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**Improvement of Information Support to
Navigation along the NSR**

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Sub-programme III: Trade and Commercial Shipping Aspects

Project III.12.1: Improve Information on Navigating the NSR

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Title: Improvement of Information Support to Navigation along the NSR

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FOREWORD - INSROP WORKING PAPER

INSROP is a five-year multidisciplinary and multilateral research programme, the main phase of which commenced in June 1993. The three principal cooperating partners are **Central Marine Research & Design Institute (CNIIMF)**, St. Petersburg, Russia; **Ship and Ocean Foundation (SOF)**, Tokyo, Japan; and **Fridtjof Nansen Institute (FNI)**, Lysaker, Norway. The INSROP Secretariat is shared between CNIIMF and FNI and is located at FNI.

INSROP is split into four main projects: 1) Natural Conditions and Ice Navigation; 2) Environmental Factors; 3) Trade and Commercial Shipping Aspects of the NSR; and 4) Political, Legal and Strategic Factors. The aim of INSROP is to build up a knowledge base adequate to provide a foundation for long-term planning and decision-making by state agencies as well as private companies etc., for purposes of promoting rational decisionmaking concerning the use of the Northern Sea Route for transit and regional development.

INSROP is a direct result of the normalization of the international situation and the Murmansk initiatives of the former Soviet Union in 1987, when the readiness of the USSR to open the NSR for international shipping was officially declared. The Murmansk Initiatives enabled the continuation, expansion and intensification of traditional collaboration between the states in the Arctic, including safety and efficiency of shipping. Russia, being the successor state to the USSR, supports the Murmansk Initiatives. The initiatives stimulated contact and cooperation between CNIIMF and FNI in 1988 and resulted in a pilot study of the NSR in 1991. In 1992 SOF entered INSROP as a third partner on an equal basis with CNIIMF and FNI.

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SUB-PROGRAMME III
TRADE AND COMMERCIAL ASPECTS OF SHIPPING

Project III.12.1
Improvement of information support to navigation along the NSR

WORKING PAPER

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The Working Paper "Improvement of information support to navigation along the NSR" has been prepared within the last 3 years. The following problems have been under consideration: organization and regulation of shipping in the Arctic; meteorological, oceanographic and hydrographic support; results of analysis of information support to merchant shipping along the NSR; arrangement of Arctic navigation; regulations for navigation on the seaways of the NSR; new legislation acts; navigational-hydrographic support; catalogues of navigation charts and editions on the NSR; provision of the NSR with nautical charts; introduction of the ISM Code in Russia and on the NSR. The approach to the problems differs from the approach used in Sub-Programme I, and is more similar to the NSR user's commercial treatment.

Keywords: Legal aspects, Meteorological, oceanographic and hydrographic support, Cartographic support, Aids to navigation, Safety management, Administration, Document of Compliance.

1 GENERAL

In 1993 the work on the project provided studies of information support to planning and functioning the safe international merchant shipping in the Russian Arctic and along the NSR. Investigation of all aspects of information support to the shipping on the NSR should be carried out in INSRP Sub-Programme 1, Project 1.2.

As to the former USSR the problem of information service on the NSR was easy to resolve because of state ownership of shipping companies (which just followed the directions of a single operating center), and due to the absence of foreign vessels (no international shipping - no language difficulties). The rules issued by the Administration were intended only for Soviet ships and were simple to implement and to follow under the authoritarian state regime. Such a system was usual and convenient under certain circumstances but is not adequate to international shipping. The aim of Project 12.1 is to study the possibilities of transformation of a real information system according to the needs both of international transit shipping, and of goods delivering to the Russian ports along the NSR.

Regulations and technical aids of information support to merchant shipping in the Arctic regions should correspond with the tasks of navigational safety and environment protection.

