in the northern areas of the world, is well above the capabilities of any other mode of collecting data. The most challenging task today is to meet the requested resolution level that users are putting. Combining the data from different satellite sources as well as with different other modes of collection is perhaps the most important issue today. Different collection techniques have different strengths and work at various resolutions, and are also subject to different disturbances and error margins. Today not all signals collected can be interpreted with full reliability. Comparisons between satellite data and data collected from ships and on ice will increase the interpretation accuracy.

Ice forecasting also requires further development. Today, forecasts are prepared for up to 3-5 days, identifying polynyas, ice drift, thickness ad coverage. This information is prepared using forecasts on other weather phenomena, such as general weather system movements, temperature, wind and wave.



Ice thickness chart based on satellite data

Ships making route plans in ice covered areas need a separate routing tool. Today, ice data can be presented on Electronic Navigational Charts, using the international Egg

Code. Further work is needed to develop an automatic routing tool, optimizing the ship route using the data on ice conditions in different areas also considering the weather forecast.

3.2 Discussion

One of the present challenges with ice services is the different client needs. Data has to be collected to satisfy the needs of political decision-makers, scientists, on-land-users and marine users. Collecting all the data with one system is a challenge.

There seems to be an overly optimistic view, regarding the capabilities of the ice service, on the market. As an example: The accuracy level is expected to be 100 meters when the available accuracy is 1 kilometre. Continuous work is being done to meet this market requirement.

Satellite images have been sent to ships in the Baltic already for 5-6 years, so the technology as such is not new. The data transmission limitations do still exist, with the coverage problems on high latitudes.

Increased amounts of data transmitted at an ever-increasing speed and frequency will put the costs for providing the data in focus. The gain that cargo ships get, when being provided this information, has to be in relationship with the costs of the services. If the service is a part of the general fee and the ships anyhow will have to follow assisting icebreakers, there is a very weak link between demand and cost of service. The data has to be cost competitive also for vessels carrying less valuable cargo than oil, where the reduced risk for oil spill `may justify the increased cost

3.2 Conclusions and recommendations

Several techniques exist to produce information on ice conditions and to transmit the information to the ships. The technological development brings continuously new applications to the market both for data collection and transmission.

Information about the prevailing ice conditions has already been given to the ships for a long time. The most extensive operation has taken place in the Russian Arctic and the Baltic. The service has been provided as part of the national weather service.

The focus of the further development needs to be on the needs of the real end user (icebreaker or ship to be assisted) and thus the economy of the service. This may lead to other priorities than the pure technical development.
As a part of the general development, further work is to be done on presenting information in a user-friendly way.

The present system focuses on collecting data about and presenting the existing ice conditions. It is important that the forecasting reliability is developed.

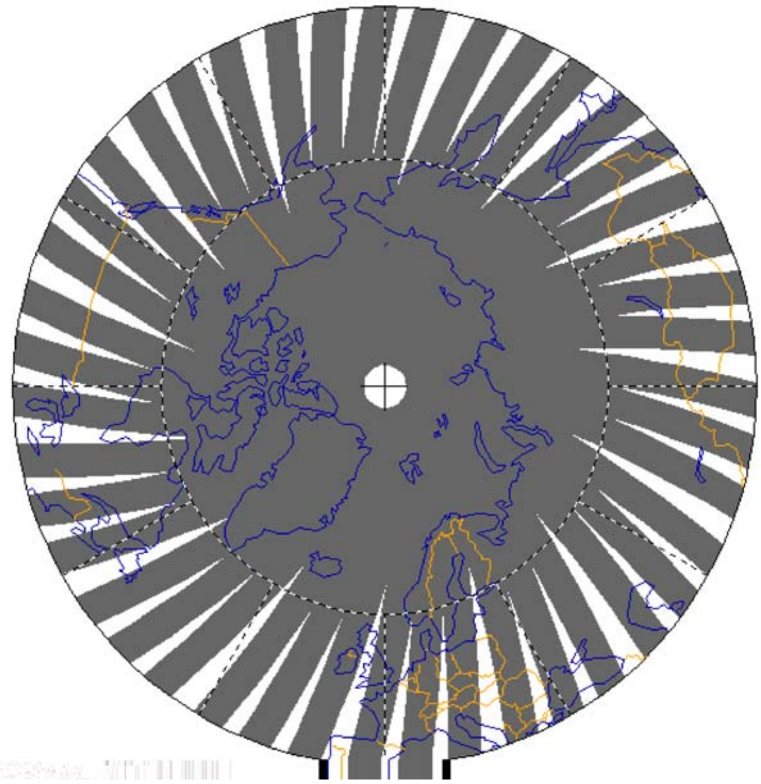
Close co-operation needed between service provider and all user levels. The needed ever increasing amounts of data, and the gain, has to be compared to the cost of producing and transmitting this information.

4. USE OF SATELLITES

4.1 Use of satellites to serve the traffic, Summary

Stein Sandven, Nansen Environmental and Remote Sensing Center, Norway

Satellite remote sensing methods are today widely in use to produce data on ice conditions. Especially along the Russian Arctic coast, satellites provide an excellent means of collecting data over large areas. Different remote sensing techniques are used to collect the data: Infrared / optical images, PMW, radar altimeter, etc. New technologies are already in pre-operational use such as Synthetic Aperture Radar (SAR), providing high-resolution and weather independent images for ice condition surveillance. From 2005 CRYOSAT radar altimeter will provide data on sea ice thickness and surface roughness.



ENVISAT coverage of the NSR after 3 days

To be able to produce information for navigation (for icebreakers), the data must be analyzed together with synoptic meteorological data and knowledge of the general ice conditions in the area in question. Comparisons of satellite based ice information and data collected on site was done during the ARCDEV voyage, providing valuable knowledge of satellite image analyses. ERS-2 and RADARSAT ScanSAR images were used in combination with optical and infrared images Areas up to 500 km in width can be covered by one SAR image, still maintaining a high resolution of 100 m. Satellite data could be provided nearly in real time (5-6 hours after satellite over pass), giving valuable information to the icebreaker for route selection (tactical navigation). It was estimated that the average ship velocity during the ARCDEV expedition would have been much lower without the satellite data. The round trip from Murmansk to Ob Gulf took only about three weeks which is fast for the severe ice conditions in this region in April – May 1998. The short sailing time was a result of careful route planning and tactical navigation along the selected route carried out by experienced ice specialists.

The high volume satellite remote sensing data increases the challenges on data transmission between land and ships. Although the SAR image file size, using compression, could be kept on a reasonable level (compressed from 4.5 MB to approximately 200 KB), more detailed and readily analyzed information will increase the file size. The compression had degraded the image quality to some extent, which in this case was not a problem. Transmission of large files is especially problematic on high latitudes, where there are shortcomings in the coverage of INMARSAT and others communication satellite systems**.** Future operations in the Arctic will require SAR data from ENVISAT and RADARSAT 2 as a key data source for ice information that can be updated every day with full data coverage of all important ice areas. Satellite SAR information should become part of an ice monitoring and forecasting system supporting Arctic operations.

4.2 Discussion

The original thought was that the presentation would have dealt with the question of using satellites for transmission of data other weather data. Possible data would then be equipment condition monitoring data, etc.

Today, much of the data is sent as attachments to emails, available over the Internet. The file size here is reasonable. Generally, the use of the Internet has reached such a level, that it is the main communication system, irrespective of your location.

There seem to be a need for a more comprehensive view on the use of satellites, since this may bring economy to the different services, that would not be viable on their own.

4.3 Conclusions and recommendations

Satellites are today the basic large-scale source of information of ice condition data. New satellites are upcoming (Cryosatat, IceSat) with additional capabilities.

Satellites have enabled the use of internet for communication between shore and ship. Data is already transmitted as attachments to emails, even if this limits the file size.

For transmission of data, there is still a problem at high latitudes, where Inmarsat does not have a perfect coverage. New means of transmitting information to vessels along the NSR need to be studied.

Satellites are today mostly used for the transmission of weather data and telecommunication.

A comprehensive approach is needed to the use of satellites for communication between shore and ship. There may be a need for transmission of different types of data from the ship, for instance for remote maintenance applications. It is recommended that such applications will be listed in WP3.

5. TRAFFIC MANAGEMENT SYSTEMS

5.1 Vessel Traffic Management and Information Service (VTS & VTMIS), Summary

Jens Froese, Hamburg University of Applied Sciences, Germany

A vessel traffic management and information service (VTMIS) gathers, evaluates and distributes vessel traffic and waterborne transport data to improve the safety and efficiency of transport and to better protect the environment. A VTMIS basically consist of a vessel traffic service (VTS) according to IMO/IALA covering the services

- information
- navigational assistance including shorebased pilotage
- traffic organisation (traffic management)
- co-operation with allied services, port operations, emergency services and adjacent VTS

additionally transport related information services to allow for co-operative resource management of transport resources .

The responsibility of a VTS is to manage the traffic on the basis of specialized local knowledge and information sensors resulting in a complete traffic picture (traffic image). In relation to this the vessel's responsibility is to safely navigate on the basis of its behaviour and the professional skills of the crew. VTS instructions to a vessel should be "result oriented" only, leaving the details of execution to the master, officer of the watch or pilot on board the vessel.

Involved actors are mainly

- the vessel command
- pilot (aboard or ashore)
- VTS operator.

There can be other relevant parties providing or requiring information in context to individual navigation and general traffic.

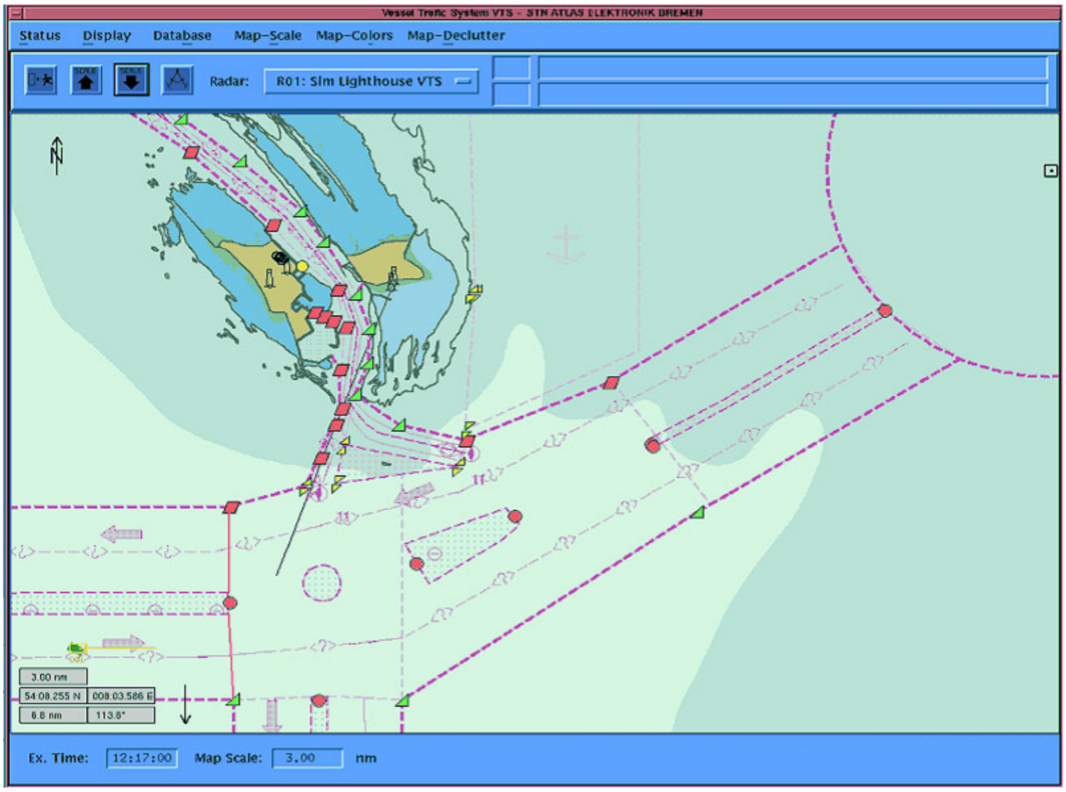
After proper planning the vessel command is executing the voyage by means of propulsion, steering, manoeuvring aids and, when required, by tugs and icebreakers whilst monitoring it by dedicated information and communication technologies. The vessel needs to be prepared to react on internal disturbances such as failure of individual systems or a blackout and on external disturbances such as hydrodynamic effects, wind, current, ice, traffic and navigational obstacles.

The functions of VTS are to

- monitor the area, traffic and related conditions
- assist onboard navigational decision making
- monitor effects.

The information required to fulfil these tasks is

- course and speed made good by individual vessels
- position relative to navigable area, way-points and aids to navigation (e.g. buoys)
- positions, identities and intentions of surrounding traffic
- alerts and warnings to traffic and individual vessels
- other on request from individual vessels.



Traffic information presentation

A VTS can participate in the decision making process by giving navigational advice but it is important to consider the distinction between navigational information and navigational advice because of its potential legal implication which depends on the fact to which extent a master can himself assess the situation and override advice according to actual local conditions.

In order to assist the safe navigation of a vessel, pilots can also give from the shore and with the agreement of the master a service to conduct the vessel to or from the pilot's transfer area. This is called shore-based pilotage (SBP) and it is an extension of the pilot's task to improve efficiency of maritime traffic in certain circumstances but its limitations on safety should be understood.

5.2 Discussion

Vessel Traffic Management Systems (VTMS) have been used ice covered areas already for a long period of time. Both StPetersburg and Murmansk have had these systems for tens of years. In the Gulf of Finland a system has been in operation since 1995.

To provide a continuous follow-up on the vessels in motion in the Gulf of Finland, the AIS will be connected through Inmarsat, which will give an updated position of each vessel every 6 minutes. Normally the range of the AIS is 20-30 miles, but this will provide full coverage of the Gulf of Finland, where the AIS is compulsory after July 2004.

5.3 Conclusions and recommendations

Traffic management systems are already in use at several locations, especially in areas with congested traffic. The traffic volumes in the ARCOP scenario may not necessarily support the use of a VTMIS, but general safety issues may still support the use.

As part of the VTMIS in use in the Gulf of Finland, an Automatic Identification System will be mandatory from July 1, 2004 for all ships over 300 dwt.

The experiences gained in the Gulf of Finland shall be used in ARCOP. The conditions are similar with ice conditions, icebreaker support and considerable tanker traffic.

6. TRAINING REQUIREMENTS

6.1 Training requirements, Summary

Anniek Platzer, Wagenborg Shipping, Holland

Wagenborg Shipping does not arrange any special training for crews on normal open water vessels; all training is done on the job.

Wagenborg Kazakhstan, affiliated company of Wagenborg Shipping has operated Supply Vessels in ice conditions in the Caspian Sea since fall 1998. Two Icebreaking Supply Vessels have been operated in heavy ice conditions, supporting the drilling rigs in the shallow water areas.

When selecting the crew for the vessels, Wagenborg decided to emphasize the importance of offshore experience. None of the captains hired had any experience with operating vessels in ice conditions nor the new propulsion system (electric podded drives).. In spring 1999 the ship designer/builder (Kvaerner Masa-Yards) and the podded propulsor manufacturer (ABB) did Ice tests with the vessels. The purpose of the ice tests was to determine the capacity and possibilities of the Azipods in the Caspian Sea. Side effect of the ice tests was that KMY and ABB could show the captains how to use the Azipods most effectively in real life situations.

Practical experience of ice conditions is important for the crew

After one season in ice Wagenborg Kazakhstan felt that the crew of the icebreakers did not have enough knowledge of ice conditions and ice operations and decided to set up a training. In cooperation with MARC Wagnborg Kazakhstan organised a training in spring 2000. The training consisted of two parts a theoretical training at MARC in Helsinki Finland and a practical training o/b MSV (Multi Service Vessel) Nordica in the Gulf of Finland.

The theoretical training envisaged creating a general understanding of ice navigation, icing breaking, operations and assistance in ice and including the following subjects:

The aim of the practical training was to see if there is something to be learned from the operation, practices and also possible problems of the Finnish Maritime Administration icebreakers and was especially useful because the Nordica has twin azimuthing thruster propulsion which is quite similar to the IBSV's WagKaz operates in the Caspian

The feedback from the program was mixed. Some of the captains were pleased, some felt the sessions unnecessary. With the first set of captain trained through a special program Wagenborg Kazakstan decided to continue the training of new crew on the job, bringing in crew to be trained on the vessels and thus also securing that the experience gained is distributed within Wagenborg.

There are some trends that make future training on the job difficult. General security issues question the possibility to perform training during the time of normal commercial operations.

Possible alternatives for arranging future training include theoretical training combined with practical training on the job by manning above the strength. The cost for manning above the strength is however also considerable and may cause problems in a very competitive environment. A less costly alternative may be to train the crew in simulators. Presently not many simulators are capable of simulating operations in ice conditions.

6.2 Discussion

It is evident that training for operation in ice is essential for officers. As much as possible of this training has to be practical training on a vessel. There are not too many areas where this can be arranged.

There is presently a shortage in simulator training: simulation of ice conditions cannot be done by most of the simulator facilities. New facilities will have this capability, especially for operations behind an assisting icebreaker.

Wagenborg has decided to provide training for its crew in-house, since this gives an opportunity to spread the knowledge within the company. Wagenborg has own vessels operating in ice both in the Baltic and in the northern Caspian Sea.

6.3 Conclusions and recommendations

With an increased amount of ships operating in ice, there is a need for more people acquainted with operations in ice. To be able to meet this need, additional training of crew for operations in ice needed. Both theoretical and practical training is needed.

Wagenborg Shipping today, who operates several vessels in ice, trains its crew only on the job. This may in the future be difficult due to stricter safety regulations that do not allow training when the vessels are in normal operations.

Simulators could be a proper way to combine theoretical and practical aspects of training. The number of simulators capable of simulating operations in ice is, however, limited.

To be able to meet the increased demand, a crew ice navigation training system, open for all, needs to be set up. The possibilities to use ongoing Russian operations in the NSR should be evaluated.

Training of crew should include both theoretical and practical aspects.

Existing facilities need to be evaluated based on their knowledge in and experience of operation of vessels in ice.

The other major area with operation of vessels in ice is North America. The procedures used in that area should be evaluated.

7. ENVIRONMENTAL IMPACT ASSESSMENT

7.1 ARCOP Environmental Impact Assessment (EIA) – Environmental Risk Analysis (ERA), Summary

Kjell A. Moe, Alpha Environmental Consultants, Norway

General approach

The ARCOP EIA is based on three main, integrated components; a) Environmental baseline data; b) Impact factors, and c) Assessments and analyses of possible interactions between the environment (a) and the Impact factors (b). For estimations of ERA, the basic conflict matrix is maintained, and the term likely is introduced by combining the probability of an event and the consequences of this event.

The study will be carried out in line with the Guidelines for EIA in the Arctic (AEPS 1997). However, the resolution of baseline data (on both a and b) will be mandatory for the selection of focal, priority issues and the corresponding in-depth assessment and analyses. In this respect, the aim of EIA and ERA – i.e. to provide a foundation for environmental strategies and decision-making, will be carefully considered.

Implementation and results

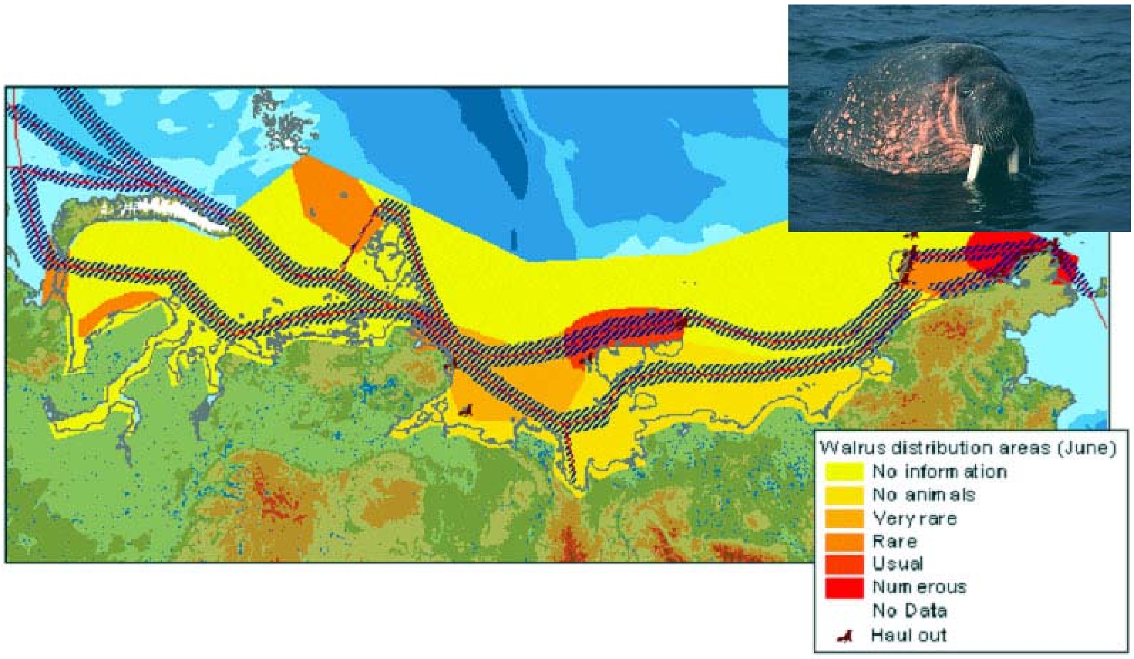
Like the INSROP EIA (cf. Moe & Semanov 1999), the ARCOP EIA and ERA will be implemented by tailored routines in a Geographical Information System (GIS). Given the main component above (a-c), the study will be organised in consecutive phases:

a) Environmental baseline data; i.e. data describing the temporal and the spatial distribution of vulnerable natural resources (- resources “at risk”), will be compiled in an early phase from the knowledge base obtained during INSROP (e.g. Brude et al. 1998), EPPR, as well as other relevant projects and programmes. Russian co-partners, primarily AARI, are supposed to provide and verify available data.

b) Characteristics of shipping and navigation; i.e. data describing the factors that in one way or another may pose impacts or risk to the environment (- sailing routes, frequency, type of ships and cargo, accidental events etc. – currents status as well as future plans), will be reviewed and systemized in parallell. Russian co-partners, primarily CNIIMF, are supposed to provide and verify available data

c) In the concluding assessments and analyses the likely impact of factors such as physical disturbance, regular discharges and accidental events (e.g. acute oil pollution) will be addressed. Particular emphasis will be placed on the ARCOP scenario presented by KMY. However, detailed assessments and analyses of oil and gas transportation alternatives by pipelines is considered beyond the scope.

Key findings and results will be entered into a web-based ARCOP toolkit. This suite of data bases and GIS tools enables the user to analyse and visualize environmental vulnerability, integrate results from oil drift modelling and contingency planning, and identify geographical areas and time periods of significant environmental concerns ("hot spots").



7.2 Discussion

It has already been identified that communicating the EIA results is one of the most central issues. Past experience has shown that there is a risk of over simplifying the issues, if only professional communicators are used, without the support of environmental professionals.

The basis of the EIA is the baseline data that exists form the area to be evaluated. For the scenario area, offshore Varandey, some environmental data exists. There is, however, a challenge, since different industrial activities have taken place in the area since the data was collected. It is therefore important that new data is collected for any new evaluations.

After the baseline data has been gathered it is important that the conditions are continuously monitored. This monitoring is a part of the EIA process.

Evaluation of the regional / local implications of different activities and possible accidents will be difficult also because of the moving nature of the ice in the Varandey area. Any oil spread at the terminal will stick to the ice and be moved long distances and thus affect distant locations.

7.3 Conclusions and recommendations

The EIA and ERA are still fairly new procedures. A common understanding of the aim of them is still needed.

Due to the lack of an internationally standardised procedure, there is today a difference in the level of detail in the Western and Russian approaches. The Russian approach requires more detail than the Western.

There is a strong relationship between input data reliability and the analysis quality. The large amount of different types of data influencing the result of the total system analysis presents challenges to the collection of reliable data.

Communication of results is an important factor of the EIA process. According to Russian law, the EIA process has to be open to the public. It is especially important to be able to efficiently communicate the process and the results to the local community.