It must be kept in mind, that the first experience of international navigation along the NSR has been obtained already. In navigation of 1992 three foreign vessels obtained permission to make a transit passage through the NSR. The French vessel "L'Astrolabe" of class "1 A Super" of 2200 t displacement left Murmansk on August 6, and after visiting Igarka, arrived in the port of Providenya. The average speed on the NSR was 11 knots. In some regions the vessel was conducted by ice breakers. This voyage has revealed a lot of problems. One of them - bad operative communication between vessel and the Marine Operations Headquarters (MOH) or the NSR Administration (NSRA) in Moscow.

Besides most of the Arctic ports have limited opportunities to provide foreign vessels with foodstuffs, fresh water, bunker, tugboats, repair facilities etc. In emergencies minimum assistance can be rendered only by ice breakers. So the reliable maintenance of international navigation on the NSR requires modernization of the Russian Arctic infrastructure.

2 ORGANIZATION AND REGULATION OF SHIPPING IN THE ARCTIC

2.1 Organization of shipping along the NSR

The shipping in the Russian Arctic is under control of the NSR Administration (NSRA), which is a division of the Marine Department of the Transport Ministry of Russia.

NSRA is a center of planning, organization, controlling, investigation and coordination of all aspects of the NSR functioning.

NSRA also exercises control over the Marine Operations Headquarters (MOH) of the West and East sectors of the NSR.

The MOH is a special navigational service that provides ice operations to be done on the NSR. The work of the MOH is co-ordinated by the NSRA.

The West MOH is based in the port of Dikson and controls shipping in the West region to the longitude 125°E, the East MOH is based in the port of Pevek and controls shipping to the East of 125°E. The State Hydrographic Office (SHO), Polar Aviation and Weather Service representatives participate in the work of MOH.

The Owner or Captain (Master) of a vessel intending to navigate through the NSR shall submit to the NSRA (MOH) a notification and request for leading through the NSR in compliance with the form and time stated in the Guide to Navigation through the Northern Sea Route.

The NSRA (MOH) shall consider the submitted request and inform the applicant of the possibility of leading through the Route and other circumstances to be taken into consideration by the Owner and Captain (Master).

The escorting of vessels along the NSR is executed only during navigation season, the beginning and end of which are determined by NSRA and MOH.

The vessel, taken under escort, should navigate along the route prescribed by MOH.

When a vessel does not satisfy special requirements for navigation along the NSR and the Captain is not experienced in operating vessel in ice, the NSRA (MOH) may assign a State Pilot to the vessel to assist in piloting it through the NSR.

MOH (or the NSRA) shall ensure that vessels are supplied with navigational information and provided with necessary pilotage, escort and rescue services.

When navigating the NSR, payments for services rendered to vessels by MOH and the NSRA shall be collected according to the rates duly adopted.

The captain is obliged to follow the directions of the MOH, concerning route changes connected with ice conditions, changes and occurrence or circumstances that may affect the safety of navigation or present any danger to the environment.

In cases where obvious necessity of environment protection or safe navigation dictates so, the NSRA or the MOH may suspend navigation of vessels in specific parts of the NSR during existence of circumstances that give ground for such measures.

The compulsory icebreaker-assisted pilotage (hereinafter referred to as icebreaker pilotage) is provided in the Vilkitskogo, Shokalskogo, Dmitrija Lapteva and Sannikova Straits.

Navigation of vessels admitted to be lead through the NSR shall be organized and controlled by the NSRA through the MOH.

For the reasons of maintenance of safety, MOH can establish: shore-based pilotage, pilotage of vessel using instructions from planes or helicopters (aircraft-assisted pilotage), conventional pilotage, icebreaker pilotage or their combinations.

The captain is obliged to maintain contact with the Radio Centre of appropriate MOH, depending upon the geographical position of the vessel.

NSRA or MOH does not bear the responsibility for damage to a vessel or its cargo caused by pilotage in ice conditions, unless it is proved that they bear guilt for the damage inflicted.

In addition to existing requirements concerning transmission of messages about marine environment pollution, the captain is obliged immediately to inform NSRA and MOH about any fact of pollution.

If a vessel on the NSR infringes the rules of navigation it can be ordered to leave the NSR.