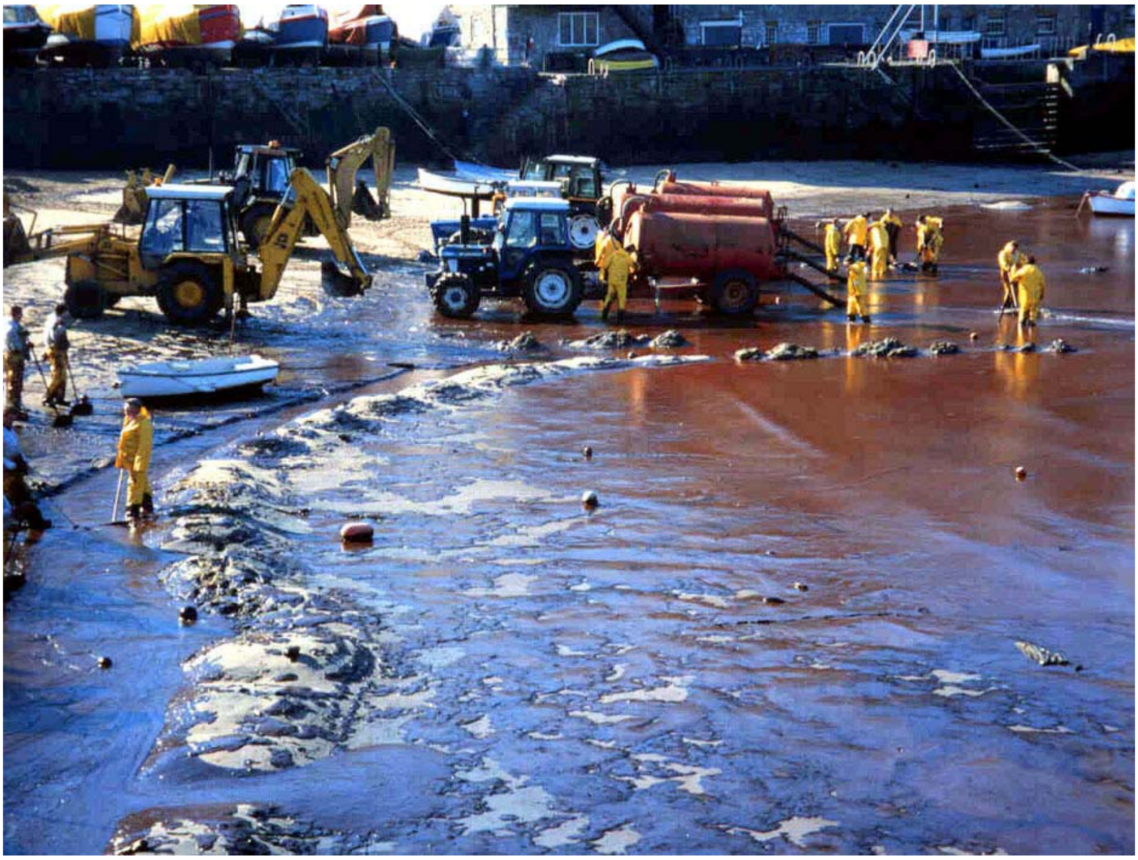
Existing base line data should be reviewed and additional data is to be collected when needed. As this data has been collected, a monitoring system has to be set up.
Emphasis has to be placed also on the communication of the EIA results. Co-operation is needed with Work Package on Social Impact to determine the correct mode of communication.

8. OIL SPILL MANAGEMENT

8.1 Oil spill management, Summary

Gennady Semanov, Central Marine Research and Design Institute, Russian Federation

An oil spill in a marine environment may start as a local problem but spreads rapidly out to cover significant areas. Accidents often occur under difficult environmental conditions and wind, waves, tide, etc. will increase the challenge to remove the unwanted substance from the sea. To limit the spreading, rapid, well-organized actions are required.



It is very labour-intensive to combat oil when it has reached shore

The Russian oil spill contingency plan has been given a three tier approach, covering spills of different magnitudes, placing the responsibility at different organizational levels (local, regional, federal) for each tier. The local authorities are in charge of combating the most probable spill within the capabilities of each facility (such as ports, plants, etc.). The regional authorities are in charge of probable larger spills that are within the capabilities of the region, while the federal authorities are in charge of the probable spills within the capabilities of the Federation.

The general response policy is, that as much as possible of the marine spill should be collected or destroyed before it reaches the shore, in order to reduce the costs of collection and the damage inflicted on the environment. Mechanical collection systems should be used, where the environment allows, to collect spills at Tier 1. When combating spills of Tier 2 and 3, all methods should be given equal consideration. All techniques should be used concurrently, using dispersants on the part that possesses the greatest threat while mechanical systems can be used to combat other parts. The decision of using dispersants should be made only on the basis of a Net Environmental Benefit Analysis performed by an authorized institution.

To manage the emergencies there is a separate Emergency Managing body. This Body manages the spill clean-up tasks, starting with an identification of the magnitude of the spill, communicating with necessary instances, appointing the incident manager and finally arranging oil spill combat drills and process improvement. This body also takes the decisions on dispersant application and in-situ burning.

8.2 Discussion

When comparing the combat challenges in the NSR with the ones in the North Sea, one can see that the open water conditions are similar, except for the visibility part of the year. This is the easy part. Combat is ice is extremely challenging. It is not realistic to expect the same combat level in ice as in open water, since the techniques are not as developed and the conditions are so difficult.

There is a clear difference in attitude towards the use of dispersants. They are commonly used to combat small spills in the West, while they must not be used on small spills in Russia, as long as mechanical methods can be used.

8.3 Conclusions and recommendations

Russian regulations prohibit the use of dispersants as primary mode for combat of small spills as long as mechanical methods can be used. In the west, dispersants and the main method for combating small spills.

The drawback of mechanical combat systems is that only 30% of oil the spill is collected (in open sea). The mechanical methods are also very often labour intensive.

It is clear, that oil spill combating in ice conditions very challenging. Interaction with ice puts additional requirements on equipment and methods. It is therefore clear that more response tools are required for ice conditions.

New methods for combating oil in ice have to be developed. The special requirements set by the ice conditions of the NSR have to be considered. Present systems have been used in the conditions of the Baltic.

New combating techniques are required in addition to the mechanical methods and dispersants that are used today. Biological methods should be studied as the most promising, especially in environmental respect.

9. SOCIAL IMPACT

9.1 Social impact, Summary

Messhtyb Nina, Arctic Centre (University of Lapland), Finland

There are three main sides of the deal, when making industrial development in the Arctic, that should coexist – nature and two types of worldview. They should find a way for understanding and in this sense the ACROP project makes an important contribution in establishing a profound dialogue between the varying opinions. There is a clear intention by the international community to provide effective methods of industrial development along with careful treatment of the Arctic environment. The assessment of the potential impact of the Northern Sea route exploration upon the Arctic biosphere, the inhabitants of the area, and foresee it's impact at the global scale plays an important role.

The Northern Sea Route will play a significant role for further exploration of Arctic natural resources and for the future strategy of Europe as a whole. When planning a long-term programme one should attach the due importance to a systematic approach at the assessment of the potential impact. The stirring industrial pressure on the northern fragile environment simultaneously will bring a number of consequences that will influence the life of the population of the area on different levels and in various senses. Indigenous peoples are the most sensitive part among the permanent inhabitants of the North because of their close connection and special attitude to the natural environment. Their traditional branches of the economy consist of the basis of their national and cultural individuality. The NSR will bring a new reality to the northern inhabitants, new profits and possibilities, but new problems as well. Only on the base of a multi-stage and multilateral approach it would be possible to assess the social impact and develop an efficient program of socio-economic and psychological rehabilitation and adaptation of indigenous peoples in the new condition. The anthropological field case study will analyze the situation among specific local indigenous communities, which have bee experienced the impact of industrial exploration, and bring this knowledge to the participants of the ACROP project. Arctic Centre sees as one of its task to provide a link with local stakeholders, especially with regional departments of the RAIPON (Russian Association of Indigenous Peoples of the North).

Along with this it is especially important to emphasise the importance of comprehensive information and communication for establishing a positive interaction in the area. The assessment of the consequences of NSR development can be done only on the base of appropriate information about the particular area and the character of the ongoing industrial development. Northern indigenous communities have also a right to access to information pertinent to their essential interest. They must define their life strategy for the future.

From their side, northern peoples possess a unique valuable knowledge, which should be brought to the world community for profound understanding of impending environmental damage. Unfortunately indigenous knowledge is too often neglected. For example, native peoples considered many places as "sacred", where it is forbidden to hunt, fish or to make a fire. This has positively affected the preservation of hibernation quarters and nests of waterfowl. Traditional ecological knowledge should become a subject of special concern during the planning work and further comprehensive analysis as well as the specific living condition of the northern indigenous population. Their food habits (eating the primary source of the vitamin for this area - raw meat and fish, using the water of lakes and rivers as potable water, natural (plant and animal) medicine remedy should attract a steadfast attention to the impact of the contaminants to the health of Arctic People.

The development along the NSR will bring a number of newcomers to the North, for whom to have a job on this distant area is a good chance to earn some money, which they use to save “for the future better life” at the central part of the country. Northern nature is a matter of exotic for them and industrial workers use to bring their habits from the previous life, knowing nothing about the peculiarity of the North. More active newcomers could squeeze out indigenous peoples from their traditional niche at the areas closely connected with active industrial development. For relevant assume of the social impact of NSR it is important to study the various aspects of previous experience of interaction the indigenous population with temporary workers of oil and gas platform.

Industrial activities will have a significant impact on basic functions such as water supply

On the deliverable stage of the activity within the ARCOP Arctic Centre carries research about the current knowledge on social impact assessment of arctic marine transportation (literature review), prepares the contacts and questionnaire for the fieldwork which will be carried out in one or two of local communities. The main focus of current study is to provide a general overview of socio-cultural impacts and socio-cultural indicators basing on the interview of the key persons of the local authority and representatives of northern indigenous peoples on different levels.

Another important part of work of the Arctic Centre within the ARCOP is to provide it with information about the environmental and other appropriate activity of the Arctic Council.

Developing the perspective long-term programme exploration we should estimate and pay serious attention to the complexity of interrelationships between the different components of the Arctic ecosystem. The traditional indigenous culture is valuable by itself in a humane perspective, but it has as well an importance as a buffer for the global environmental security, it gives a chance to decisive multi-national companies and projects one more time to consider carefully the assessment before making a step, it means to care, and care not only about Arctic future, but about the Future itself.

9.2 Discussion

According to Russian law, ethnic people are characterised by the fact that they are living in the locations of their ancestors. This puts a special emphasis on their right to the grounds.

Practical limitations have been put on the local inhabitants already. The old Varandey village was closed, since it was too expensive to provide all the necessary services.

In the discussion, it became clear that there are different opinions regarding the present state of the settlements. This is of course of interest when evaluating the impact of any new activity.

9.3 Conclusions and recommendations

Indigenous peoples have though history inhabited the areas along the NSR. The Varandey (terminal site) area has been a settlement for local inhabitants between seasons.

Reindeer hearding, fishing and hunting are the primary means for living. All these will be influenced by industrial activities.

As described in the EIA session, local people have to be involved in the planning process. Efficient and open communication will enhance the successful development in the area.

The contacts that are achieved in the social impact evaluation process should be used also for communicating other tasks (EIA and others).

The interests of the local inhabitants should be taken into account in all aspects of the project. Representatives should be invited to participate in meetings / seminars.

Legal position of indigenous peoples should be clarified together with WP 2.1 and the results should be reported at the next ARCOP workshop.

10. CONCLUSIONS AND RECOMMENDATIONS OF THE WORKSHOP

A successful development still requires work in several different fields of technology. Developing this technology with the simultaneous need to limit the environmental and social impact is a challenging task. The workshop managed to highlight the different needs and perspectives that these workpackages will have to work with.

The workshops also acted as a good starting point for the project, where scientists from very different areas met and discussed subjects of relevance for the total project even if they might have been outside the key interest of separate individuals.

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.

INTEGRATED TRANSPORTATION SYSTEM

By Kimmo Juurmaa
Kvaerner Masa-Yards Inc.

System components

In the ARCOP context the transportation system is understood very widely. The system does not consist only of ships and cargo handling but also from other factors which are needed to make the transportation possible. These other factors consist of all what a shipping company needs to be able to practice shipping in ice conditions. And also of all those things that are required from the home country the waterways which are used for the transportation. All these will be discussed under the different work packages of ARCOP. The economic evaluation will however consider only those parts that are directly connected to a specific transportation task that is the transportation vessels, assisting fleet and loading terminal. The more general factors like the VTMIS in the area, the required training, the administrative infrastructure and the measures for environmental protection are discussed and analyzed, but the costs originating from these are assumed to be included in the waterway fee system.

Transportation vessels

Based on the selected ARCOP scenario, the vessels to be studied will be crude carriers of size up to 120.000 tdw. For the economic comparison three different sizes will be analyzed. For each size, two different basic designs will be selected. One will be more conventional and designed to operate mainly with the assistance from icebreakers. The other type will be designed to operate mainly independently with only minimum use of assistance from supporting vessels.

Assisting fleet

The main task for the assisting fleet is assisting the cargo vessels on the route and at the terminal. In addition the vessels in the assisting fleet may have tasks related to search and rescue operations and environmental protection.

Loading terminal

The main task of the loading terminal is to transfer the oil from the storage to the ship. The terminal must also be able to hold the tanker in position during the loading phase. The terminal may have storage capacity or the storage can be located onshore. The size of the storage is dependent on the size of the tankers. The terminal must be so designed that the tanker can approach the terminal to connect the loading hoses.

Ice information system

As was shown by ARDEV, the available ice information system is essential for successful navigation. The ice information system may be designed to serve individual vessels or it can be part of the vessel traffic management system.

VTMIS

The safety of transportation at any area calls for a system that can provide information on vessels and cargoes at any time. The system must also be capable to give instructions to the vessels in the area. In the Arctic areas the system must contain the information on sailing conditions and the assistance available.

Training

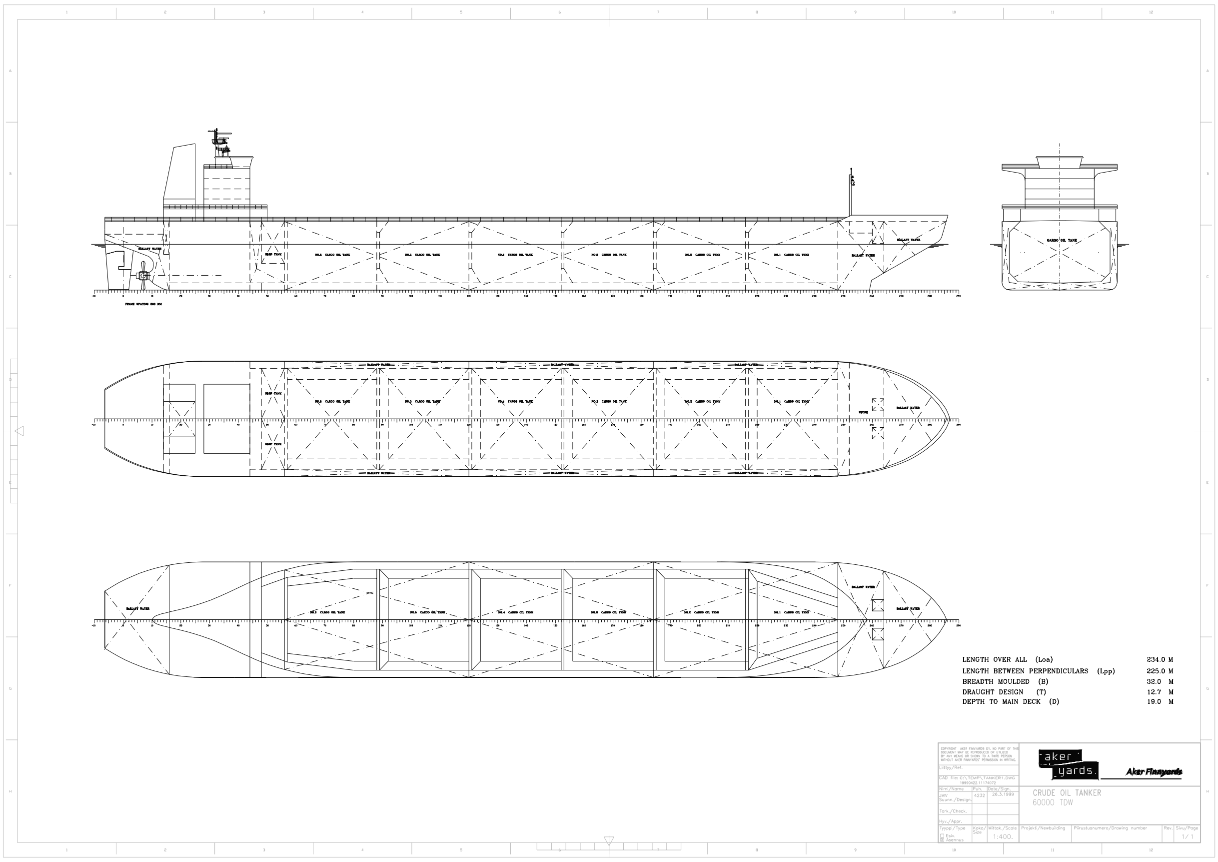
Training of seamen has long traditions. The sailing in the Arctic areas is however a new area for most of the ship operators. The training for Arctic navigation is not widely available today. Each operator must find the skillful crew for his fleet.

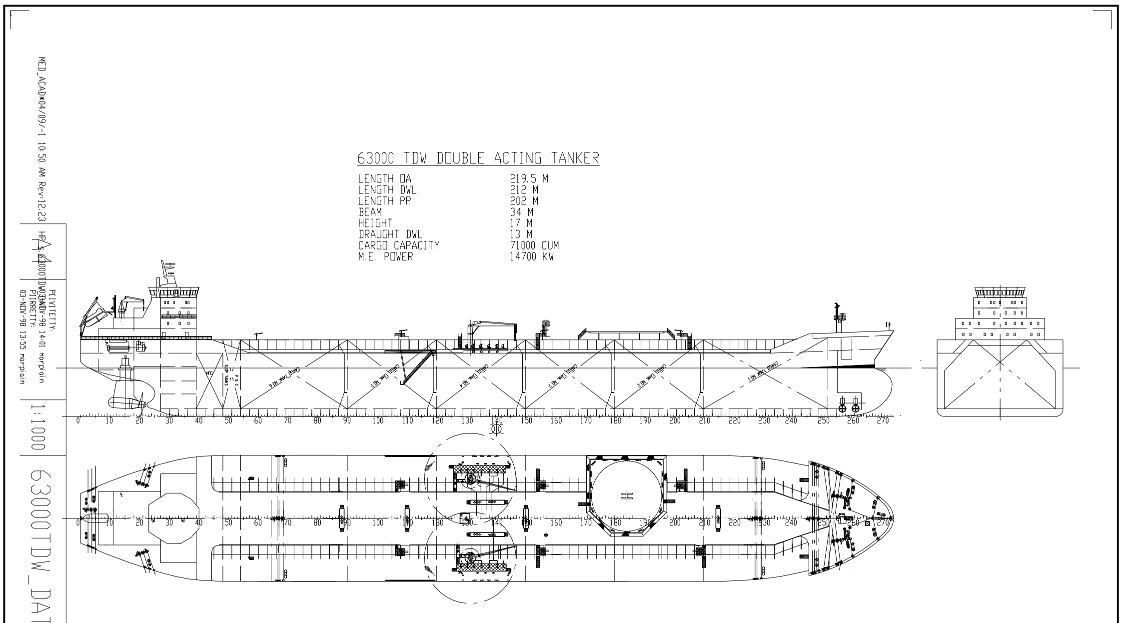
Infrastructure for administrative measures

The custom and immigration procedures in remote Arctic areas need new infrastructure so the required procedures can be carried out.

Environmental protection

Environmental protection in the sensitive Arctic areas calls for special attention. Technology to monitor, methods to manage and equipment for combating should be developed.


LENGTH OVER ALL (Loa) 234.0 M
LENGTH BETWEEN PERPENDICULARS (Lpp) 225.0 M
BREADTH MOULDED (B) 32.0 M
DRAUGHT DESIGN (T) 12.7 M
DEPTH TO MAIN DECK (D) 19.0 M
COPYRIGHT AKER FINNYARDS OY. NO PART OF THIS DOCUMENT MAY BE REPRODUCED OR UTILIZED BY ANY MEANS OR SHOWN TO A THIRD PERSON WITHOUT AKER FINNYARDS' PERMISSION IN WRITING.
CAD file: C:\TEMP\TANKER1.DWG
19990422.11174072
JMV Suunn./Design. 4232 26.3.1999
Aker Finnyards
CRUDE OIL TANKER
60000 TDW
Mittak./Scale 1:400.
Sivu/Page 1/1


63000 TDW DOUBLE ACTING TANKER
LENGTH OA 219.5 M
LENGTH DWL 212 M
LENGTH PP 202 M
BEAM 34 M
HEIGHT 17 M
DRAUGHT DWL 13 M
CARGO CAPACITY 71000 CUM
M.E. POWER 14700 KW
1:1000
63000TDW_DAT

APPENDIX 1

Integrated transportation system

By

Kimmo Juurmaa

Kvaerner Masa-Yards Inc.

www.arcop.fi 5th FP project/DGTREN

System components

- All elements to be considered
- Physical infrastructure
- Human infrastructure
- Environmental infrastructure

www.arcop.fi 5th FP project/DGTREN

Transportation vessels

- tankers of different design and size
- different modes of operation
- costs for construction and operation

www.arcop.fi 5th FP project/DGTREN

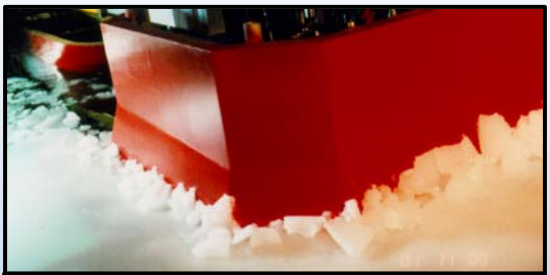
Assisting fleet

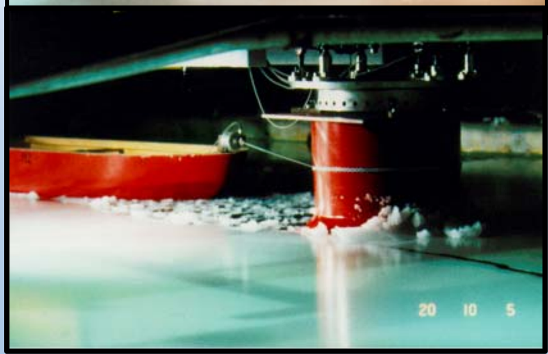
- Icebreakers of different size and purpose
- Terminal support vessels
- Escort tugs
- Search and Rescue
- Environmental protection

www.arcop.fi 5th FP project/DGTREN

Loading terminal

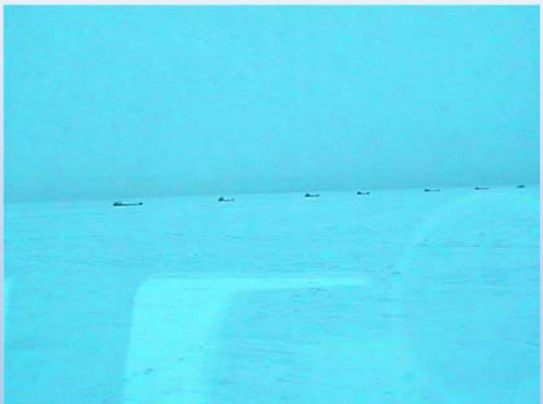
- Alternative consepts
- Basic design for selected alternative
- Construction and operational costs





VTMIS

- Requirements in Arctic conditions
- Safety in remote areas
- Link to ice information system



Training

- Use of competent personnel
- Possibilities to train seamen for Arctic navigation
- Possibilities to use simulators

www.arcop.fi 5th FP project/DGTREN

Infrastructure for administrative measures

- Inspection of the vessels
- Pilot service
- Customs
- Immigration

www.arcop.fi 5th FP project/DGTREN

Environmental protection

- Technology for monitoring
- Methods to manage
- Equipment for combating

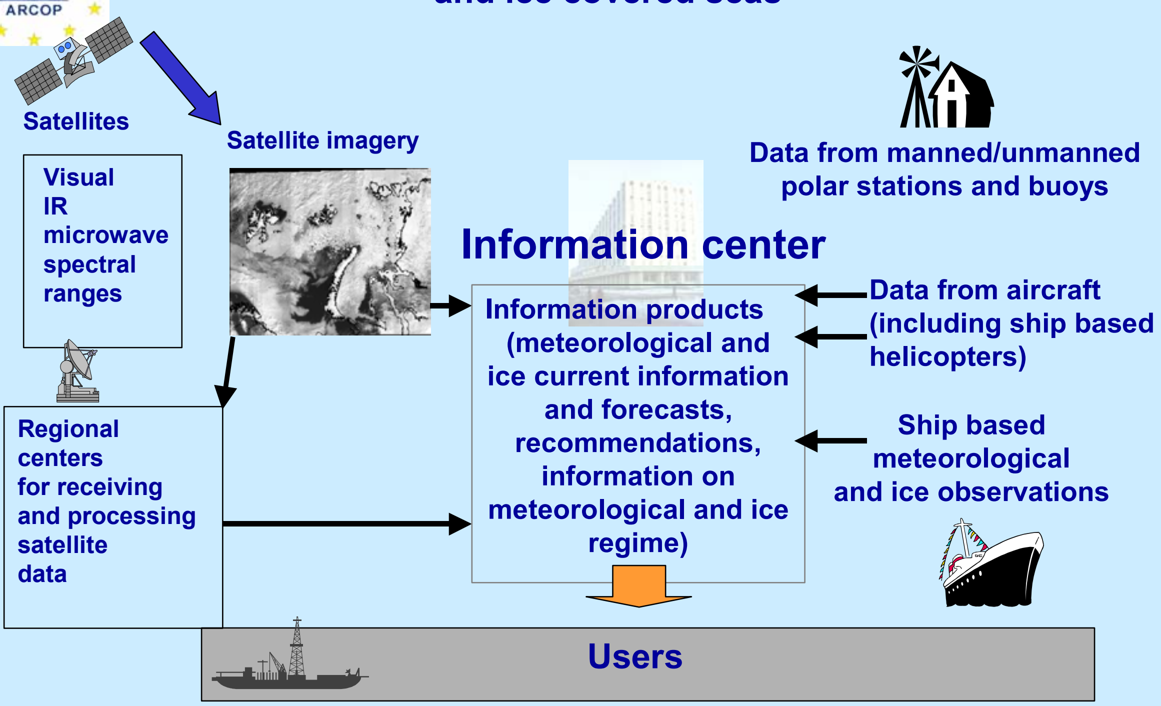
www.arcop.fi 5th FP project/DGTREN

Ice service capabilities

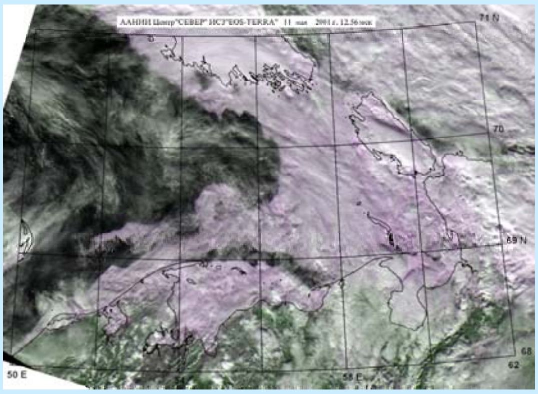
Arctic and Antarctic Research Institute
St. Petersburg
www.aari.nw.ru

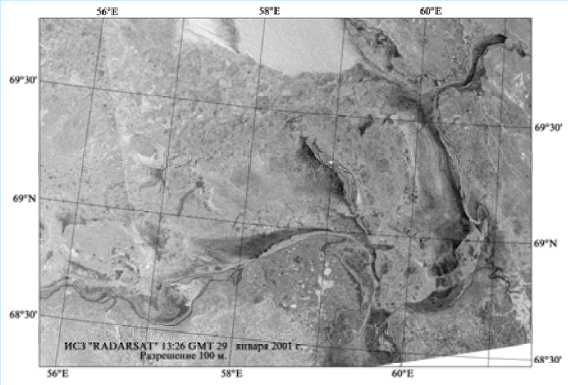
V.G. Smirnov
I.V. Stepanov

Ice Information System for the Arctic and ice covered seas



Use of satellite data from modern satellites
(different spectral ranges)



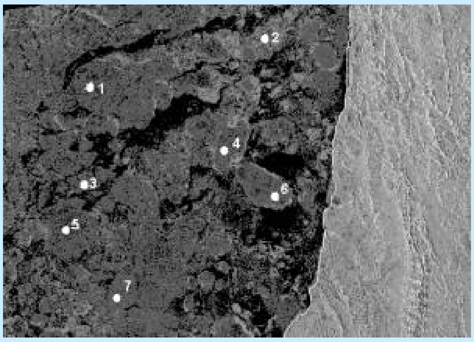


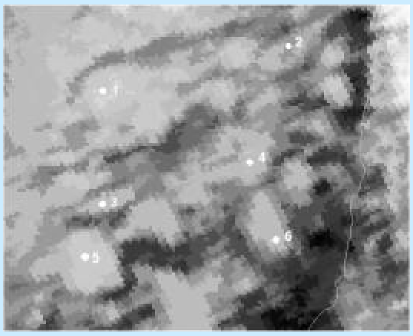
MODIS (TERRA)
May 11, 2001

SAR (RADARSAT)
January 29, 2001

Barents Sea

Joint use of data received from different satellites

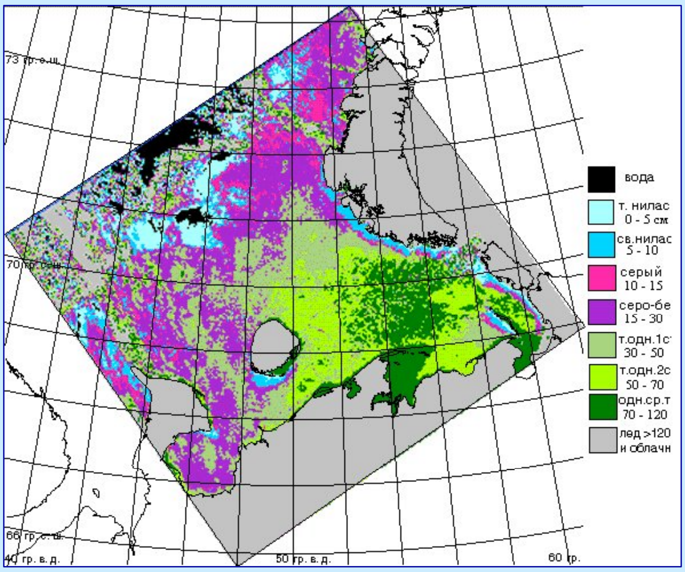




Scaled images RADARSAT & NOAA

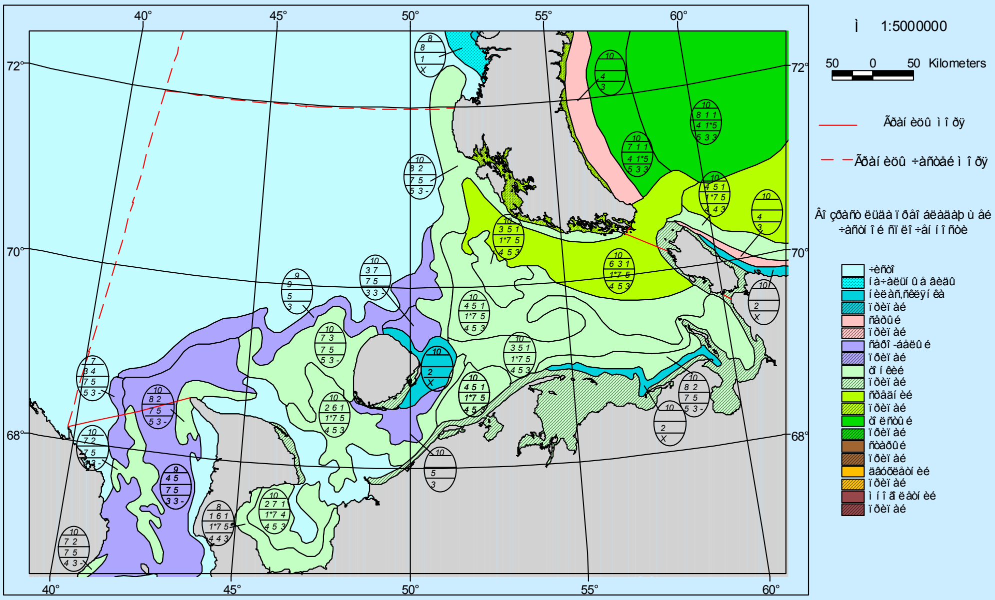
Use of NOAA IR data for of ice thickness determination

(original technique developed at AARI is applied)



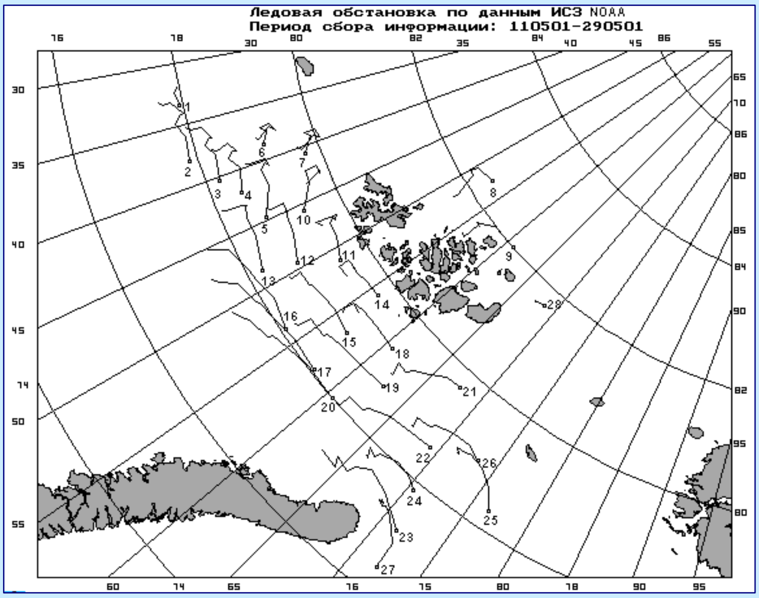
Barents Sea, April 1, 2001

Ice charting using international egg codes

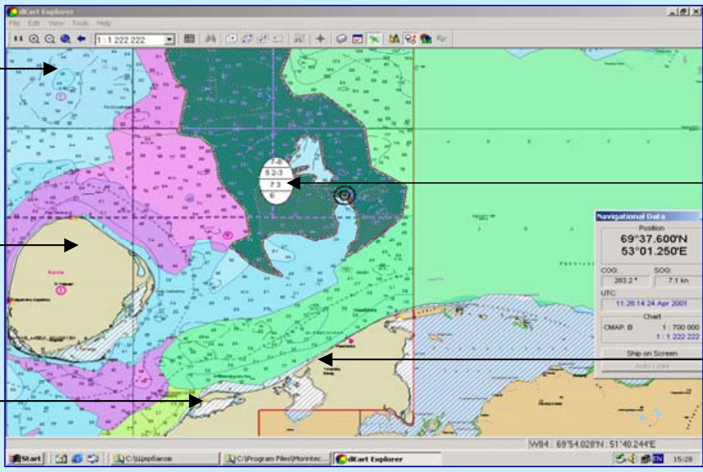


Barents Sea, April 26-30, 2002

Ice drift determination using satellite imagery

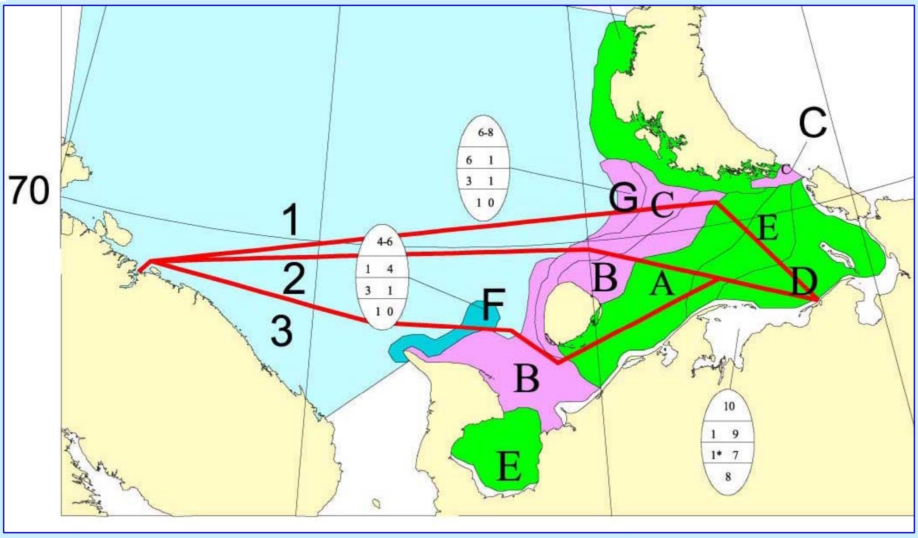


Ice drift (May 11-29, 2002)

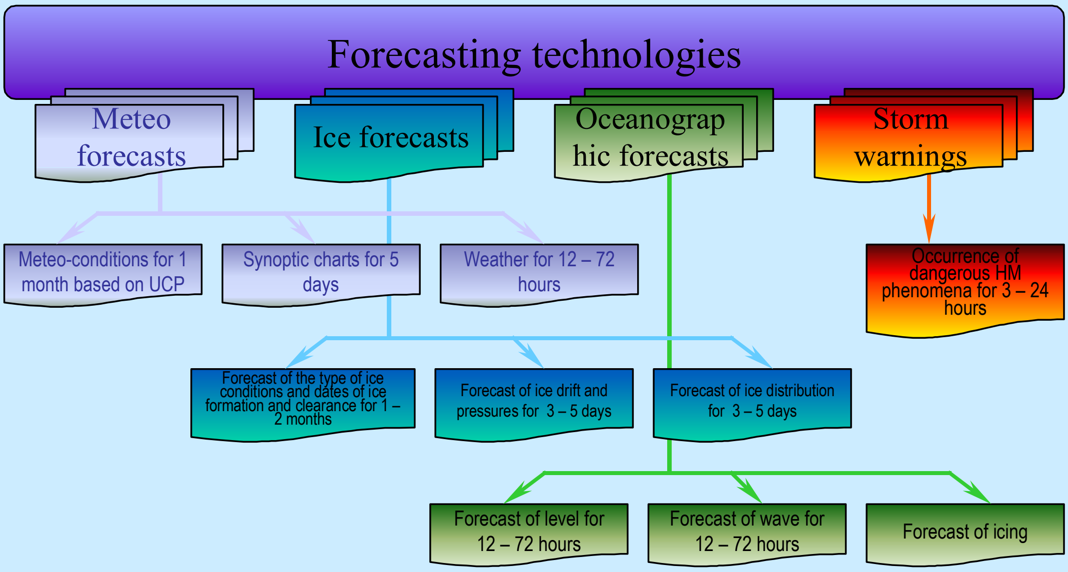


Use of ArcView software for ice information presentation in ECDIS (Electronic Chart Display Information System) format (navigation chart)

Selection of optimal route



Forecasting Subsystem



Hydrometerological support to operations in Pechora sea (Varandey island region)

№	Type of activity	Information
1.	Satellite images receiving and processing (Terra, RADARSAT)	Images (spatial resolution 50-250 m)
2.	Construction of detailed ice charts	Ice cover distribution
3.	Meteorological forecasting up to 1 month in advance	Pressure and temperature fields
4.	Ice forecasting up to 1month in advance	Fast ice and polynyas boundaries
5.	Weather forecasting up to 5 days in advance	Wind speed and velocity, temperature, phenomena
6.	Sea level forecasting up to 5 days in advance	Sea level for synoptic times
7.	Sea ice distribution forecasting up to 5 days in advance	Ice thickness, fast ice and polynyas boundaries
8.	Ice drift forecasting up to 5 days in advance	Ice drift velocity and direction
9.	Storm warnings up to 24 hours in advance	Dangerous HM phenomena
10.	Recommendations on the safety of operations	Expected natural conditions

Conclusions

- Satellite imagery is the main source of data on ice conditions in the Arctic and ice covered seas. To increase the reliability of ice information derived from satellite imagery joint processing of the data from different spectral ranges has to be applied.
- As a preferable option ice information system which will be designed under ARCOP project will have to include advanced technologies developed in various countries for processing of ice data from various sources and model calculations using GIS-based systems

To increase ice service capabilities the system needs:

- adjustment of technologies for satellite imagery interpretation;
- improvement of technologies for ice and hydrometeorological forecasting including forecasting and warning of dangerous natural phenomena;
- improvement of algorithms and technologies for ice-routing;
- design of information formats corresponding to standards for international navigation and adapted for use in ECDIS (Electronic Chart Display Information System);

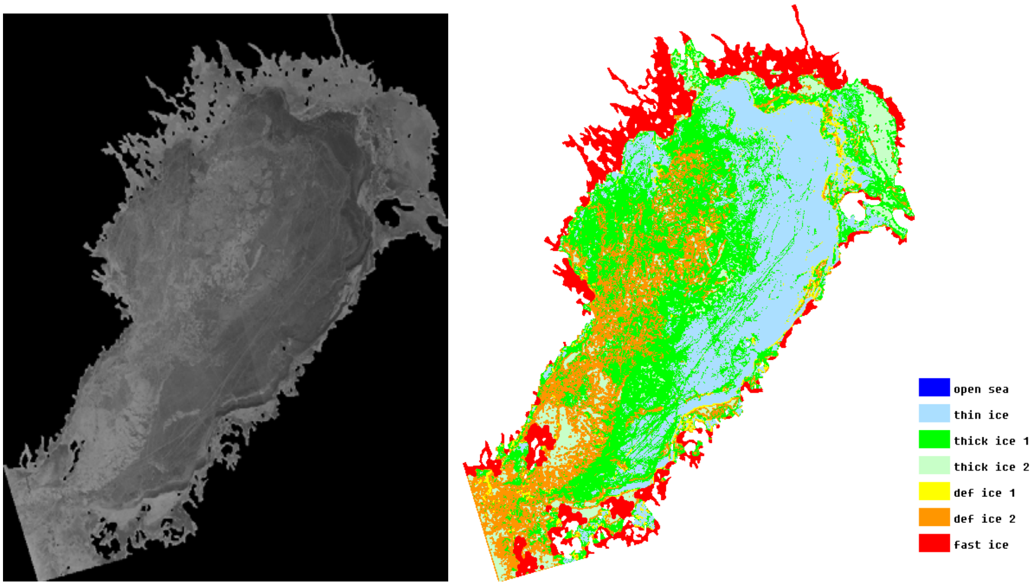


Figure 2. ***Example of the EO data and product delivered to the icebreakers and ships. RADARSAT based data on 9 February 1998 over the Bothnian Bay. Left: original RADARSAT SAR image © RADARSAT processed by TSS and FIMR. Right: automatic classification © FIMR.***

3. DIGITAL DATA TO FINNISH ICEBREAKERS AND MERCHANT VESSELS IN 1997-1999

The Finnish ice service has delivered digital sea ice data to the users at sea. The users have been Finnish icebreakers and various merchant vessels. For icebreaker use, the ice service has put the data into the server of the Finnish Maritime Administration from where it was automatically delivered to the icebreakers via cellular telephone network or via communication satellites (Fig. 2 and 3). For the merchant vessels, the data have been put into a server from where the ships have been able to pick up the necessary information via the cellular telephone network. In 1999, the data has been sent in attached files by e-mail.

The digital data have also been sent to some merchant vessels; in 1997 to three vessels of three shipping companies, in 1998 to three vessels of one shipping company and in 1999 to eight vessels of two shipping companies. The technology was developed and tested in 1997, and in 1998 and 1999 the transmission has been operational (7).

The data sent to the merchant vessels in 1997 consisted of EO data from AVHRR and ERS (European Remote Sensing Satellite) SAR, routine and special ice charts, plain language ice drift forecasts, and automatic ERS SAR image classifications. In 1998 the data was AVHRR and RADARSAT SAR and plain language ice drift forecasts. In 1999, the data were AVHRR and RADARSAT SAR, digital routine and special ice charts, plain language ice drift forecasts and automatic RADARSAT SAR image classifications.

NOAA AVHRR data have been used in the ice service in full 1.1 km resolution. For the use of icebreakers and ships, sub-images for areas of interest, such as the Bothnian Bay, or the Gulf of Finland were made. File sizes were made smaller by using compression. This also means, that image resolution become poorer, and thus the AVHRR data have been available onboard icebreakers and ships in a resolution of 1.5-2 km.

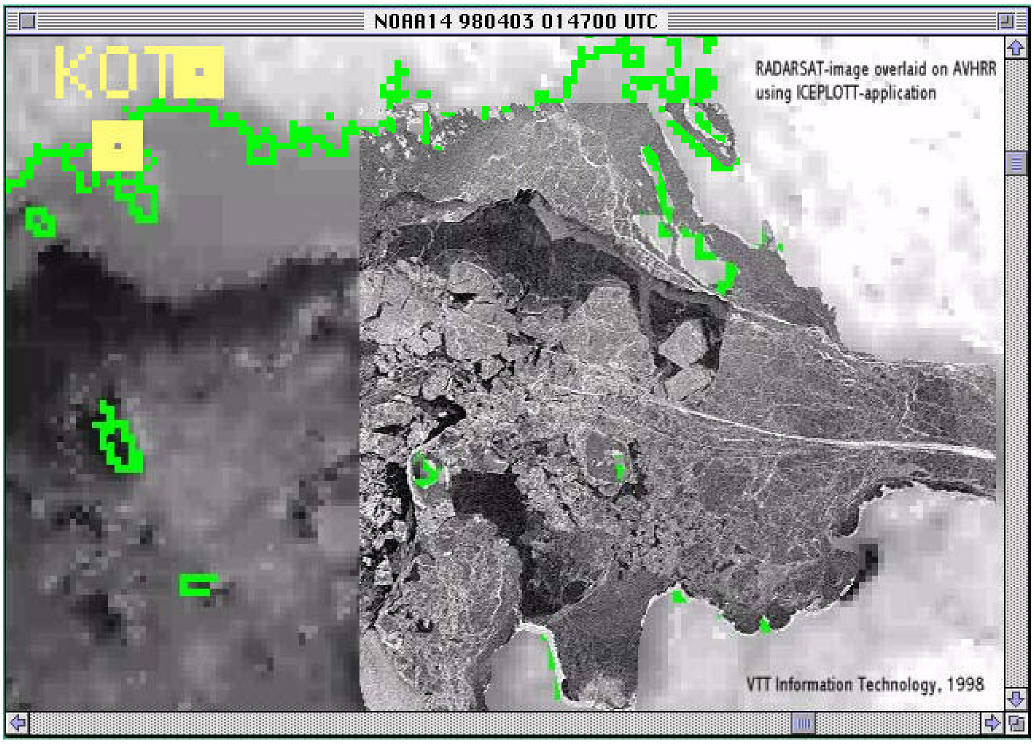


Figure 3. ***An example of the AVHRR and SAR data combination in the eastern Gulf of Finland as seen in the presentation environment used in by Finnish icebreakers and some ships.***

When space-borne SAR become available with ERS-1 in early 1990s, new possibilities opened up in operational sea ice monitoring. In the Finnish ice service ERS SAR data were available under ESA's research application umbrella. This data were also sent to the icebreakers for validation. The SAR data proved to be so valuable, that the Finnish ice service purchased several hundred images in winters of 1995-1997. Automatic SAR image classifications were also developed, and put into operational use in 1995-1997 (8, 9, 10). The ERS SAR data is rather inexpensive, but the swath is too narrow for operational use. In 1995 a Canadian RADARSAT was launched, and operational SAR data with up to 500 km swath become available.

Table 1. ***Digital data delivered to the Finnish icebreakers and merchant vessels in 1997-1999.***

	No of users			Digital ice charts			AVHRR data		
	1997	1998	1999	1997	1998	1999	1997	1998	1999
Icebreakers	5	6	8			Y	Y	Y	Y
Merchant vessels	3	3	8	Y		Y	Y	Y	Y
	ERS SAR data			RADARSAT SAR data			SAR image classifications		
	1997	1998	1999	1997	1998	1999	1997	1998	1999
Icebreakers	Y				Y	Y	Y	Y	Y
Merchant vessels	Y				Y	Y	Y	Y	Y

ERS SAR images were delivered to the icebreakers and vessels at sea in 150 m resolution. The RADARSAT SAR images, however, have a large file size, and therefore resolution had to be reduced. The relative low capacity of the network made it necessary to reduce the images from 100 m into 800 m. The transmission of one screen took some four minutes at ideal conditions. Sub-images of 100 by 100 km with resolution of 200-250 m were

Comment to Smirnov & Stepanov's (AARI) presentation on ice service capabilities.

Ari Seina
Head of Finnish Ice Service
Finnish Institute of Marine Research
P.O.Box 33
FIN-00931 Helsinki
Finland
Tel. +358 9 613941
e-mail: ari.seina@fimr.fi

Motive of ice services

Timely and variable information on sea ice conditions are essential for all operations in ice-covered areas. The safety and efficiency of sea transportation, off-shore operations, fisheries and other activities in regions covered by sea ice have been the motive for establishing operational sea ice monitoring and forecasting services in many countries.

Drivers of ice services

1) Policy makers in international and national level require ice information. E.g. European Union needs information for EEA (ice parameters), Traffic Policy (handling of traffic flow and smoother marine transportation), Environmental Policy (risks, hazards, pollution, etc.), Fishing Policy (risks, hazards, ice-edge, etc.). National policy makers need information for e.g. traffic control and environmental protection.
2) Science needs inputs to e.g. models of all kind. One of these is Global change.
3) Users on land need information for logistic in e.g. transportation, export, import, offshore industry, etc.
4) Users at sea need operational information for ice navigation and offshore activities.

Output products of ice services must respond requirements of all these driver groups.