2.2 Legal aspects

The legal base of merchant shipping in the Arctic as a component of the USSR legal base merchant shipping, had a great number of impracticable requirements of unclear contents due to bureaucratic character of the State. All of them gave rise to the total dependence of subordinates on chiefs.

The characteristic feature of the USSR legal base was strictest restrictions on access to it: almost all the rules of law had the restrictive signature stamps of different categories, so that many rules had never been published in open issues. Thus, the system of information maintenance was strictly centralized, i.e. users received the texts of laws, rules, instructions and so called "guidance documents" in strict conformity with their ranks in soviet service hierarchy.

At the moment of disintegration of the USSR the legal base of merchant shipping included scores of acts, orders and decrees of the USSR and republics bodies, grouped in series of collections, edited

in particular by the Head Department of Navigation and Oceanography of the USSR Ministry of Defence as appendix to issue # I of Notices to Mariners with a signature stamp "For internal use"; the orders of the Merchant Marine Ministry of the USSR (about 1200 normative acts, and 600 acts issued annually), grouped in collections making 12 volumes and issued with a signature stamp "Restricted"; about 1500 of guidance documents, grouped in continuously renewed collections put in force by instructive letters of the Ministry; the orders and instructions of chiefs of state shipping companies; the General rules of trading and fishing ports and mandatory additions to decrees on ports; manuals, rules, instructions etc., compulsory for execution, issued by various divisions of the Merchant Marine Ministry and many other classes of documents.

Since the Russian Federation is a successor of the USSR, and the Marine Transport Department is a successor of the Merchant Marine Ministry of the USSR, all the state legal acts in the parts consistent with the current legislation of Russia, are valid for vessels of merchant fleet, sailing under the Russian flag, irrespective of kinds and forms of ownership. It is an enforced measure, otherwise the merchant shipping in Russia will fall in legal vacuum.

On the other hand, at present certain measures are taken to withdraw obsolete rules of law and to replace them with normative documents, adequate to the modern international marine law.

2.3 Proposals on improvement of legal regulations

As it follows from the above, to provide the reliable maintenance of international navigation on the NSR, today's legal base of Russia should be transformed and supplemented by a lot of essential rules.

It is necessary, that all rules of law, regulating the navigation on the NSR, and their changes should certainly be published in available Notices to Mariners and transmitted by radio together with operative navigational information. The most important rules should be placed on nautical charts and in pilot-books.

NSRA and MOH, which collect charges for providing services, should stipulate the obligations on medical help, organization of rescue work, repair of ice damages, maintenance of supply and bunker, maintenance of mail services etc.

The Russian federal plan of radio navigation must be supplemented with a particular item on the terms and places of construction of D-GPS reference stations on the NSR, with this information being published.

Since the construction of nuclear ice breakers in Russia is executed at the expense of the state, the outlooks of the program of construction are to be openly published.

3 CARTOGRAPHIC AND HYDROGRAPHIC SUPPORT

3.1 Cartographic support

The main part of hydrographic surveys in the Arctic is executed by specialized hydrographic vessels, equipped with sonars, radionavigation systems, data collection and processing systems and other devices. Hydrographic vessels are provided with special boats for surveying shallow waters. The state geodetic networks with respect to the coordinate system of 1942 is a geodetic base of navigation charts.

The coordinates of some points of island geodetic networks, which were defined in past years with respect to local astronomic systems, were redetermined with the aid of the satellite system TRANSIT by method of translocation.

The state surveying net and bench marks elevations are the base of long-term observation of sea level.

The scale of survey was chosen in accordance with its purpose and bottom configuration, but in any case it was not smaller than a scale of the chart to be compiled. The spacings of the sounding lines were chosen proceeding from importance of region, bottom configuration, depth, width of band covered by sonar and means ensuring evaluation of bottom configuration between sounding lines. Usually, the spacings of sounding lines make not more than 10 mm with respect to the scale of survey.

In accordance with Russian standards the positioning accuracy of survey, represented by average square error, should not exceed 1.5 mm with respect to the scale of survey. The error of measurement of depth should not exceed 1% of the depth.