Main components of ice services

Input data:

- Space-borne data (satellites)
- Air-borne data (airplanes & helicopters)
- Ground truth (ships, icebreakers, stations, buoys)
- Oceanographic & weather models
- Statistics

Main problems
Space-borne data (ice monitoring needs on daily basis wide coverage, daylight & cloud independent, near real-time and high resolution data and long series of same type of sensors, like SAR, AVHRR)

- Daylight & cloud independent passive microwave data is available on daily basis (SSM/I). Swath is c. 1400 km but resolution is 12-25 km. Not available in near real-time (+24h).
- The best ice monitoring data today is SAR data, which is daylight & cloud independent. Only two operational sensors available: Canadian RADARSAT and European ENVISAT. Both are equipped with wide swath mode of 500 km swath. Resolution with wide swath is 100-150 m, which is suitable to ice monitoring. Data is available in every 1-2 d at latitude of 60 deg. Main problems are high cost of data and large file size. Available in near real-time (+2h).
- Visual & infrared data is not daylight & cloud independent thus 60-80% of images are useless. It has poor resolution (AVHRR) but c. swath of c. 2600 km and 10-12 potential orbits a day. Resolution is c. 1 km. Available in near real-time (+15 min).

Ice service on daily basis:

- Collection of data
- Analysis of data
- Interpretation of data
- Product making

Main problems

- Growing traffic needs better service, better information, better ice routing and better traffic planning.
- Due high costs, ice services could not use as much space-borne data as they would like (E.g. in Finnish Ice Service 100 RADARSAT SAR scenes a winter). Optimally areas EO covered once a day.
- Users need information in various scale: in best the ice charts today are in resolution of 1 km. Users at sea need information in ship's scale. Solution: e.g. algorithm based high-resolution charts.
- Ice forecasts must be develop further towards user demands. When reliable weather forecasts available, quality of ice forecasts will go up.
- Advanced and basic national ice services with advanced and basic services.

Output data:

- Ice charts,
- Ice reports
- Ice forecasts
- Satellite images
- Special products (e.g. SAR based high resolution thickness charts)
- Inputs to models (e.g. In Finnish Ice Service to HIRLAM, Wave Model and Ice Drift Model)

Communication:

- Various kinds of communication systems available. User requirements for digital, high-resolution products onboard ships.

Main problems

- Communication possibilities limit high-resolution product delivery to users at sea.
- Communication costs.

Users of information:

- On land
- At sea

Main problems

- Interpretation of information. Users are not keen to invest for better information and service. Users are not aware of what is possible and what is not possible to produce. Training activities of users have been in general limited.

More information

Finnish Ice Service: http://www.fimr.fi
Satellite data use in ice monitoring: http://www.nrsc.no/OSIMS/
Satellite data use in Finnish winter navigation (attached)

Satellite data use in Finnish winter navigation

Hannu Gronvall and Ari Seina

Finnish Institute of Marine Research, P.O. Box 33, FIN-00931 Helsinki, Finland

Abstract

In Finland the winter marine transportation is worth about 20 billion Euro. All Finnish harbours are ice bound up to 7 months, which means that merchant vessels must be ice-strengthened and assisted by the icebreaker fleet. In ten years winter traffic has increased by 30%. The number of icebreakers has not increased, but the traffic is smoother than ever. This has been possible by extensive use Earth Observation (EO) data in ice navigation. The value of sea ice information is determined by its accuracy, validity and fast delivery. Large-scale, high resolution, accurate and fast-delivered data are essential for ice navigation. The EO data consists of at least 80% of the input in the Finnish ice service. Lack of this kind of data could block ice navigation or cause at least considerable economical losses. Experimental since 1985 and in operational use since the early 1990s in all Finnish icebreakers, digital data, e.g. satellite data, have been delivered via the ice service to the icebreakers using a Finnish-Swedish icebreaker communication network. The EO data consist of NOAA AVHRR and SAR data (1992-1997 ERS SAR, 1998-1999 RADARSAT SAR) including e.g. automatic SAR image classifications. The data, especially the high-resolution SAR data, have been used directly in ice navigation. The extensive use of EO data have reduced the number of reconnaissance flights considerable. The AVHRR data are in use in the icebreakers in about half an hour and RADARSAT SAR data in some 3-4 hours after receiving at the ground station. Since 1997 digital EO data have also been sent experimentally to some merchant vessels using special designed applications.

1. INTRODUCTION

Timely and variable information on sea ice conditions are essential for all operations in ice-covered areas. The safety and efficiency of sea transportation, off-shore operations, fisheries and other activities in regions covered by sea ice have been the motive for establishing operational sea ice monitoring and forecasting services in many countries.

The Baltic Sea freezes annually. The maximum annual ice extent occurs between January and March, with the maximum ice cover being 12-100% of the total 420,000 sq. km and being on average 218,000 sq. km (1). The 0.5 probability of ice cover is lying in the northern Baltic Sea at around the latitude of Stockholm. The ice season lasts from weeks up to seven months.

The ice in the Baltic Sea occurs as fast ice and drift ice. Fast ice exists in coastal archipelago areas. Drift ice has a dynamic nature being forced by winds and currents. Ridges and brash ice are the most significant obstructions to navigation in the Baltic Sea. Powerful, ice-strengthened vessels can break through thick level ice, but they are not capable of navigating through ridges and heavy brash ice barriers without icebreaker assistance. Ice dynamics cause high pressure in the ice field and can be dangerous to the vessels and may cause time delays up to several days.

The two most heavily trafficated waterways in the word, where seasonal sea ice plays an important role in navigation, are Gulf of St. Lawrence in Canada and the Baltic Sea in Europe. In Gulf of St. Lawrence some 180 million tons of goods are transported annually. The total cargo turnover in the Baltic Sea in 1995 was about 450 million tons, some 40% of which occurs during winter. Ice conditions make all winter navigation difficult at least in Finland, Sweden, Russia and Estonia, and during severe seasons all over the Baltic Sea.

In Finland almost 90% of foreign trade is transported by sea The annual turnover in 1997 was 75 million tons. During the winter months there are more than 23,000 port-calls in Finnish harbours transporting about 30 million tons of goods. The winter marine transportation is worth about 20 billion Euro.

Winter navigation is made possible by the use of icebreakers, ice-strengthened vessels and by restricting navigation. Navigation is restricted by closing half of the harbours for the winter and giving assistance only to vessels suitable for ice navigation. During normal winters a vessel bound for the northern Bothnian Bay must navigate up to 300 nautical miles through ice, a vessel bound for southwestern Finland for 50 nautical miles and a vessel bound for the eastern Gulf of Finland up to 150 nautical miles, making winter navigation extremely expensive. Under normal conditions the sailing time from the ice-edge to the northern Bothnian Bay is one day, but under severe conditions it can extend to nearly one week.

During last ten years the marine traffic has increased by 30%, and the trend is expected to continue. In the same period, however, the number of icebreakers has not increased. The smoothness of traffic has been possible due to by better ice monitoring, where use of EO data has become more and more important. Icebreakers need detailed ice information for route planning. Considerable savings in ice navigation could be made by optimising the use of satellite based operational ice monitoring.

2. THE ICE MONITORING SYSTEMS TODAY

Today there are national ice services in all the Baltic Sea with responsibility to collect, analyse and distribute sea ice data.

The input data consists of (a) ground truth, such as data from observation stations and observations of vessels and icebreakers, (b) visual and/or digital air-borne data collected by aeroplanes and icebreaker-based helicopter and (c) space-borne data of various satellites (Fig. 1). All these data are collected by the ice services using various means of communication such as networks, faxes, telexes, mail and radio. In Finland and Sweden a network called IbNet (previously IRIS) links Swedish and Finnish icebreakers, icebreaking leaderships, main pilot stations and the ice services. Using cellular telephone or communication satellite based IbNet networks the information could be distributed fast and at a relatively low cost. Other means of communication are more time-consuming and the quality is not acceptable.

The value of an ice chart is determined by its accuracy and validity. The real-time aspect is important as the ice conditions change over time. To speed up the production of high-quality charts using remote sensing, the ice services have taken a sophisticated ice charting applications, including image-handling, analysis and drawing application into operational use. In Finland, Sweden and Germany a joint application called ICEMAP is in use. EO data have been available to the Finnish ice service since 1968. In the 1960s and 1970s mainly low-resolution ESSA (Environmental Science Service Administration) satellite data were in use. Since the late 1970s NOAA AVHRR (National Oceanic and Atmospheric Administration - Advanced Very High Resolution Radiometer) have been the main visual/infrared satellite data. SAR (Synthetic Aperture Radar) data have been used since the early 1990s.

Ice charts issued on a daily basis are the most important and widely used ice information products of the Finnish ice service. Other products are daily ice reports in the national languages and in English, ice reports in the Baltic Sea ice code and ice forecasts. In Finland and Sweden, digital satellite images are sent to the operative icebreakers daily in the ice season. The Finnish ice service has developed automatic classification maps of SAR images and sent them to the users. These maps are show the deformation degree of the area in detail and thus help shipmasters to make ice navigation decisions (2, 3, 4, 5, 6).

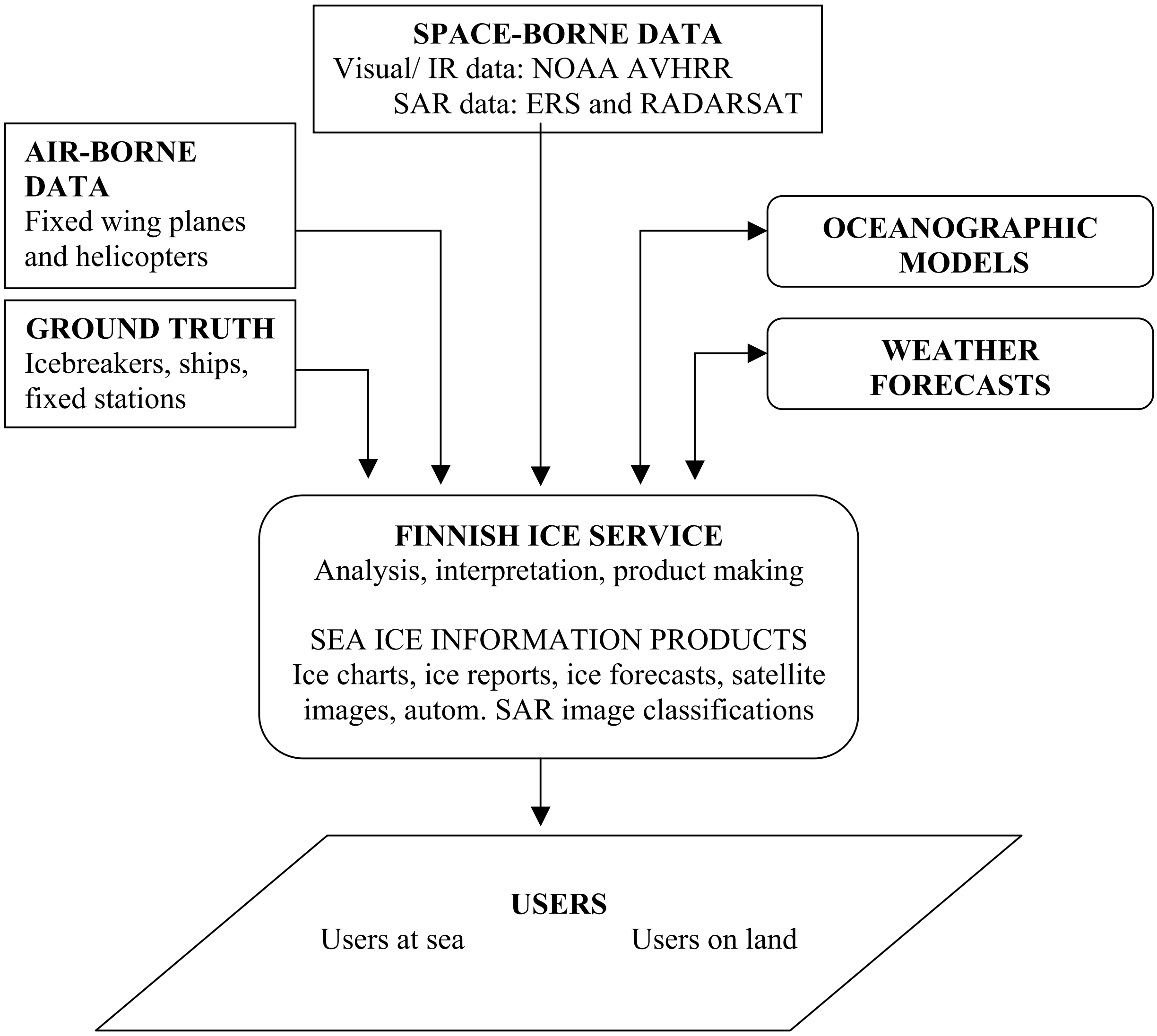


Figure 1. ***Operational scheme of the Finnish ice service. Data input and information product flow to users are shown.***

Traditionally, sea ice information products, of which the ice charts are the most important, have been distributed by mail, fax and radio. These systems are, however, slow and/or the quality of faxed satellite images has been poor. In order to deliver space-borne data of excellent quality to users at sea, digital systems have been developed. Since the early 1990s, digital networks, e.g. IRIS / Ib/Net in Finland and Sweden, have been also been in use. These methods have been based on communication satellites or cellular telephone networks. In areas of high traffic density with feasibility of high technology, e.g. the Baltic Sea, use of this kind of advantages have been possible to a relative low-cost also made and sent to the icebreakers. A modest number of RADARSAT SAR images were delivered to merchant vessels in 800, 400, 250 and 200 m resolution.

In 1999, the resolution of the RADARSAT image sent to icebreakers and ships has improved to 400-500 m for full size 300 by 300 km images. This is a major improvement compared to 800 m resolution in 1998. The aim is to improve compression applications, so that images can be sent optimally in full 100 m resolution and the transmission time would become very short. (Table 1).

4. VALIDATION OF EO DATA AND SYSTEMS

4.1 Limitations and capabilities of the current EO data

The main limitations of current satellite data are:

- AVHRR and other visual/infrared sensors are limited by cloud and daylight, which means that regular observations of sea ice are not possible every day.
- SAR data from ERS can provide most of the important ice parameters at sufficient resolution, but spatial and temporal coverage is not adequate for regular use in sea ice monitoring.
- SAR from RADARSAT can fulfil most technical requirements for sea ice observations. The main problem is the high cost of data.

AVHRR data are the basic EO data in ice monitoring, because the data are free of charge, easy to receive by fairly simple equipment and several orbits are available daily. A resolution of 1 km is good enough for general ice mapping. The Baltic Sea is frequently covered by clouds especially during low pressure passages and since major changes occur during such conditions, visible/infrared data have limitations. It has been estimated, that some 60% of the images in the Baltic Sea are useless because of cloud cover.

SAR data are ideal for ice monitoring, because of their cloud and daylight independence, assuming the swath is wide enough and the resolution is suitable. Among the present satellites only RADARSAT can provide data for operational ice monitoring, which makes the system vulnerable. SAR data processing is complex and time-consuming. Moreover, the file sizes are large and transmission via Internet takes time. This means that several hours elapse before the data are available for the ice services. An other disadvantage is a cumbersome ordering procedure which requires that images are ordered several weeks in advanced. The data are also rather expensive to use.

4.2 Limitations of current delivery systems

The main limitations of current delivery systems are:

- Cellular telephone systems used in data delivery are slow and have gaps in coverage in the northern part of the Baltic Sea.
- The delivery time of large-size files from the SAR data receiving station and ice services via Internet is too long.
- The RADARSAT SAR images delivered to the icebreakers and ships in 1998 had too low resolution (800 m) to be used directly in tactical ice navigation.

Terrestrial cellular telephone systems (NMT-450 and GSM) used in data transfer have rather low data transfer capacity. However, the system is inexpensive to use and has been used for years despite its limitations. In near future, all data transfer at sea should be based on telecommunication satellites with high data transfer capacities.

The schedule of the RADARSAT morning passes over the Baltic Sea has been optimal, making it possible to use images in ice mapping for the same day. The evening screens have been available the next morning. This means that the morning images can reach the end users at sea within 3-4 h, while the evening images on the other hand may need more than 12 h.

5. CONCLUSIONS

The economic value of winter navigation in the Baltic Sea is huge, and ice navigation is vital at least to Finland. By improving the sea ice monitoring, and high resolution data and information product distribution, considerable savings could be achieved in ice navigation, mostly by reducing sailing times.

One of the activities in the Finnish ice service in 1990s has been to demonstrate the utilisation of EO data in sea ice monitoring to a wider user community. In the Baltic Sea, the user community has consisted of the Finnish icebreakers and a number of merchant vessels.

A trend towards a fully digitised information system onboard ships can be perceived. The development of digital information systems for ships, including digital sea charts and other high resolution data, will have a strong impact on the development of sea ice monitoring systems.

New communication systems will be available in near future. New communication satellites able to transfer high data rates at reasonable prices, are expected to be operational in on a large scale in the near future. Providers of sea ice information products should take advantages of the new communication technology by developing high-resolution information products to be used directly in ice navigation.

REFERENCES

1. A. Seina and E. Palosuo, The classification of the maximum extent of ice cover in the Baltic Sea 170-1995, Meri -Rep. Ser. Of the Finnish Institute of Marine Research, 1996, 79-91.
2. J. Karvonen and M. Simila, Pulse-coupled neural network for sea ice SAR image segmentation and classification, Proc. Workshop on Virtual Intelligence-Dynamic Neural Networks 1998 (VI-DYNN'98), Stockholm, Sweden.
3. J. Karvonen and M. Simila, Classification of sea ice types from ScanSAR RADARSAT images using pulse-coupled neural networks, Proc. IEEE International Conference on Geoscience and Remote Sensing (IGARSS'98), 1998, 2505-2508, Seattle, USA.
4. J. Karvonen and M. Simila, Comparison of two pulse-coupled neutral models for sea ice SAR image classification, in J. Tuhkuri and K. Riska (eds.) Proc. Of the 15th International Conference on Port and Ocean Engineering under Arctic Conditions (POAC'99), 1999, 220-229, Helsinki, Finland.
5. S. Sandven, M. Makynen, M. Hallikainen, M. Simila, H. Gronvall, A. Seina, A. Cavanie, R. Ezraty, C. Maroni, R. Gill, H. H. Valeur, L. T. Pedersen, V. Alexandrov, S. Andersen, M. Lunghaug, E. Bjorgo, O. Dalen and K. Koster, Integrated use of new microwave satellite data for improvement sea ice observation. IMSI Report No. 8: Development of new satellite ice data products. European Commission Environmental and Climate Programme 1994-1998, Theme 3, Area 3.3.3. Contract No. ENV4-CT96-0361. - NERSC Technical Report No. 145.1998, 1-76.
6. M. Simila and J. Karvonen, Classification of first-year sea ice using pulse-coupled neural network, to appear in the book Information Processing for Remote Sensing, ed. by C. H. Chen, World Scientific Publishing.

7. A. Seina, H. Gronvall, M. Nizovsky and J. Vainio, Integrated use of new microwave satellite data for improvement sea ice observation -IMSI Report No. 3: Dissemination of test products to selected users in the Baltic Sea. Report on activities in the winter of 1997. European Commission Environmental and Climate Programme 1994-1998, Theme 3, Area 3.3.3. Contract No. ENV4-CT96-0361, Meri - Report series of the Finnish Institute of Marine Research No 33.1998, 49-68.
8. H. Gronvall, A. Seina and M. Simila, The Finnish ice service and real time automatic classification of SAR data, Nordic Space Activities, Vol. 4, No. 4/96, 1996, 28-29, 33-35.
9. M. Simila and J. Helminen, The identification of the deformed sea ice fields from ERS-1 SAR image by wavelets. in Proc. IEEE Geoscience and Remote Sensing Conf. (IGARSS'95), Firenze, 1995, 868-870.
10. M. Simila, SAR image classification according to ice deformation. Proc. of the Second ERS Applications Workshop, London, UK, 6-8 December 1995, ESA SP-383, 1996, 211-214.

ARCOP
Workshop
Helsinki

TRAFFIC
Management
Service

Requirements
And
State of the Art

Vessel Traffic Management and Information (VTS & VTMIS)

Jens Froese

ISSUS
HAMBURG

ARCOP
Workshop
Helsinki

TRAFFIC
Management
Service

Requirements
And
State of the Art

Vessel Traffic Management

There is no internationally agreed definition for *Vessel Traffic Management*

However, VTM is commonly understood as part of Vessel Traffic Service.

ISSUS
HAMBURG

Page 2/35

ARCOP Workshop Helsinki

TRAFFIC Management Service

Requirements And tate of the Art

ISSUS HAMBURG

Source of Information

VTS Manual

IALA
Vessel Traffic
Services Manual
(VTS Manual, 2002)
3rd Edition 2002

Download free of charge from
www.actme.es/areas_de_estudio.htm

ARCOP Workshop Helsinki

TRAFFIC Management Service

Requirements And tate of the Art

ISSUS HAMBURG

VTS Definition

A VTS is a service implemented by a Competent Authority, designed to improve the safety and efficiency of vessel traffic and to protect the environment.
The service should have the capability to interact with the traffic and respond to traffic situations developing in the VTS area.

IALA VTS Manual 2002

ARCOP
Workshop
Helsinki

TRAFFIC
Management
Service

Requirements
And
State of the Art

ISSUS
HAMBURG

Service and Operating Options

- **Information Service**
- **Navigational Assistance Service**
- **Traffic Organisation Service (= VTM)**
- **Co-operation with Allied Services, Port Operations, Emergency Services and adjacent VTS.**

ARCOP
Workshop
Helsinki

TRAFFIC
Management
Service

Requirements
And
State of the Art

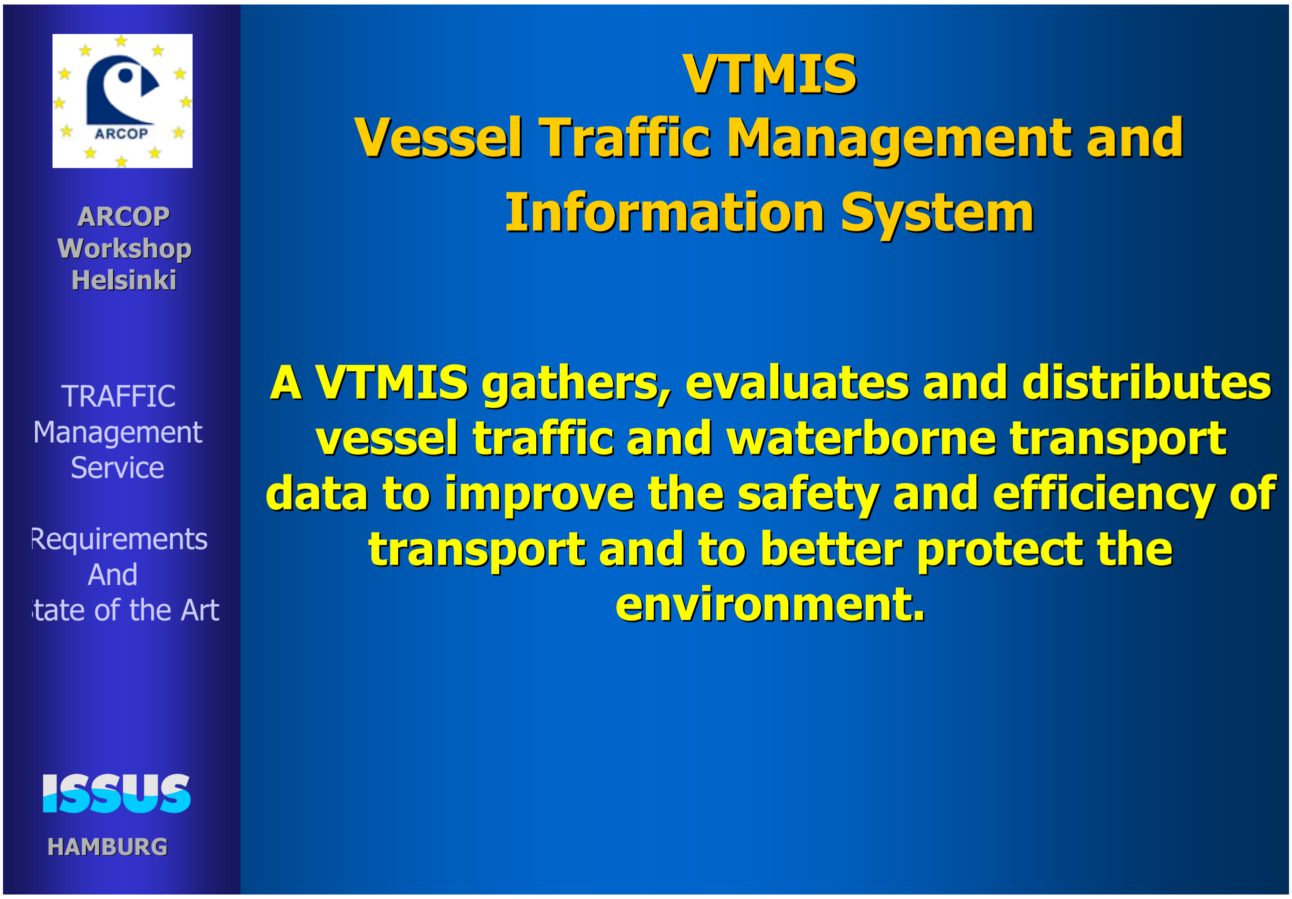
ISSUS
HAMBURG

VTMIS
Vessel Traffic Management and Information System

Vessel Traffic Service (VTS)

- ♦ **traffic information**
- ♦ **navigational assistance**
- ♦ **traffic organisation**

+ transport related information to allow for co-operative resource management


ARCOP
ARCOP
Workshop
Helsinki
TRAFFIC
Management
Service
Requirements
And
tate of the Art
ISSUS
HAMBURG
VTMIS
Vessel Traffic Management and
Information System
A VTMIS gathers, evaluates and distributes vessel traffic and waterborne transport data to improve the safety and efficiency of transport and to better protect the environment.


ARCOP
ARCOP
Workshop
Helsinki
TRAFFIC
Management
Service
Requirements
And
tate of the Art
ISSUS
HAMBURG
VTS - Vessel Relationship
VTS
responsibility to manage the traffic on the basis of specialised local knowledge and information sensors resulting in a complete traffic picture (“traffic image”).
Vessel
responsibility to safely navigate the vessel on the basis of its behaviour and the professional skills of the crew.
IALA VTS Manual 2.4.3

ARCOP
Workshop
Helsinki

TRAFFIC
Management
Service

Requirements
And
State of the Art

ISSUS
HAMBURG

VTS - Vessel Relationship

VTS instructions to a vessel should be "result orientated" only, leaving the details of execution to the master, officer of the watch or pilot on board the vessel.

IALA VTS Manual 2.4.3

ARCOP
Workshop
Helsinki

TRAFFIC
Management
Service

Requirements
And
State of the Art

ISSUS
HAMBURG

Liability

The question of assignment of liability in regard to vessel movement is one of constant controversy. It is complicated by the legal relationships between masters, pilots, ship owners, and VTS. Although there are many cases setting precedence on this issue, it continues to be an area in maritime and civil law that seems to be developing on a case by case basis.

IALA Manual 2.4.4


ARCOP
ARCOP
Workshop
Helsinki
TRAFFIC
Management
Service
Requirements
And
tate of the Art
ISSUS
HAMBURG
Navigational Requirements
Water depth requirements:
• Draught
• Draught inaccuracies
• Tide level prediction inaccuracies
• Survey inaccuracies
• Changes in water density
• Rolling and pitching
• List caused by rudder or wind
• Squat.
UKC


ARCOP
ARCOP
Workshop
Helsinki
TRAFFIC
Management
Service
Requirements
And
tate of the Art
ISSUS
HAMBURG
Navigational Requirements
Water depth requirements:
Draught
+ Squat
+ Under Keel Clearance (UKC)

ARCOP Workshop Helsinki

TRAFFIC Management Service

Requirements And State of the Art

Navigational Requirements

Navigable space requirements:

- Coverage and nature of ice
- Position inaccuracies
- Motion inaccuracies
- Chart inaccuracies.

ISSUS HAMBURG

ARCOP Workshop Helsinki

TRAFFIC Management Service

Requirements And State of the Art

Navigational Requirements

Navigable space requirements:

- Coverage and nature of ice
- Position inaccuracies
- Motion inaccuracies
- Chart inaccuracies.

ISSUS HAMBURG

ARCOP

ARCOP Workshop Helsinki

TRAFFIC Management Service

Requirements And tate of the Art

ISSUS HAMBURG

Techniques and Technologies

Required information:

continuous highly accurate information on position and motion in real-time in relation to navigable space, traffic and obstacles.

ARCOP

ARCOP Workshop Helsinki

TRAFFIC Management Service

Requirements And tate of the Art

ISSUS HAMBURG

Navigational Requirements

Track keeping:

- by propulsion, steering and manoeuvring aids (e.g thruster, Becker rudder, Azipod) and by tugs/icebreakers

Internal disturbances:

- from failure of systems to black out

External disturbances:

- ice
- hydrodynamic effects
- wind
- current
- traffic and navigational obstacles.

ARCOP
Workshop
Helsinki

TRAFFIC
Management
Service

Requirements
And
State of the Art

ISSUS
HAMBURG

VTS Navigational Assistance

Actors

- vessels command (master, OOW)
- pilot
- VTS operator.

ARCOP
Workshop
Helsinki

TRAFFIC
Management
Service

Requirements
And
State of the Art

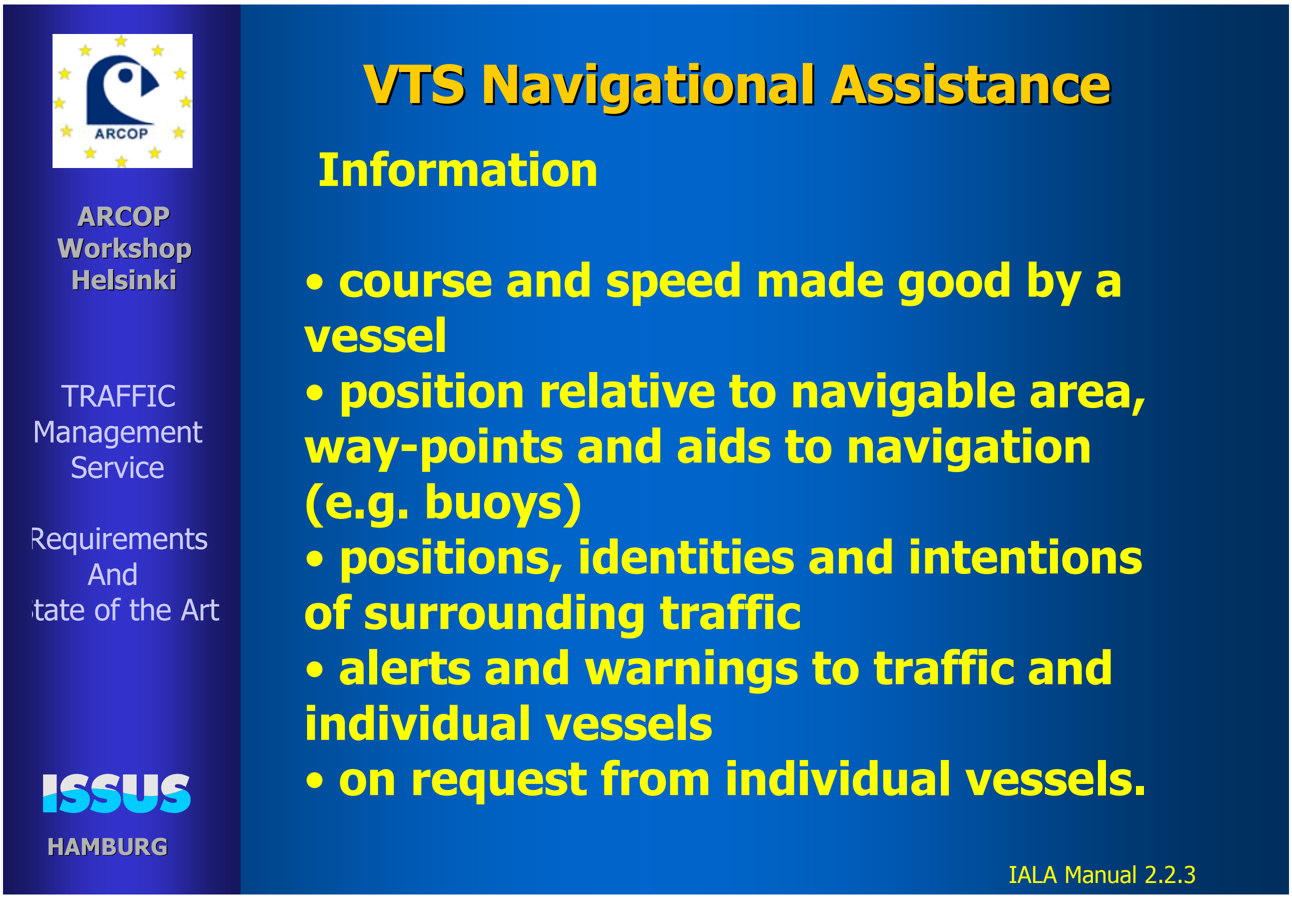
ISSUS
HAMBURG

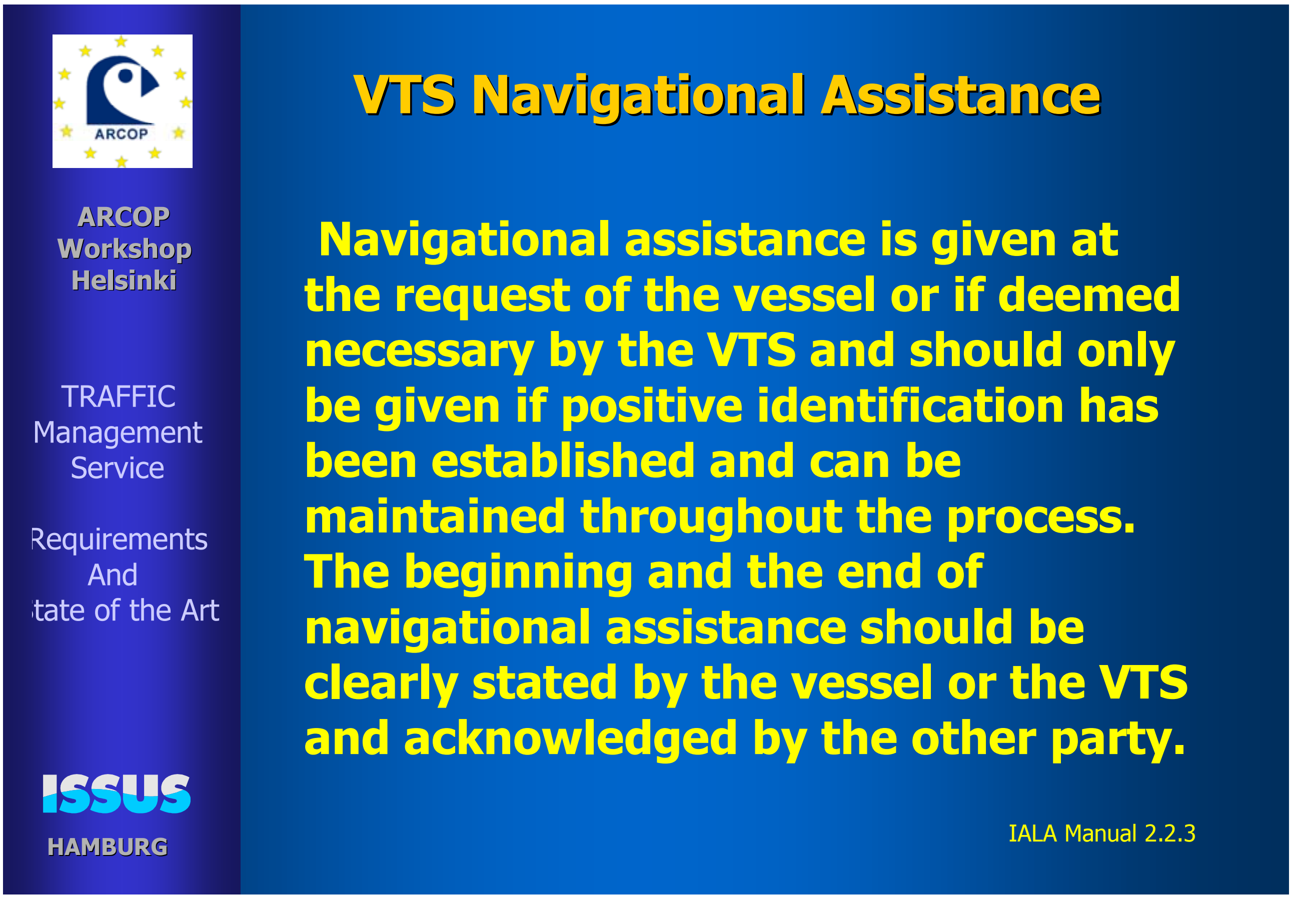
VTS Navigational Assistance

Functions

- monitor the area, traffic and related conditions
- assist onboard navigational decision making
- monitor effects.

IALA Manual 2.2.3


ARCOP
ARCOP
Workshop
Helsinki
TRAFFIC
Management
Service
Requirements
And
tate of the Art
ISSUS
HAMBURG
VTS Navigational Assistance
Information
• course and speed made good by a vessel
• position relative to navigable area, way-points and aids to navigation (e.g. buoys)
• positions, identities and intentions of surrounding traffic
• alerts and warnings to traffic and individual vessels
• on request from individual vessels.
IALA Manual 2.2.3


ARCOP
ARCOP
Workshop
Helsinki
TRAFFIC
Management
Service
Requirements
And
tate of the Art
ISSUS
HAMBURG
VTS Navigational Assistance
Navigational assistance is given at the request of the vessel or if deemed necessary by the VTS and should only be given if positive identification has been established and can be maintained throughout the process. The beginning and the end of navigational assistance should be clearly stated by the vessel or the VTS and acknowledged by the other party.
IALA Manual 2.2.3

ARCOP Workshop Helsinki

TRAFFIC Management Service

Requirements And State of the Art

VTS Navigational Assistance

A VTS can participate in the decision making process by giving navigational advice.
Be aware of the distinction between navigational information and navigational advice because of its potential legal implication which depends on the fact to which extent a master can himself assess the situation and override advice according to actual local conditions.

IALA Manual 2.2.3

ISSUS HAMBURG

ARCOP Workshop Helsinki

TRAFFIC Management Service

Requirements And State of the Art

VTS Navigational Assistance

Shore-based pilotage (SBP)

In order to assist the safe navigation of a vessel, pilots can also give from the shore and with the agreement of the master a service to conduct the vessel to or from the pilot's transfer area.

This SBP is an extension of the pilot's task to improve efficiency of maritime traffic in certain circumstances but its limitations on safety should be understood.

IALA Manual 6.5.1

ISSUS HAMBURG

ARCOP Workshop Helsinki

TRAFFIC Management Service

Requirements And tate of the Art

ISSUS HAMBURG

VTS Navigational Assistance

Shore-based pilotage (SBP) requires

- **it is in accordance with national legislation**
- **limits and limitations are established by local pilotage regulations**
- **direct co-operation is established with VTS centres regarding traffic organisation**
- **suitable radar and radio equipment are utilised.**

IALA Manual 6.5.1

ARCOP Workshop Helsinki

TRAFFIC Management Service

Requirements And tate of the Art

ISSUS HAMBURG

VTS Navigational Assistance

Shore-based pilotage (SBP) requires a VTS - vessel communication

- **technically reliable**
- **consistent and comprehensive**
- **language-wise understandable**
- **content-wise understandable**
- **the onboard ability and will to perform according VTS recommendations.**

ARCOP Workshop Helsinki

TRAFFIC Management Service

Requirements And State of the Art

ISSUS HAMBURG

VTS Navigational Assistance

Shore-based pilotage (SBP) - safety aspects

- lack of real-time information (vessel & equipment status, human aspects, operational conditions) in a VTS even after the invention of AIS
- no intentions or ideas can be monitored only results which might be too late if something goes wrong
- high potential danger even if a risk analysis (e.g. formal safety assessment) results in acceptable figures (question of probabiltiy).

ARCOP Workshop Helsinki

TRAFFIC Management Service

Requirements And State of the Art

ISSUS HAMBURG

VTS Navigational Assistance

Shore-based pilotage (SBP) - efficency aspects

- advantages when guiding vessels towards a pilots boarding ground in an area where pilots are not mandatory including so-called over-seas pilotage (also improved safety)
- no interruption of traffic flow in cases pilots cannot board (e.g. rough weather) or a pilot is not available
- cost savings for not boarding a pilot (especially when done by helicopter) and through reduced pilots working time (no waiting times).

ARCOP
Workshop
Helsinki

TRAFFIC
Management
Service

Requirements
And
tate of the Art

ISSUS
HAMBURG

Techniques and Technologies

- Geographical Information System (GIS) e.g. Electronic Chart Display and Information System (ECDIS)
- detailled weather and environment information
- precise position sensor (GPS)
- Radio-Transponder (AIS)

ARCOP
Workshop
Helsinki

TRAFFIC
Management
Service

Requirements
And
tate of the Art

ISSUS
HAMBURG

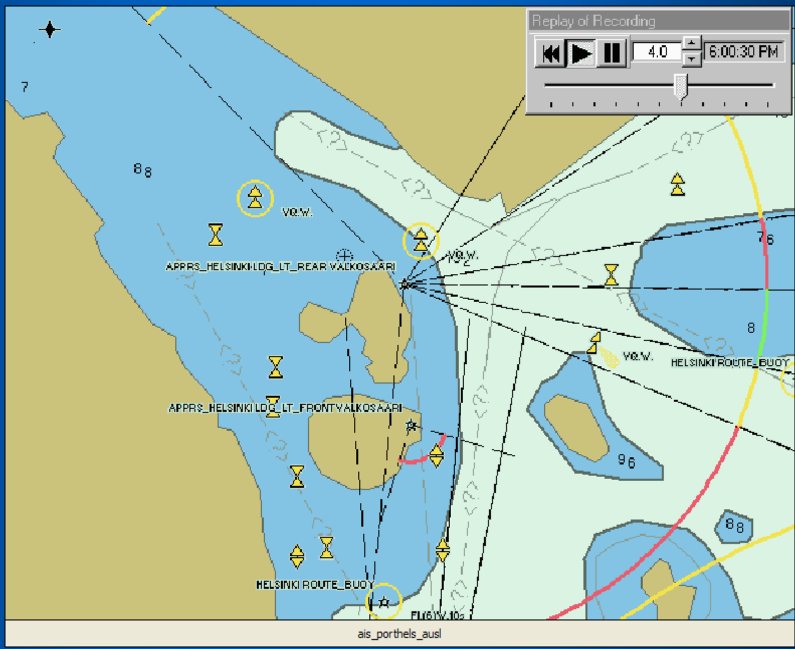
Techniques and Technologies

ARCOP
Workshop
Helsinki

TRAFFIC Management Service

Requirements And State of the Art

Broadcast Transponder



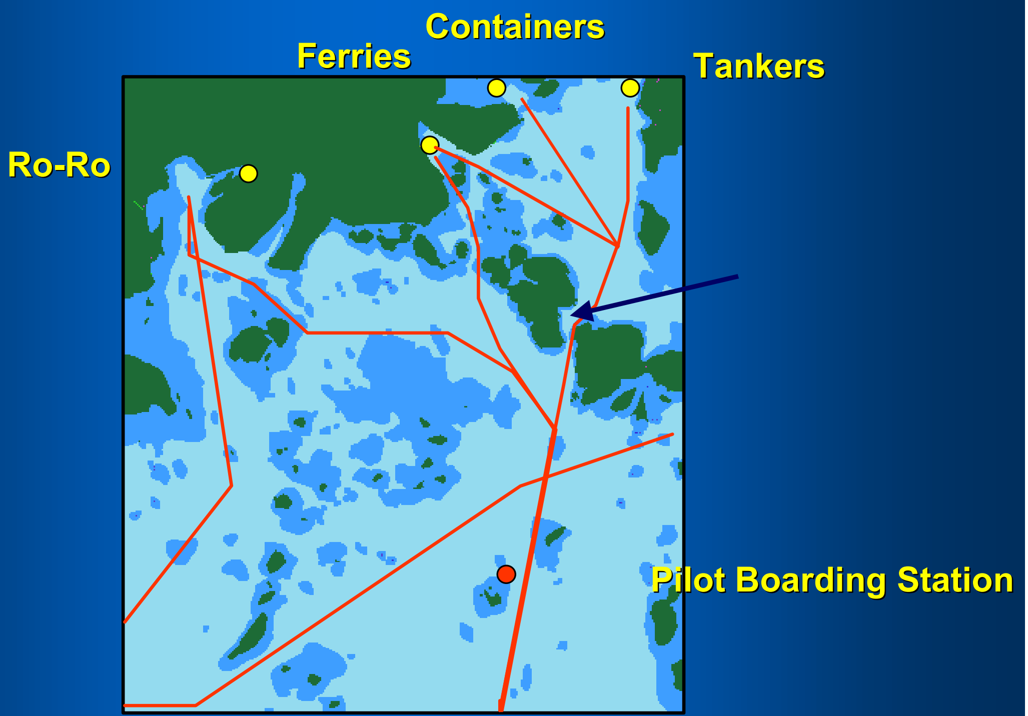
ISSUS
HAMBURG

ARCOP
Workshop
Helsinki

TRAFFIC Management Service

Requirements And State of the Art

Approaches to Helsinki



ISSUS
HAMBURG

ARCOP
Workshop
Helsinki

TRAFFIC
Management
Service

Requirements
And
tate of the Art

ISSUS
HAMBURG

Approach Helsinki Ferry Port

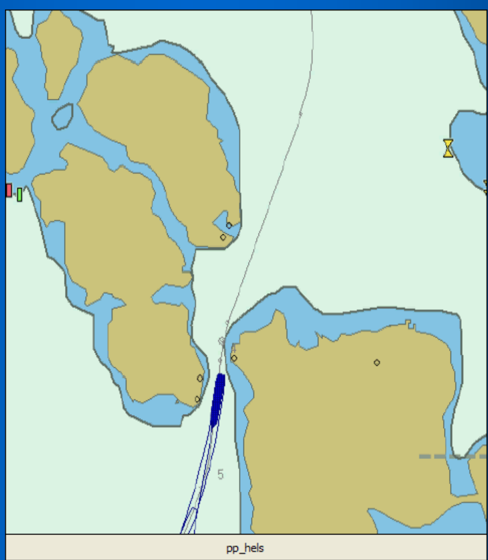
ARCOP
Workshop
Helsinki

TRAFFIC
Management
Service

Requirements
And
tate of the Art

ISSUS
HAMBURG

Path Prediction



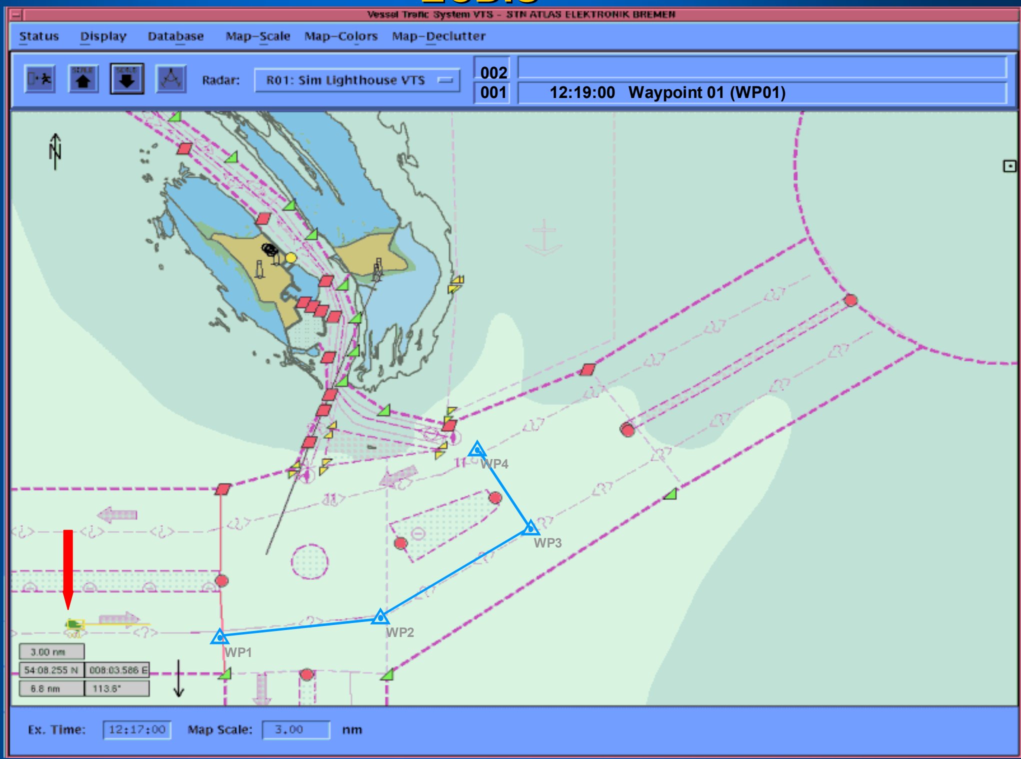
ARCOP
Workshop
Helsinki

TRAFFIC
Management
Service

Requirements
And
State of the Art

ISSUS
HAMBURG

ECDIS



ARCOP
Workshop
Helsinki

TRAFFIC
Management
Service

Requirements
And
State of the Art

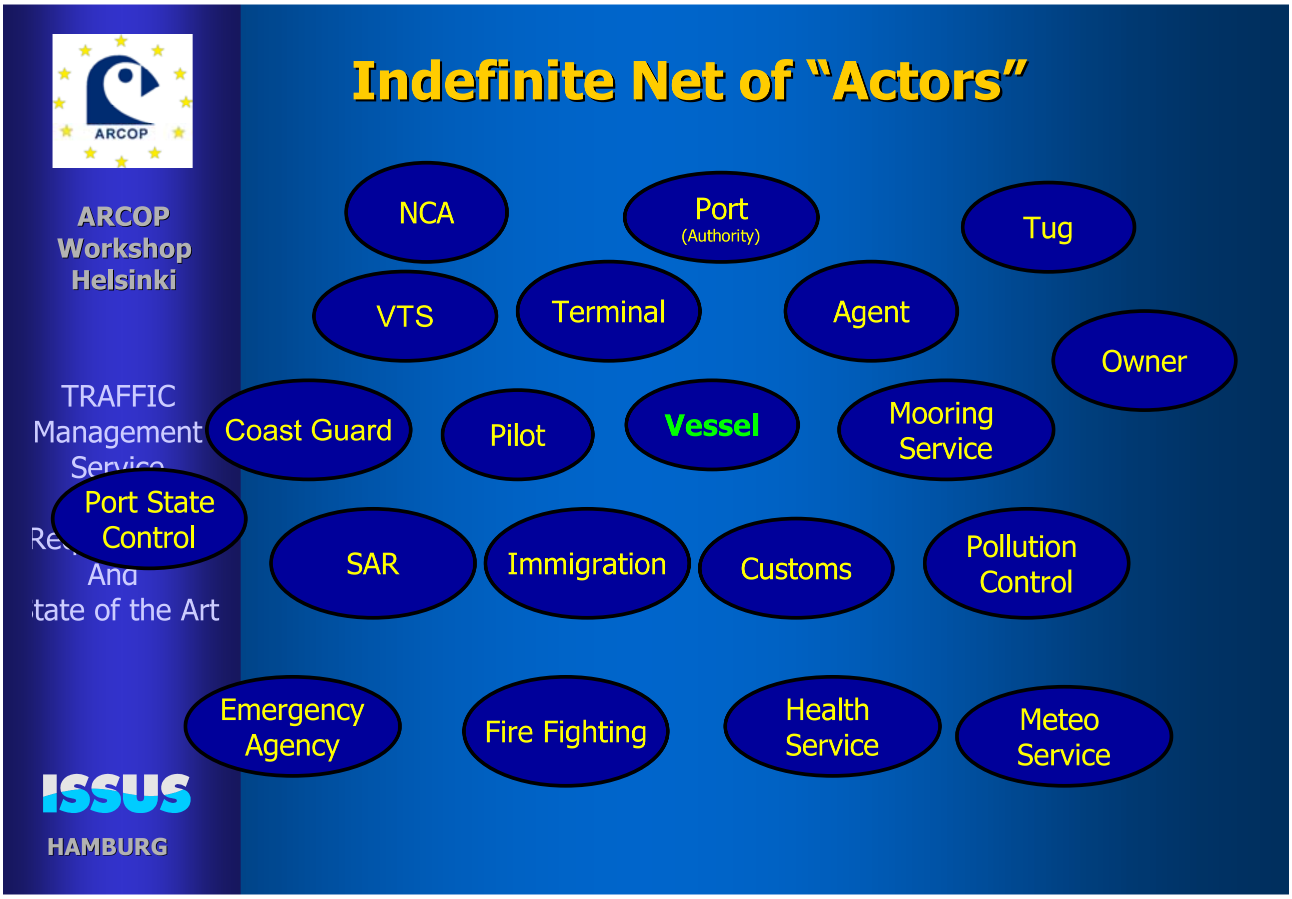
ISSUS
HAMBURG

Techniques and Technologies

The new maps will be accurate to around 20 feet

(Source: Lufthansa Magazin 7/2001)

The islands of Miquelon and Saint Pierre off Newfoundland, Canada, surveyed from 143 miles up in space as part of the Shuttle Radar Topography Mission (SRTM).


Indefinite Net of "Actors"
ARCOP
ARCOP Workshop Helsinki
TRAFFIC Management
And
tate of the Art
NCA
Port (Authority)
Tug
VTS
Terminal
Agent
Owner
Coast Guard
Pilot
Vessel
Mooring Service
Port State Control
SAR
Immigration
Customs
Pollution Control
Emergency Agency
Fire Fighting
Health Service
Meteo Service
ISSUS
HAMBURG


Techniques and Technologies
Areas for improvement:
• non-verbal communication
• exchange of sailing plans
• exchange of detailled weather and environment information (current and forecast)
• continuous contingency plan, i.e. updated according position and status of vessel(s)
• emergency task force.
ARCOP
ARCOP Workshop Helsinki
TRAFFIC Management Service
Requirements
And
tate of the Art
ISSUS
HAMBURG

COMMENT

TOPIC-TRAFFIC MANAGEMENT SYSTEMS

Dr. R.N.Chernyaev. Deputy Director General, CNIIMF

Central Marine Research and Design Institute (CNIIMF) as a participant of WP.3.6 intends to substantiate VTMIS for Arctic area providing the background gained for the long period of activity in this field.

Over the last 45 years we have been working on the development shore-based vessel traffic systems. The firsts were constructed in St.Petersburg (1960) and Murmansk (1965) ports. Before USSR demise we participated in construction of 27 VTS of different complicity.

In 1995 we developed the VTMIS project for russian territorial waters in the Gulf of Finland. It included 4 port VTS`s and 5 remote-controlled stations. All the objects are linked with one VTMIS Centre. It ensure uninterrupted ship surveillance along the channels and routes in the Gulf. The modern technologies were applied in the system (GNSS, radars, AIS, GMDSS). Nowdays this VTMIS is being constructed. At the same time ship separation sehemes were corrected and deep water way was established. These innovations were adopted by IMO.

Our participation in EU RTD Project VTMIS-NET (1998-2000) had broadened outlook and we were nearing the European Community goal. In the project (WP 14) CNIIMF presented the layout of the future VTMIS-NET for the whole Gulf of Finland. We are content that this VTMIS is being constructed now with plan to put it in operation from July of 2004. The RF Ministry of Transport is supporting the construction of the integrated VTMIS for the Gulf admitting its role in safety of navigation big oil tankers in extremely vulnerable region.

As for ARCOP project the task requires to find solutions available to ensure as all legitimate as commercial interests.

Based on the objectives and common view on the transportation scenario VTMIS for Arctic region has to consist of the components tied together in united infrastructure.

The main components of the system are:

- broad coverage GNSS and DGNSS along the coast and port approaches for the high precision ship position determination;
- Automatic identification system (AIS) with long range mode (via ship-borne Standard C) for continuous ship monitoring and ship autotracking in areas covered with VTS;
- Automatic surveillance and management of ships approaching coastal waters and ports, using the net of VTS united by VTMIS Centre;
- Area 1 and Area 2 of Global Maritime Distress and Safety System (GMDSS) for search and rescue operations in case of calamity;
- Radio links along the coasts and fibreoptic lines along the underwater pipelines for connection VTMIS`s situated at distant places;
- Safety-NET system to ensure the tankers with meteoro logical, ice and other information.

TRAINING REQUIREMENTS
ICE OPERATIONS

Author: A.M. Platzer
Organisation: Wagenborg Shipping B.V.
Date: 27/03/2003

Introduction

Within the Wagenborg Group there are two companies, which operate vessels in ice infested waters: Wagenborg Shipping BV and Wagenborg Kazakhstan BV.

Wagenborg Shipping BV operates a fleet of over 140 vessels. Their main cargoes are forest products, steel, bulk and containers. Since the Baltic area is one of the main trading areas for Wagenborg already for over 100 years, most of the vessels are ice classed (Finnish/Swedish Ice Class 1A or 1A Super).

Wagenborg Kazakhstan B.V. is a shipping company that operates two Ice Breaking Supply Vessels, three Shallow Draft Tugs and three Ice Classed Barges in the Kazakhstan part of the Caspian Sea in order to supply drilling rigs.

Wagenborg Shipping's experience with navigating in Ice

Wagenborg Shipping vessels are ice strengthened, but have no icebreaking class, which means that the vessels are escorted by icebreakers in for example the Finnish Gulf.
Wagenborg Shipping B.V. officers are trained through training on the job, which in practice means that an inexperienced Chief Officer learns from his experienced Captain, but also the other way around.

Wagenborg Kazakhstan's experience with navigating in Ice

Ice Breaking Supply vessels of Wagenborg Kazakhstan have highest ice class so they are able to break ice under the extreme conditions in the Caspian and perform during winter as well as during the summer.
Most members of the crews that Wagenborg hired for the Ice Breaking Supply Vessels did not have experience in ice. Wagenborg chose these people for several reasons.

Because the vessels were dedicated built for offshore supply in the Caspian, Wagenborg decided offshore experience had a higher priority than experience in ice

And because the vessels are of a unique design with a new concept of propulsion and ice breaking Wagenborg could not find experienced crews. Wagenborg Kazakhstan B.V. was among the first to use Azipods in ice operations in a double acting mode.

On top of that the circumstances and conditions in Caspian are unique; shallow waters and grounded ice ridges

Training for navigation in ice

Wagenborg Kazakhstan B.V. feels that the following two events have added to the experience of the crews.

The first event was the Ice tests March 1999 - KMY and ABB. The purpose of the ice tests was to determine the capacity and possibilities of the Azipods in the Caspian Sea. Side effect of the ice tests was that KMY and ABB could show how to use the Azipods most effectively in life situations.

The second event was the Ice Operation Training March 2000 – MARC. The immediate cause for organising this training was that the late Koos Veldman sensed that the crew of the icebreakers did not have enough knowledge of ice conditions and ice operations.

The objective of the training was to familiarise the crew with icebreaker design issues and present ice breaker operations in the Baltic, thus improving the IBSV operations and to reduce the operating risks and to help the planning of future operations with existing fleet and platform

The training consisted of two parts a theoretical training at MARC in Helsinki Finland and a practical training o/b MSV (Multi Service Vessel) Nordica in the Gulf of Finland.

The theoretical training envisaged creating a general understanding of ice navigation, icing breaking, operations and assistance in ice and including the following subjects:

- Ice conditions
- Ships
- Conventional Icebreakers
- Structure of cargo vessels sailing in ice conditions and their strength and ice class
- Special features of vessels equipped with Azipods

The aim of the practical training was to see if there is something to be learned from the operation, practices and also possible problems of the Finnish Maritime Administration icebreakers and was especially useful because the Nordica has twin azimuthing thruster propulsion which is quite similar to the IBSV's WagKaz operates in the Caspian

The practical training included the following:

- Ice breaking (ice management of tracks in Gulf of Finland)
- Assistance of cargo vessels
- Towing
- Ship handling
- Discussions with crew

Effect of the training

The opinions of the captains are divided on this, but the general opinion is that they have learnt more about operating in ice in general. Unfortunately there were no possibilities to train operations in ice in similar conditions to the Caspian.

Training is not organised again for new captains. Wagenborg has videos of both the ice tests and the operations in ice training to show to new captains. New officers learn to operate the vessel in the Caspian conditions by training on the job, by promotion of 2nd officers and chief officers to higher positions.

Future developments

The high expectations of customer and the safety of crew, vessel, cargo and environment will become more and more a motivator for shipping companies to increase the knowledge and experience of their crews. But at the same time the freighrates are under great pressure and the labour market is very tight.
Al the more reason to investigate the possibilities and feasibility of training crews in navigating in ice.
Anticipating the next phase of the study on the subject of training we can roughly say that there are 3 ways of training, being training on the job, theoretical knowledge and training with simulators

WAGENBORG EXPERIENCE

- **Wagenborg Shipping B.V. navigating crew is trained through training on the job**
- **Wagenborg Kazakhstan B.V. organised a one week training for the captains**
- **Wagenborg hired captains with offshore experience not experience in ice**
- **New concept of propulsion and ice braking**
- **Circumstances and conditions in Caspian unique**

TRAINING

- **Ice tests March 1999 – KMY and ABB**
- **Ice Operation Training March 2000 - MARC**

TRAINING MARCH 2000

- **Theoretical training at MARC in Helsinki, Finland**
- **Practical training o/b MSV (Multi Service Vessel) Nordica in the Gulf of Finland**

RESULTS

- **The opinions of the captains are divided on the effect of the training**
- **Training is not organised again for new captains**

FUTURE TRAINING

- **Theoretical training as a basis for the practical training**
- **Training on the job by manning the vessel above the strength**
- **Training with simulators**

FUTURE DEVELOPMENTS

- **Training on the job will become more difficult**
- **Higher safety demands**

The first ARCOP workshop 1.3 Technology and Environment (March 27, 2003)

TOPIC -TRAINING REQUIREMENTS.
Comment Dr. R.N. Chernyaev, Deputy Director General, CNIIMF

Generally training of navigators and pilots for handling in ice conditions, despite of generality of tasks, solved by them, is possible to share on:

- training of icebreakers navigators;
- training of cargo ship navigators;
- joint training of icebreakers and vessels navigators.

The training of icebreakers navigators should include such basic problems, as:

- choice optimum paths of the moving and leading of a convoy of vessels on the basis of the various information on ice circumstances, overcoming of ice arrays (hummocks);
- manoeuvring in ice at a various denseness and ice depth;
- solution of tasks on organization of search and rescue operations, etc.

Simulation training of navigators and pilots in manoeuvring and ship handling under ice conditions navigation differs from ordinary simulation training and requires appropriate methods and software for training process.

Some time back in INSROP project CNIIMF prepared the Program for simulation training of the masters, chief mates and pilots to manoeuvring and vessel handling in ice conditions. The long-term experience of work of CNIIMF Marine Research Simulation Centre (MRSC) was put in Program.

The given program had been experienced by navigators of Northern, Murmansk and Arctic marine shipping companies, as well as navigators of nuclear and diesel icebreakers.

For ten years period of functioning, more than 4000 navigators have been trained, and granted internationally recognized certificates. The simulation training on MRSC was received by some groups of foreign navigators.

Thus, the task of special simulation training of the masters and crews of vessels sailing the Arctic waters is not new for us. It will be applied for coming ARCOP project.

Training of navigators in handling and manoeuvring by a vessel in ice - conditions should be provided not only Simulation Centres but development of corresponding software for everyday training on board the ship.

Some companies successfully work in the market of training hardware. The new modem simulators will be able to resolve tasks on control and manoeuvring by a vessel at ice navigation in broken ices, along an edge of a compact ice, in open ice, moving behind the icebreaker, and also in the channel in structure of a convoy.

WP 4 Environmental Protection

Environmental Impact Assessment - EIA
Environmental Risk Analysis - ERA

Some Basic Principles & Focal Issues
of Relevance to ARCOP

α **Alpha Environmental Consultants**

WP 4 Environmental Protection

Basic Principles

Definition:
The EIA is a process ➡ SEA!

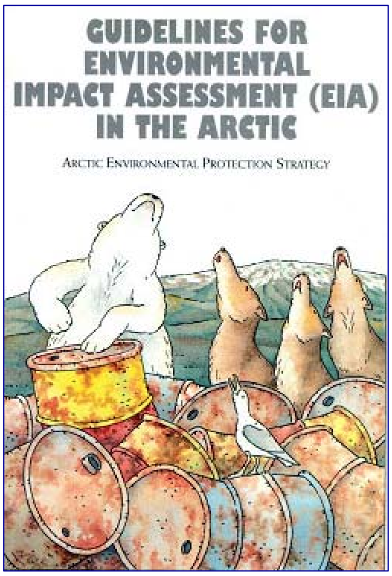
Aim:
Provide decisions-makers with an indication of the likely consequences of their actions ➡ Identify Remedial Actions

Challenges:
Entropi Reduction and Communication of Results ➡ Implementation of Environmental Concerns (Remedial Action)

WP 4 Environmental Protection

Disciplinary Approach

- Cross- & Multidisciplinary Nature
- Numerous Methods Available
- Requirements to Harmonisation, Simplification, Priorisation, Documentation, Legislation



WP 4 Environmental Protection

EIA vs. ERA

EIA: Indicate Likely Consequences

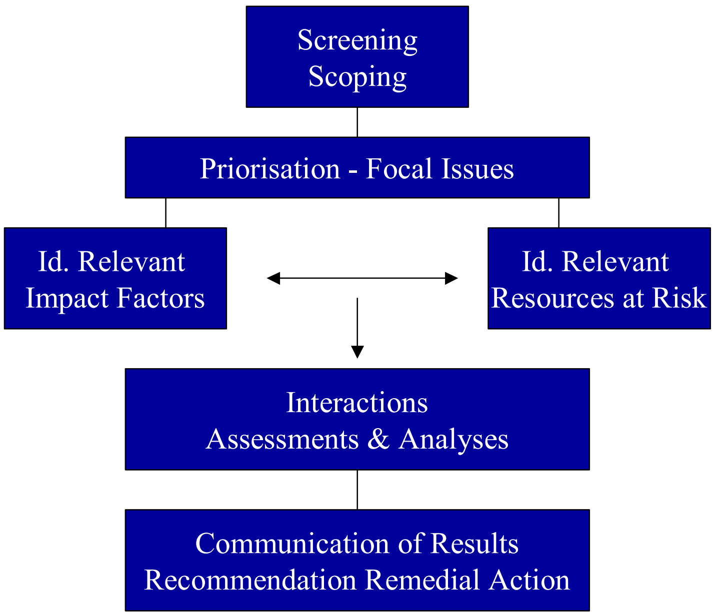
ERA: Integrate Likely & Consequences

➡ **Probability of an Event (P) * Consequences of the Event (C)**

Remedial Actions: both Regarding P & C

WP 4 Environmental Protection

The Process



ERA - EIA - SEA
Cradle to Grave

WP 4 Environmental Protection

Impact Factors

Key characteristics of shipping and navigation

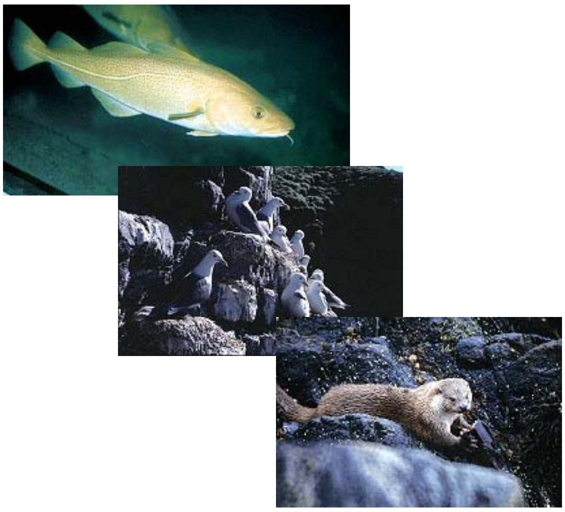
- Emissions to air; exhaust gases and combustion waste, evaporation of loading and cargo etc.
- Discharges to sea; sewage and garbage, anti-fouling paints, ballast water (alien species), fuel residues etc.
- Landbased activities
- Safety
- Accidental events; loss/ release of cargo / oil

WP 4 Environmental Protection

Resources at Risk

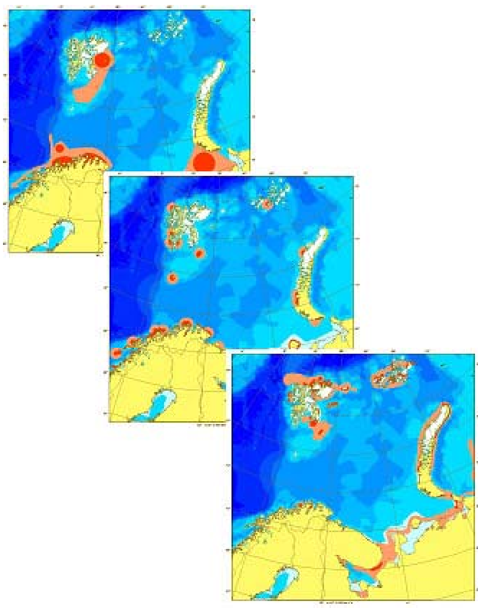
Key Characteristics of Natural Resources

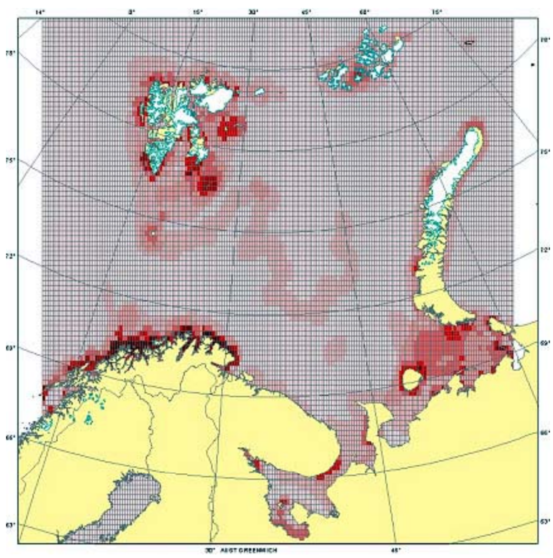
- Temporal & Spatial Distribution (Baseline)
- Abundance
- Life-history
- Status & Trends
- Sensitivity & Vulnerability to the given Impact Factors



WP 4 Environmental Protection

Georeferenced Baseline

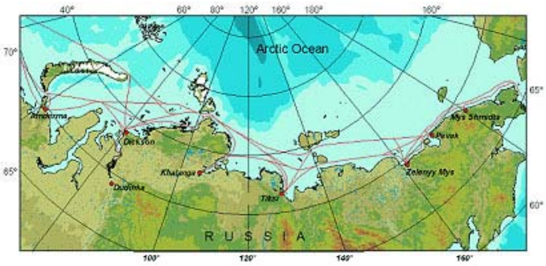


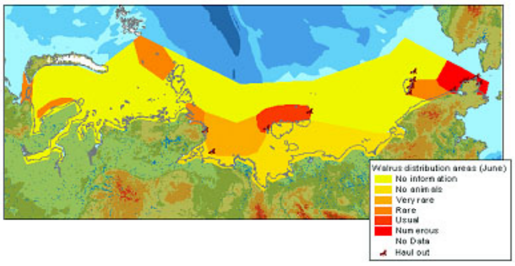


WP 4 Environmental Protection

Assessments & Analyses

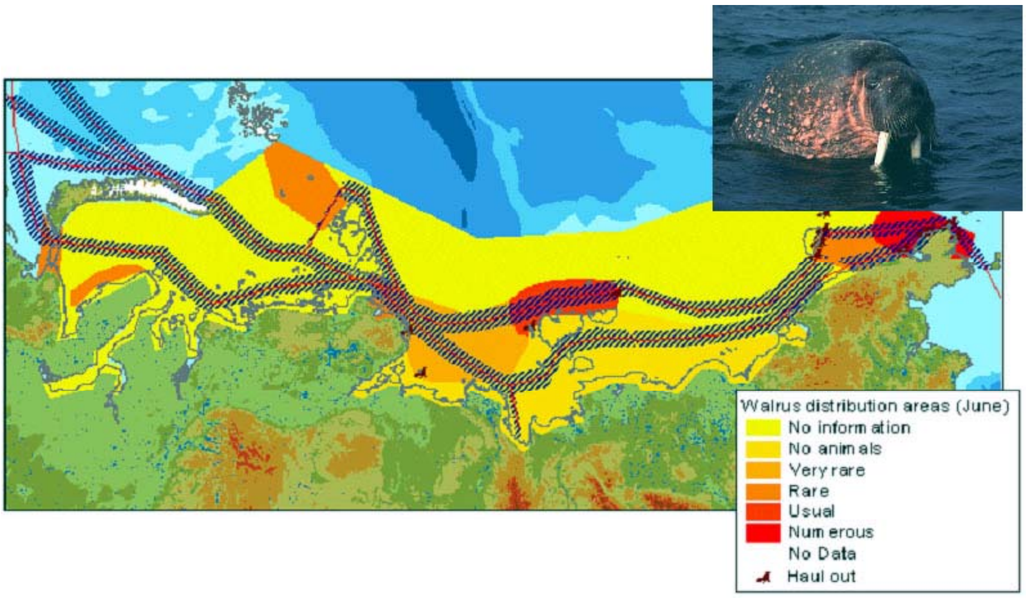
- A systemised base of georeferenced information on:
- Shipping routes, incl. records on sailing frequency, transport vol., port calls etc.
- Natural resources: incl. records on temporal and spatial distribution, abundance, status & trends, vulnerability etc.





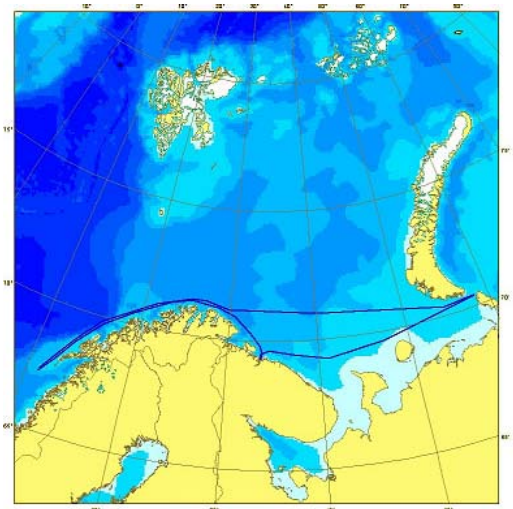
WP 4 Environmental Protection

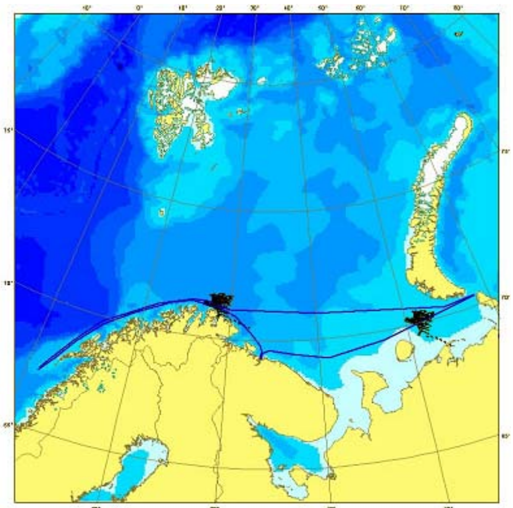
Assessments & Analyses



WP 4 Environmental Protection

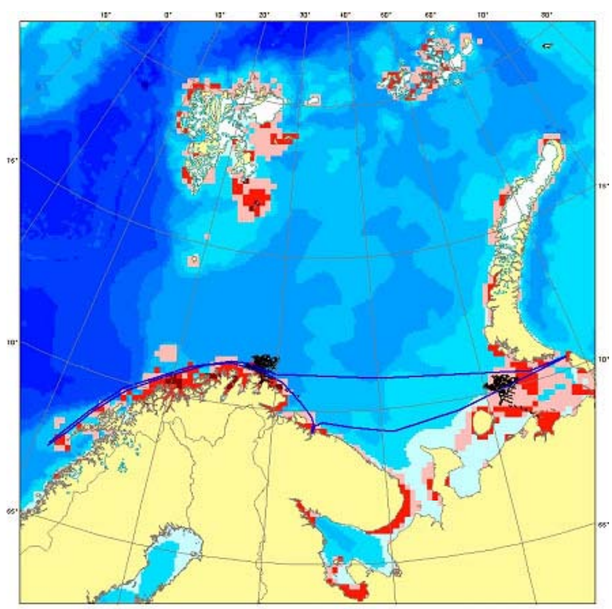
If: accidental oil spills





WP 4 Environmental Protection

Accidental oil spill vs. Hot spots



WP 4 Environmental Protection

Implementation & Communication by GIS – Web

- Baseline digital maps - Standard GIS software (ArcView)
- Interactive selection of scale and themes as well as “on screen” analyses
- User-friendly - harmonised interface
- Tailored for multiple use and re-use - in contrast to “hard-copy” one-off solutions
- EIA - ERA; Mitigating measures - Remedial actions; Oil spill contingency planning
- Basis for environmental management strategies and decision-making

Russian Oil Spill Contingency Planning

Dr. Gennady Semanov

Central Marine Reseach & Design Institute

Head of Laboratory - Environmental Safety of Maritime Transport

St. Petersburg, Russia

Tiered Response Approach :

- Tier 1(local) - preparedness and response to the most probable oil spills within the capabilities of facility (oil terminal, port).
- Tier 2 (regional) - preparedness and response to the probable oil spills within the capabilities of region.
- Tier 3(federal) - preparedness and response to the less probable oil spills within the capabilities of the Federation.

Oil spill responce policy

- As much oil as possible should be destroyed at sea before it reaches shore in order to cut costs and reduce environmental damage.
- Mechanical recovery systems should preferably be used to clean up Tier 1 oil spills if environmental conditions allow to do this.
- All spill cleanup resources (mechanical equipment, dispersants, in-situ burning) should be given equal consideration for cleaning up Tier 2 and Tier 3 spills.

- The chosen oil spill response techniques should be applied concurrently. That part of slick that poses the greatest threat should be treated with dispersants or burned while the rest should be cleaned up mechanically.
- A decision to use dispersants or in-situ burning should be made solely on the bases of a Net Environmental Benefit Analyses of Russian authorized bodies pre-approved dispersants for the polluted areas or the areas threatened by pollution.

Oil spill risk assessment is included:

- identification of potential pollution sourses;
- oil spill volume calculation, probability and frequency assessment;
- identification of natural resourses and industrial objects at risk;
- modelling of oil spill behavior and development of scenarios.

Types of oil spill contingency plans.

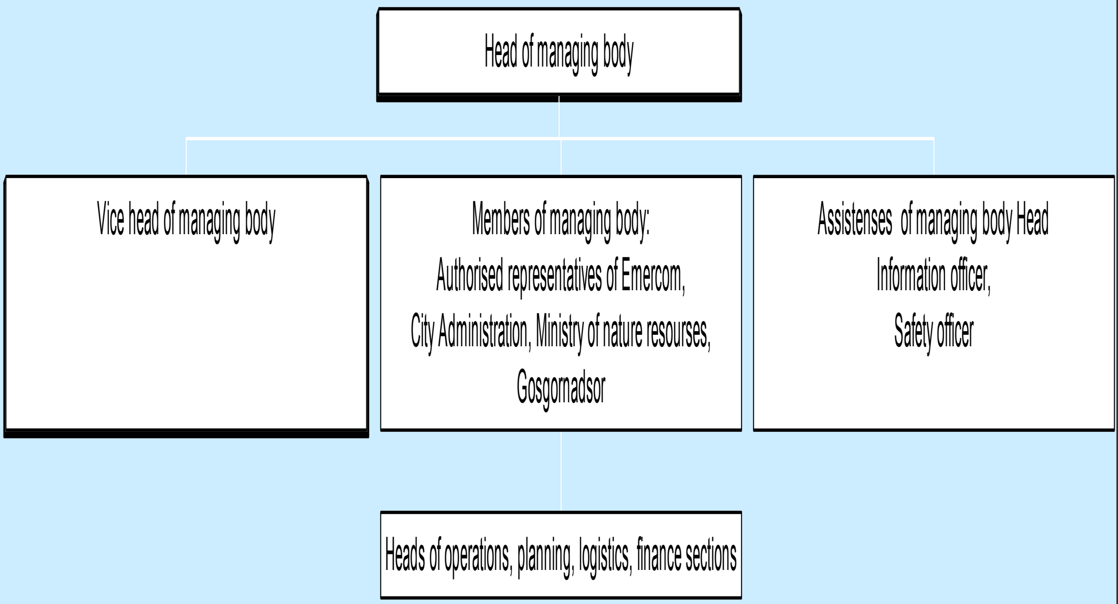
1. Plans of objects (offshore platform, oil terminal, port)
2. Regional plans, based on object plans, (Baltic sea, Far East seas, Black sea and so on)
3. Federal plan, based on regional plans

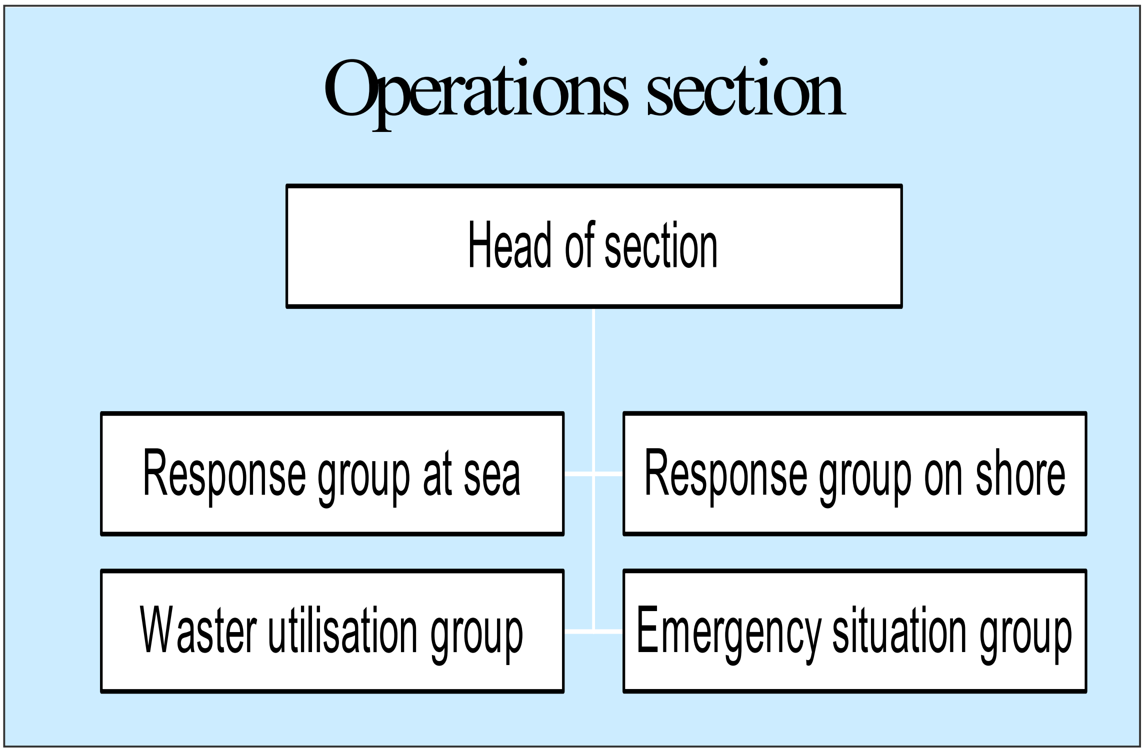
The Structure of Plans

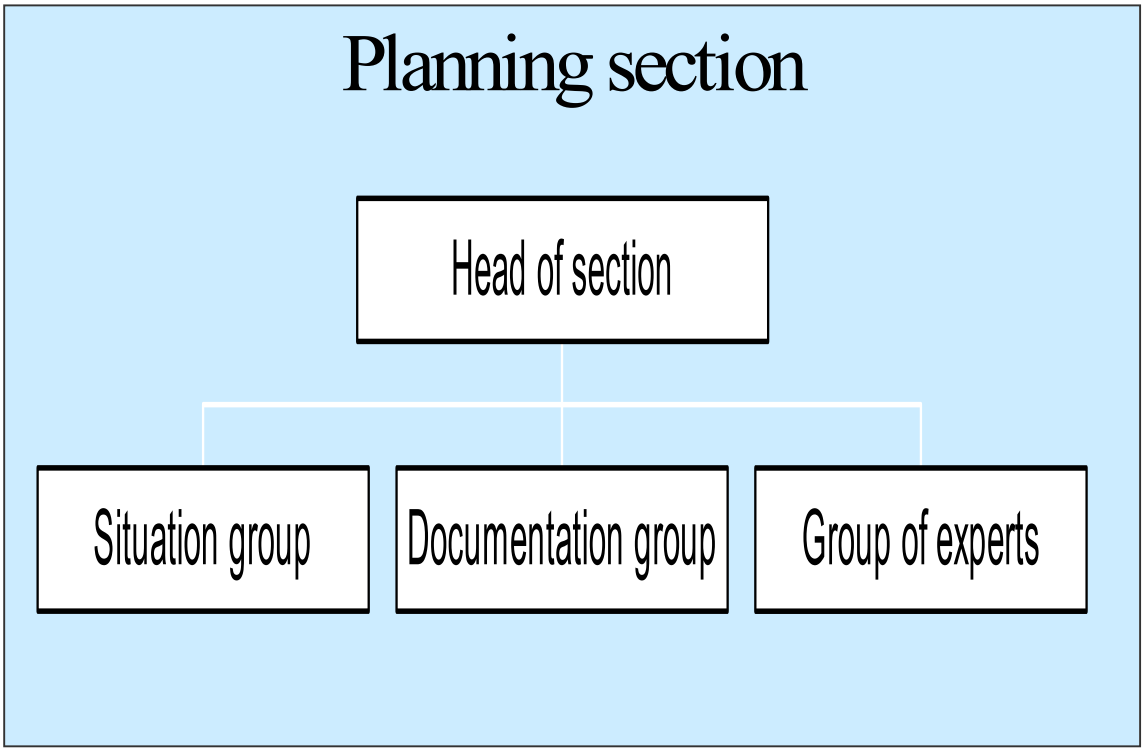
1. Scope of Plan.
2. Description of Region.
3. Response Areas and Risk Assessment.
4. Operational Control Headquaters (Ochq).
5. Notification Procedures.
6. Recommended Actions (Surveilance, Response Actions).
7. Oil Spill Combating Equipment.
8. Logistic.
9. Safety Guidelines.
10. Pablic Relations.
11. Liabilities and Compensations of Damages.

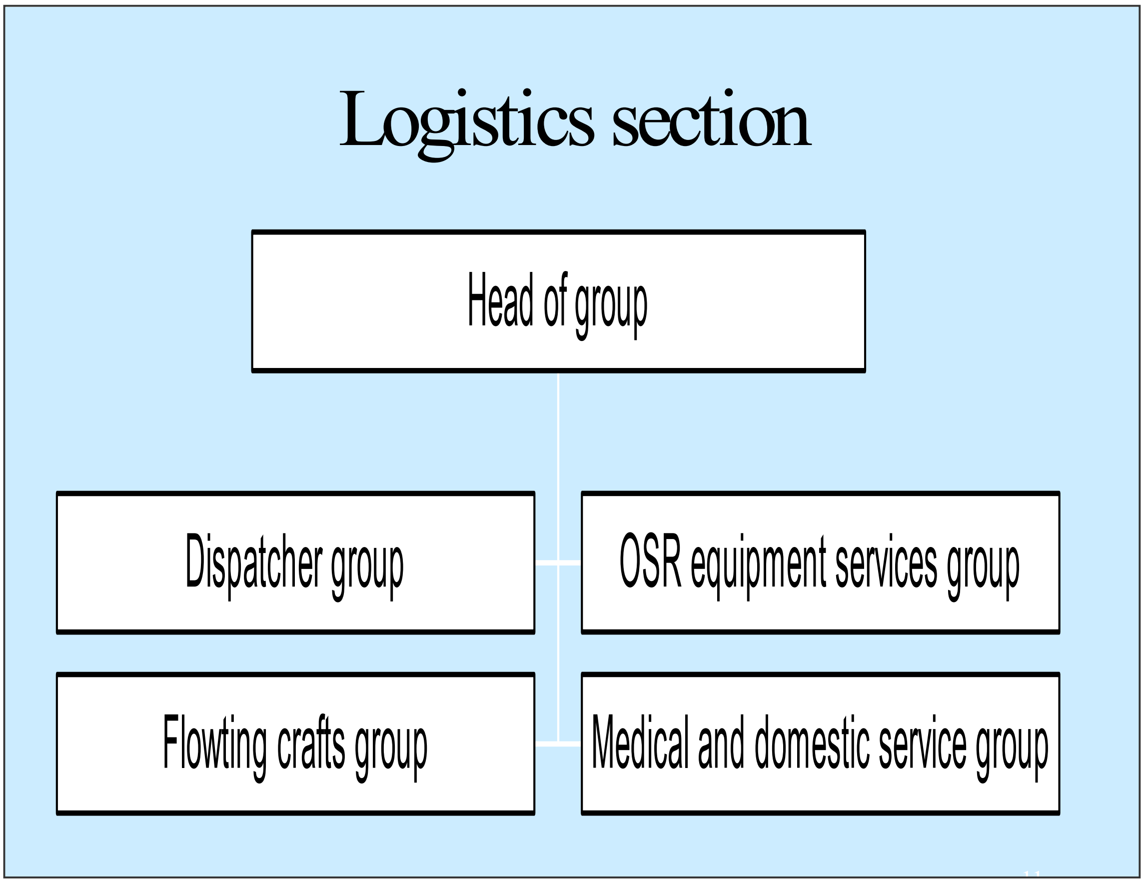
Annexes

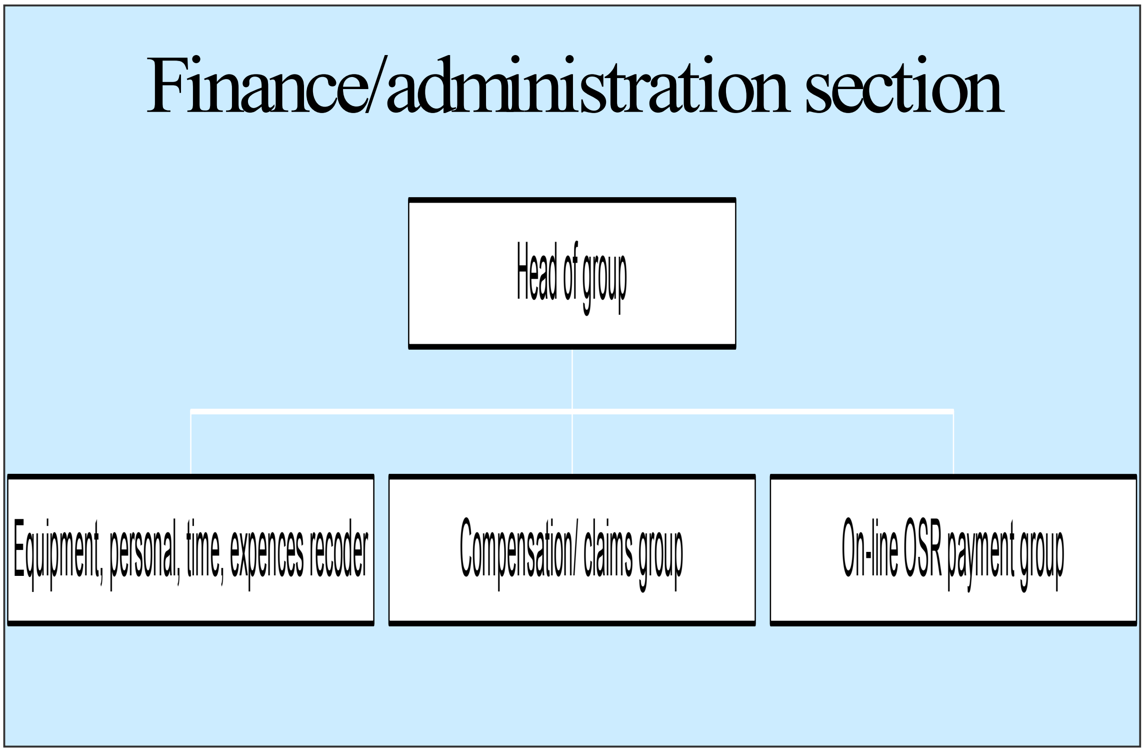
Structure of emergency managing body




Operations section
Head of section
Response group at sea
Response group on shore
Waster utilisation group
Emergency situation group


Planning section
Head of section
Situation group
Documentation group
Group of experts

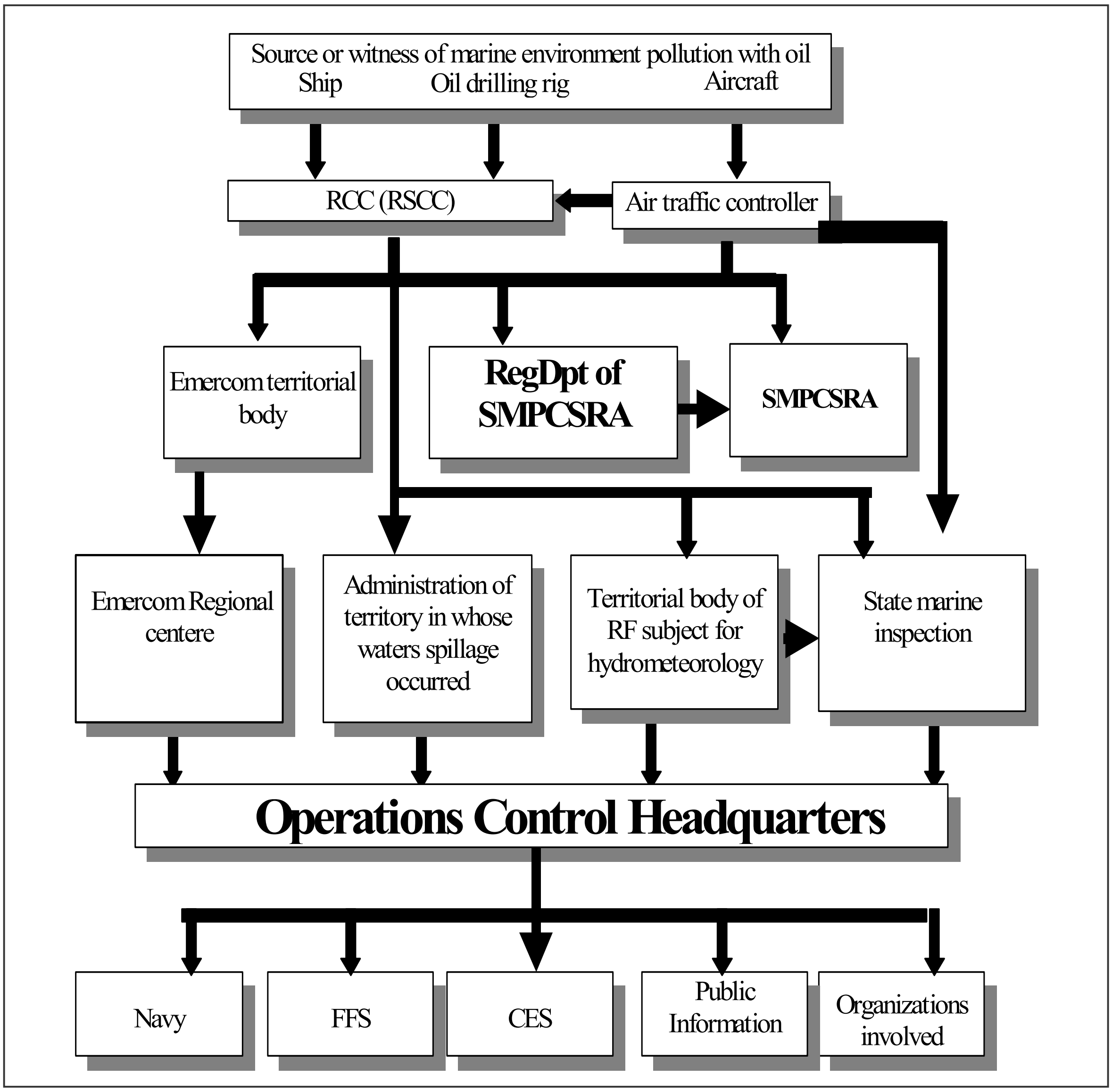

Logistics section
Head of group
Dispatcher group
OSR equipment services group
Flowting crafts group
Medical and domestic service group


Finance/administration section
Head of group
Equipment, personal, time, expences recoder
Compensation/ claims group
On-line OSR payment group

Tasks of managing body.

- Collect and analyse information about spill,
- prepare proposals on strategy and tactic of OSR,
- perform notification,
- assess the need for involving forces, arrange their delivery to the place of incident, appoint incident commander,
- develop and approve the incident action plans,
- prepare the information for the local authorities about the spill, taken and planned measures as to SMPCSRA and to relevant services of contiguous oblasts and republics,
- take decisions about beginning, temporary cessation,resumption and termination of OSR operations,

- ensure control and execution of announced pattern of top priority actions,
- take decision on appealing to higher level managing body for assistance,
- execute operational management and co-ordination of actions of strike teams,
- maitaince communication, monitor the emergency situation and the progress of work,
- keep a record log,
- solve problems of application of dispersants and in- situ burning,
- keep the record of expenditures for spill clean up,
- invite experts, advisors,
- prepare the final technical report,
- arrange exercises and drills, submit proposals for correction of contingency plan.


Source or witness of marine environment pollution with oil
Ship
Oil drilling rig
Aircraft
RCC (RSCC)
Air traffic controller
Emercom territorial body
RegDpt of SMPCSRA
SMPCSRA
Emercom Regional centere
Administration of territory in whose waters spillage occurred
Territorial body of RF subject for hydrometeorology
State marine inspection
Operations Control Headquarters
Navy
FFS
CES
Public Information
Organizations involved

APPENDIX 6

WP 4 Environmental Protection

ARCOP - OIL SPILL RESPONSE

Some comments re. "Response Toolbox"

- ✓ Mechanical recovery
- ✓ In situ Burning
- ✓ Dispersant application

2 ARCOP oil spill scenarios (based on the transport scenario):

- ✓ Spill scenario 1: In open water
- ✓ Spill scenario 2: In ice

WP 4 Environmental Protection

Spill scenario 1: In open water

- ✓ Apart from less daylight and low temperatures during long periods, operational conditions are not more severe than for instance in the North Sea

WP 4 Environmental Protection

Spill scenario 2: In ice

Statement yesterday about ARCOP transportation scenario:

"Ice conditions are challenging"

For oil spill response, safe to say this is an understatement

WP 4 Environmental Protection

Spill scenario 2: In ice

- **Additional problems compared to open water**

  - ✓ Detection, monitoring of spill (camouflaged, visually/sensors)
  - ✓ Limited access to the oil (all techniques)
  - ✓ Spreading of spill by propeller washing (all)
  - ✓ Reduced flow of oil to the recovery device (mech.)
  - ✓ Deflection of oil together with ice (mech.)
  - ✓ Icing/freezing/jamming of equipment (hoses, valves, pumps..) (mostly mech.)
  - ✓ Smoke plume (burn)
  - ✓ Contamination of ice (all techniques)

WP 4 Environmental Protection

Spill scenario 2: In ice

- **Additional problems compared to open water (cont.)**

  - ✓ Separation of oil from ice (mech.)
  - ✓ Strength considerations (mech.)
  - ✓ Motivation of personnel under difficult conditions (mech.)
  - ✓ Thin films cannot be ignited (burn)
  - ✓ Reduced wave action (dispersant)

WP 4 Environmental Protection

Spill scenario 2: In ice

- **Advantages compared to open water**

Ice will act as barrier, hence:

- ✓ Reduced spread of oil (all techn.)
- ✓ Reduced weathering (all)
- ✓ Reduced emulsification (dispersant, burning, less mech.)
- ✓ Increased response time window (all)
- ✓ Reduced wave action (burn)

WP 4 Environmental Protection

Spill scenario 2: In ice

- **Burning in ice - overall impression**

  - ✓ Requires little equipment (igniter, operational platform)
  - ✓ Burning seems like the most promising response technique, especially for larger spills
  - ✓ Will not be used close to vessel or surface structure

WP 4 Environmental Protection

Spill scenario 2: In ice

- **Dispersant application in ice - overall impression**

  - ✓ Reduced weathering and reduced emulsification means wider time window
  - ✓ Difficult to avoid application on ice
  - ✓ Application more difficult (less choise of operational platform)
  - ✓ Dispersant application will not be a primary response technique in ice
  - ✓ Could be very useful in ARCOP open water

WP 4 Environmental Protection

Spill scenario 2: In ice

- **Mechanical recovery in ice - overall impression**

  - ✓ Very little equipment designed for operation in ice and low temperatures
  - ✓ The amount of ice to recover and store could be overwhelming
  - ✓ Little encouragement for industry to develop special equipment for ice conditions
  - ✓ Plenty of possibilities to improve recovery in ice, first of all for small spills

WP 4 Environmental Protection

ARCOP - OIL SPILL RESPONSE

Summing up:

- ✓ Oil spill response in ARCOP winter conditions are more challenging than for instance North Sea winter conditions, first of all in ice.
- ✓ Not realistic to have as good oil spill response in ice as in open water, but this cannot prevent us from improving our technologies.
- ✓ Burning has the highest potential for success in ice, especially for larger spills.
- ✓ Dispersant application has a low potential in ice.
- ✓ Mechanical recovery in ice is underdeveloped. There are plenty of possibilities for improvements.
- ✓ ARCOP ice conditions require more response “tools” to choose from (most existing response techniques are designed for open water conditions).

SOCIAL IMPACT ASSESSMENT IN THE ARCTIC

Messhtyb Nina
University of Lapland, Arctic Centre, Rovaniemi

One of the administrators of the Gas-Oil Company exclaimed once during the interview, "Why indigenous peoples are settled on the places of the most perspective and rich natural deposits!" Northern indigenous people who's ancestors and descendants were grown up and live here, could exclaim in answer, "Why peoples build a road on the territory of our pastures, our cemeteries and sacred place?"

There are three main sides of the deal that should coexist – nature and two types of the worldview. They should find a way for the understanding and in this sense the ACROP project make an important contribution in establishing a profound dialog between the varieties of existing opinions. Ongoing meeting showed the intention of the multinational community to provide the effective methods of industrial development along with careful treatment of Arctic environment. The important role play the assessment of the potential impact of the Northern Sea rout exploration upon the Arctic biosphere, the inhabitants of the area, and foresee it's impact at the global scale.

That is true that Northern Sea Rout will play a significant role for further exploration of Arctic natural resources and for the future strategy of Europe as a whole. Planning long-term programme we should attach the due importance to a system approach at the assessment of potential impact. That is quite clear that the external changes usually bring both positive and negative affect. The stirring industrial pressure on the northern fragile environment simultaneously will bring the number of consequences that will influence the life of population of the area on different levels and in various senses. Iindigenous peoples are the most sensitive part among the permanent inhabitants of the North, because of their close connection and special attitude to the nature environment. Their traditional branches of the economy consist the basis of their national and cultural individuality. NSR will bring a new reality to the northern inhabitants new profits and possibilities, but new problems as well. Only on the base of multi-stage and multilateral approach it would be possible to assessment the social impact and elaborate efficient opportune programme of socio-economic and psychological rehabilitation and adaptation of indigenous peoples in the new condition. It is the advantage of the anthropological field case study to analyze the situation among specific local indigenous community, which has undergoing close connection with new industrial exploration, and bring this knowledge for the comprehensible information to multinational participators of the ACROP project. This important work could be done like monitoring and reviewing research within the ongoing project on the perspective.

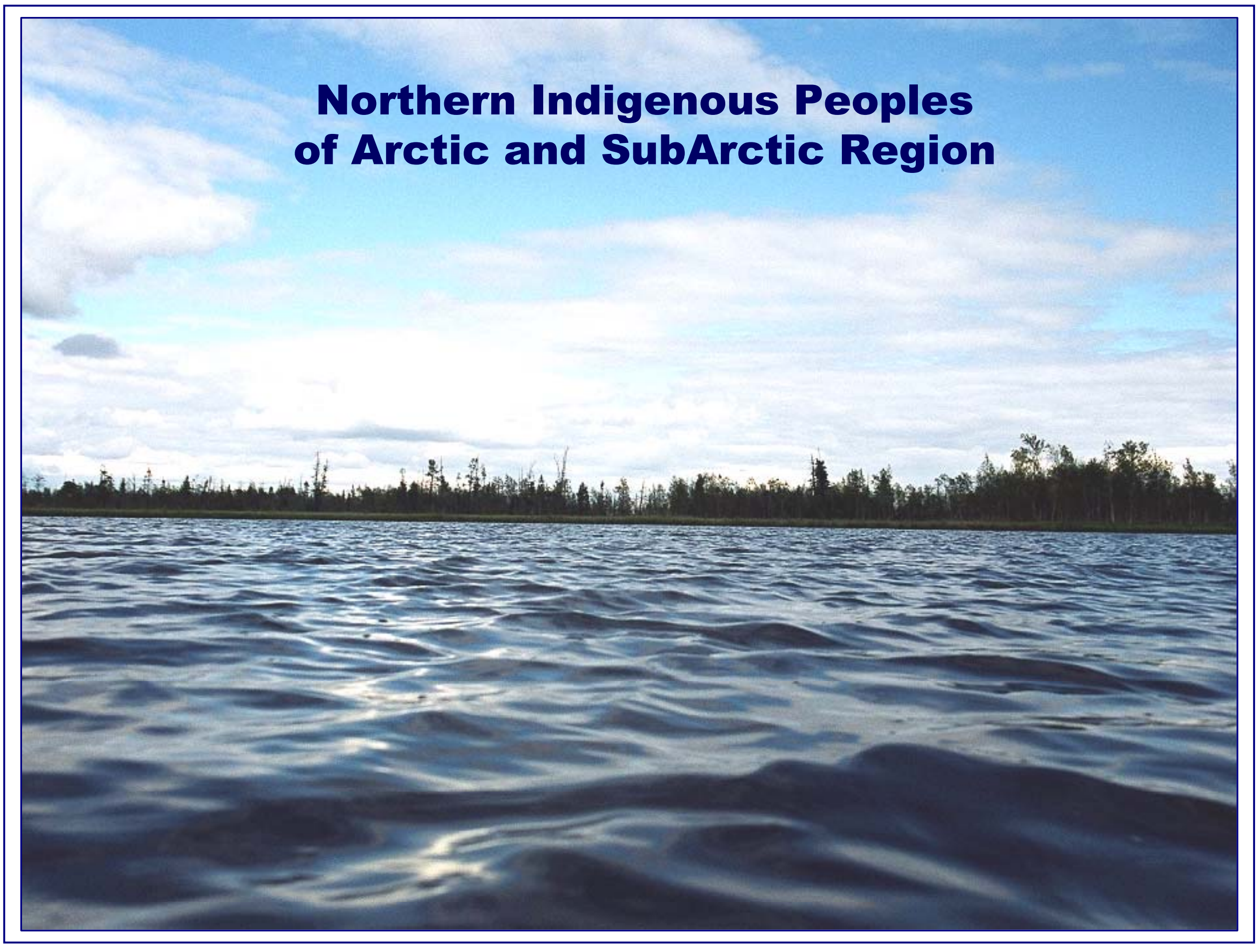
Along this it is especially important to emphasise the crucial meaning of the comprehensive information and communication for the establishing positive interaction in the area. The possibility to make the assessment of the consequences of NSR could be done only on the base of appropriate information about the particular area and the character of the ongoing industrial development. Northern indigenous communities have also a right to access to information pertinent to their essential interest. They must to define their life strategy for the future. To reach the understanding between sides it is important to exam the quantity of possession the valid information about the ongoing programme of northern exploration.

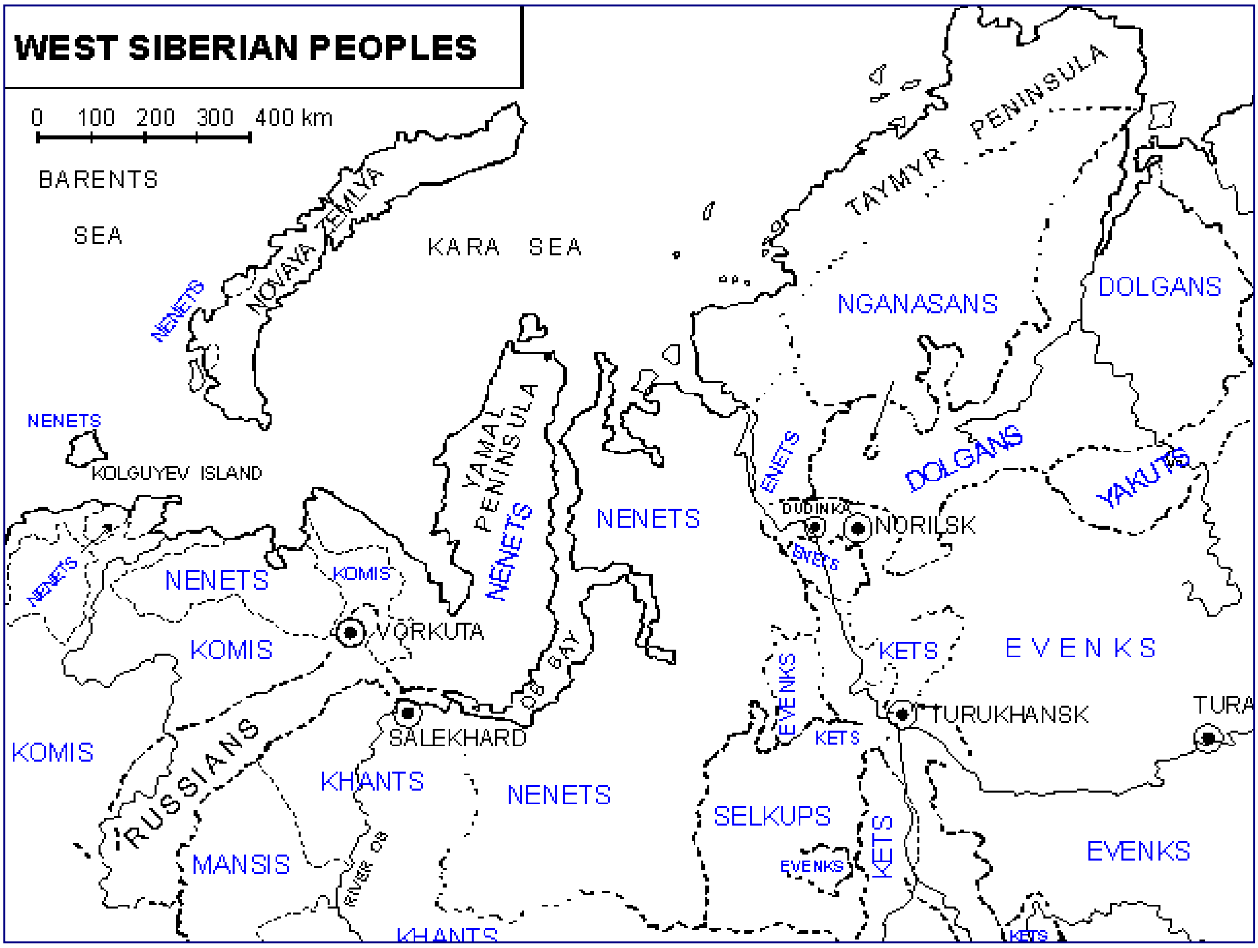
From their side northern peoples possess a unique valuable knowledge, which should be contributed to the world community for profound understanding of impending environmental damage. Unfortunately indigenous knowledge is neglect too often. For example, native peoples considered as “sacred” many places, it is forbidden to hunt, to fish or to make a fire on these places. In such way hibernation quarters and the nests of waterfowl were preserved. Traditional ecological knowledge should become a subject of special concern during the planning work and further comprehensive analysis as well as specific living condition of the northern indigenous population. Their food habits (eating the primary source of the vitamin for this area - raw meat and fish, using the water of lakes and rivers as potable water, natural (plant and animal) medicine remedy should attract a steadfast attention to the impact of the contaminants to the health of Arctic People.

Initialisation of the NSR will bring a number of alien newcomers workers to the North, for them to have a job on this distant area is a good chance to earn a good money for the future; northern nature is a matter of exotic for them, where they bring their habits from the previous life, knowing nothing about the peculiarity of the North. More active newcomers could squeeze out indigenous peoples from their traditional niche at the areas closely connected with active industrial development. For relevant assume of the social impact of NSR it is important to study the various aspects of previous experience of interaction the indigenous population with temporary workers of oil and gas platform.

On this stage of the activity within the ARCOP our workshop we carry research about the current knowledge on social impact assessment of arctic marine transportation, prepare the contacts and questionnaire for the fieldwork which will be carried out in one or two of local communities. Current study which will focus on the general overview of socio-cultural impacts and socio-cultural indicators basing on the interview of the key persons of the local authority and representatives of northern indigenous peoples on different levels.

Developing the perspective long-term programme exploration we should estimate and pay serious attention to the complexity of interrelationships between the different components of the Arctic ecosystem. Traditional indigenous culture is valuable by itself in humane perspective, but as well it has an importance as a buffer for the global environmental security, it give a chance to decisive multi-national companies and projects one more time to consider carefully assessment before to make a step, it means to care, and care not only about Arctic future, but about the Future itself.


Northern Indigenous Peoples
of Arctic and SubArctic Region


WEST SIBERIAN PEOPLES
0 100 200 300 400 km
BARENTS
SEA
KARA SEA
NOVAYA ZEMLYA
NENETS
NENETS
KOLGUYEV ISLAND
NENETS
NENETS
KOMIS
KOMIS
VORKUTA
KOMIS
RUSSIANS
MANSIS
KHANTS
SALEKHARD
RIVER OB
KHANTS
YAMAL PENINSULA
NENETS
OB BAY
NENETS
NENETS
TAYMYR PENINSULA
NGANASANS
DOLGANS
ENETS
DUDINKA
NORILSK
DOLGANS
YAKUTS
ENETS
KETS
EVENKS
EVENKS
KETS
TURUKHANSK
TURA
SELKUPS
EVENKS
KETS
EVENKS
KETS

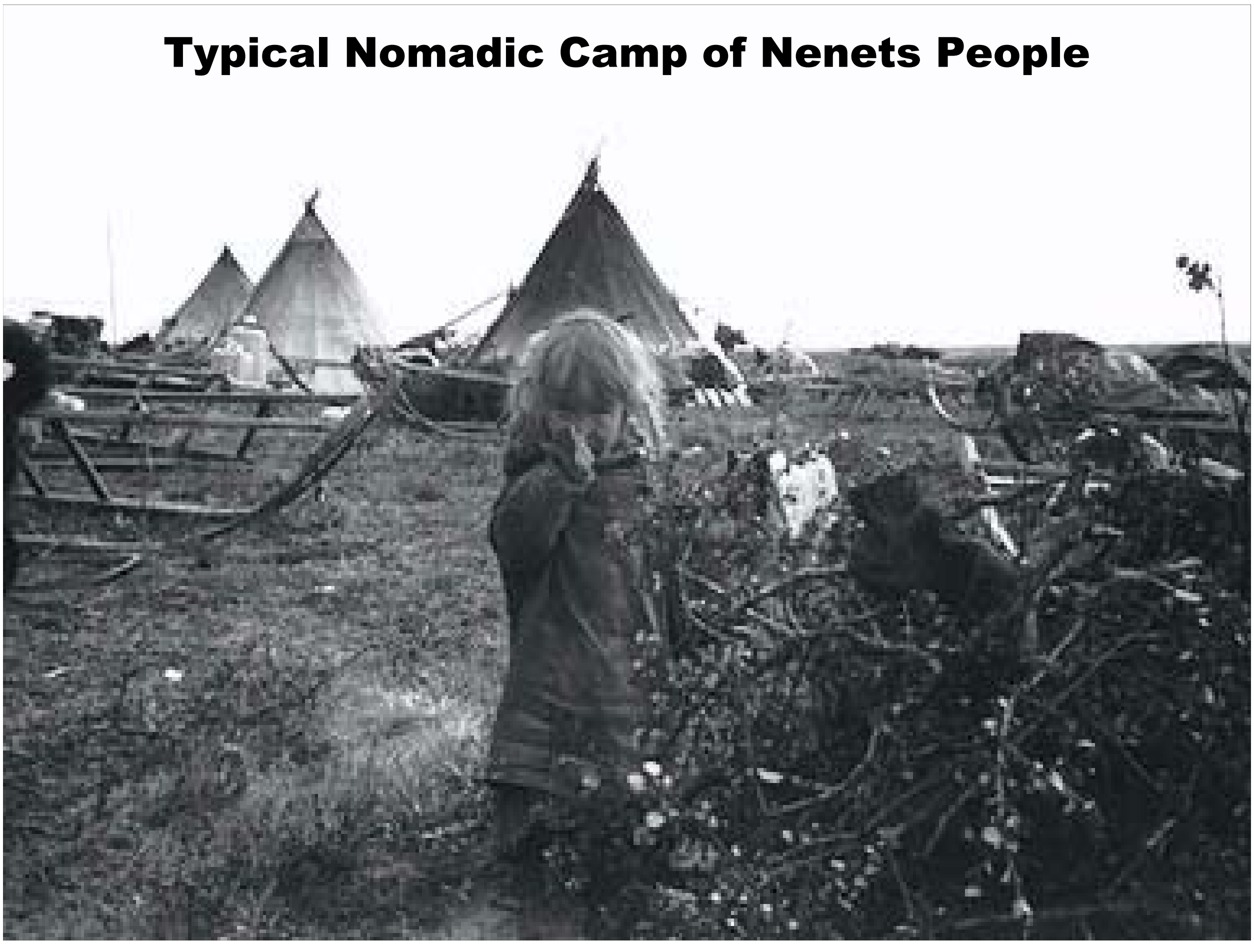
- 6.4 thousand in the Nenets autonomous territory;
- 20.9 thousand in Yamalo-Nenets autonomous area;
- 2.4 thousand in Khanty-Mansi autonomous territory.
- Small groups of Nentsy also live in Taimyr autonomous area, republic of Komi, Murmansk region

Nenets are settled on the vast territory

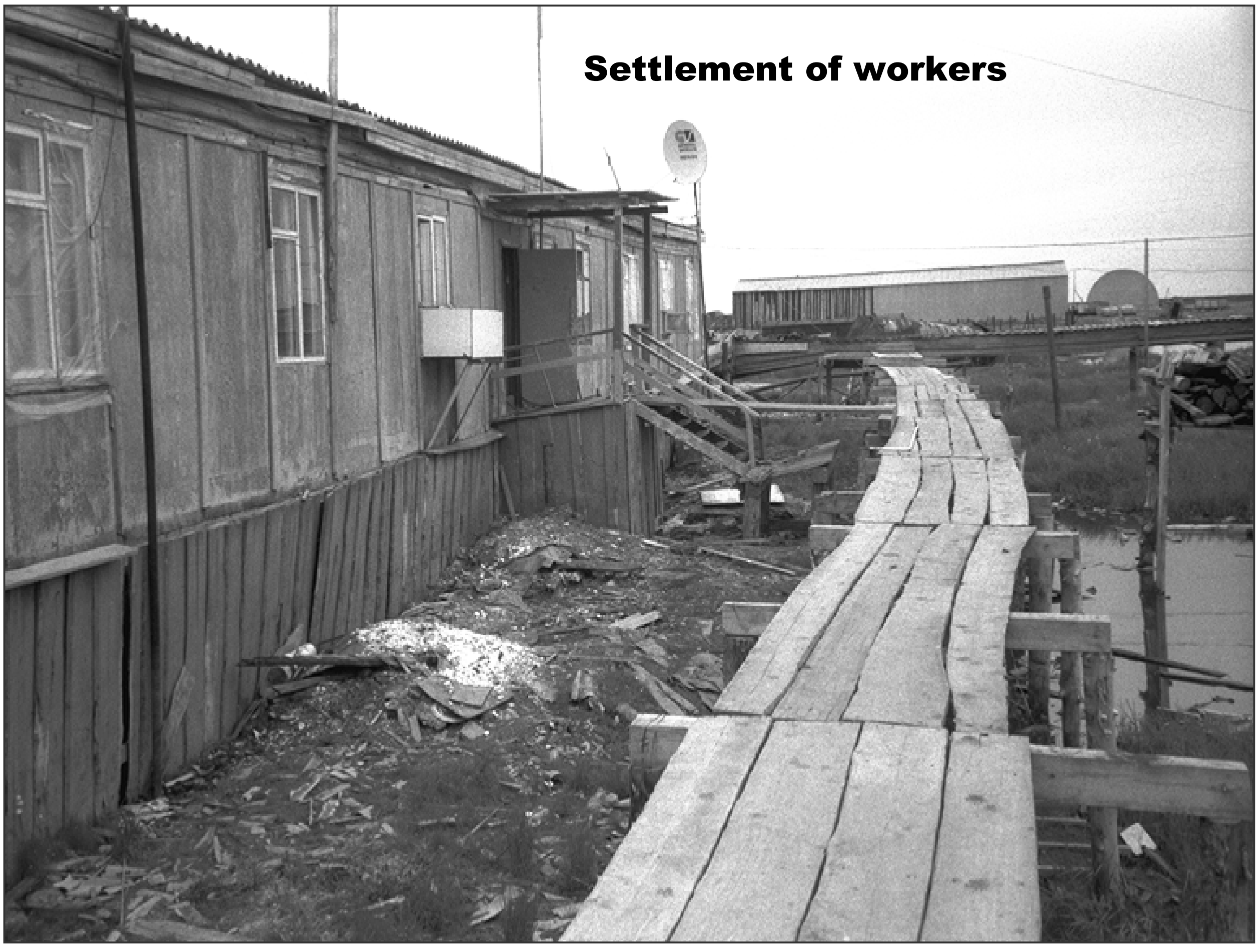
- from the Mezen river in the west
- to the Lower Yenisey - in the east

Reindeer herding is a base of subsistence and ethnic identification

Condition of the water resources has a principal importance for fishing



Typical Nomadic Camp of Nenets People



Settlement of workers

Environmental rehabilitation of the territory

Off-road vehicle tracks, road dust.

State Legislation

- The Continental Shelf (Russian Federation) Act also legislates for the protection of environmental interests and the traditional way of life
- It places the strategy for studying, searching, prospecting and developing mineral resources and exploiting live resources within the jurisdiction of the federal organs of State power, while giving special attention to the economic interests of the indigenous peoples and ethnic groups of the North (article 3, item 6).
- Those peoples and ethnic groups are also granted special rights for the exploitation of live resources in the waters of the continental shelf (article 11).

As the special subjects of the law, the small-numbered aboriginal peoples of North were designated in the Constitution of Russian Federation of 1993 (article 69).
They were determined, as

" … Ethnic groups living on the territory of the traditional settlement of their ancestors, that maintain their traditional occupation, self-awareness and numbering in Russian Federation less than 50 thousand peoples (each)".

Further intensification industrial exploration should be provided carefully

- effect on the environment and alters the natural habitat of the indigenous population
- leads not only to alteration in the way of life of local peoples
- have negative affect on their health condition.

Territory of traditional occupation (hunting and fishing area)

ARCTIC CENTER
Role and contribution in ARCOP project:

- Study Environmental and Social Impact Assessment in the light of participation of the local stakeholders (especially the indigenous peoples), the social impacts of the marine transportation and associate infrastructures as well as providing views for mitigation measures.

- By providing the link to Arctic Council environmental and sustainable development work by informing ARCOP about its current work and raising possibilities for co-operation for discussing by the ARCOP.

The general overview of socio-cultural impacts and socio-cultural indicators will be made on the base of the interview of the key persons of the local authority and representatives of northern indigenous peoples on different levels, along with anthropological observation of the current situation