All data, obtained during survey, are transmitted to the base center for final processing. The processing produces plastic plotting sheets, containing depths, isobaths, ground, coastline, navigating characters and navigation lines information. The detailed report on the work performed is also drawn up. The produced sheets form the basis for compiling the navigational charts.

The modern condition of hydrographic coverage of the Arctic seas is as follows:

the spacings of sounding lines in the Barentz Sea are:

- in the straits of the Franz-Iosif Land archipelago - 250-500 m;
- in the open sea eastward of longitude 45°E - 1000 m;
- in the inshore waters of Novaja Zemlja- 250-500 m.

the spacings of soundings lines in the Kara Sea are

- in the inshore waters of the Kara Sea - 100-250 m;
- in the offshore part of the Kara Sea - 500-1000 m.
- in the navigable part of the Yenisey River - 50-100 m, survey is repeated every five years.

Before navigation, the cross lines of soundings are used during a control survey to sound the places of cross-overs.

in the waters of Arctic ports - 20-50 m, in danger places the hydrographic trawling is carried out.

the spacings of soundings lines in the straits of Novaja Zemlja are:

- in the Karskie Vorota Strait- 100-250 m;
- in the Ugorsky Shar Strait - 250-500 m.

the spacings of soundings lines in the Laptevs' Sea are:

- in the inshore waters and extensive banks with a depth less than 10 m - 100-250 m;
- in the other water areas accessible for survey - 500-1000 m.

the spacings of soundings lines in the Dmitry Laptev and Sannikov Straits - 250-500 m

the spacings of soundings lines in the East Siberian Sea are:

- in the shallow part of the East Siberian Sea up to 10-15 m in depth - 100-250 m;
- in the other water areas of sea - 500-1000 m.

the spacings of soundings lines in the Chukchi Sea is the same as in the East Siberian Sea.

Having been done, the survey has allowed in general to supply the Russian vessels with nautical charts of adequate quality. However all these charts until recently had restrictive signature stamps.

The first open charts were issued by governmental permission for navigation of foreign vessels on the NSR.

In 1994-1995 several more dozens of nautical charts on Arctic seas were supposed to be published. Thereafter the cartographical support of the NSR would be continuous. In connection with organization of international navigation all charts were supposed to be printed not only in Russian, but also in English.

3.2 Aids to navigation

Early in 1930, aids to navigation consisted of 42 lights and 44 land marks installed near the coasts of Novaja Zemlja and in the mouths of the Ob and Yenisey Rivers. The other Arctic regions had no aids to navigation. As the number of vessels in the Arctic increased, the aids to navigation were developed accordingly. Radiobeacons and electric power supply for lights were elaborated and installed in the Arctic. By the end of 1937 in the Arctic straits and seas there were installed 2 radiobeacons, 12 electric and 125 gas lights, and 233 landmarks. Before the World War II there were more than 400 unit of aids to navigation installed along the NSR. 29 polar stations and 38 radio stations served the NSR navigation. After the war these aids to navigation were reconstructed in

short terms and provided with foreign made radiobeacons (one per 4000 miles of coastline). The number of aids to navigation (one for 111 miles of 19440 miles of total Arctic coastline) was not enough for the purposes of navigation.

In the early fifties the installation of radiobeacons was started. Since 1961 automatic Radiobeacons with a range of 20-25 miles were produced in quantity. In 1965 the radiobeacons were installed every 250 miles of the NSR. At the end of the sixties the radioisotope power unit and 150 miles range radiobeacon had been worked out. Since 1970 several radiobeacons were supplied with electricity by such power units. Since 1975 radioisotope power units were used to supply navigation lights. The greatest number of radioisotope power units were installed between the ports of Dikson and Dudinka to support the prolonged and all-the-year-round navigation. 50 radioisotope power units were installed in the Arctic in 1977. Optical and light aids to navigation were erected every 5 miles of the NSR.

The coasts in the Arctic have few conspicuous landmarks, that is why radar and visual aids of navigation are very useful. The construction of radar reflectors was based on the radar survey data. The radar reflectors seen from distances of 6-14 miles were built every 5 miles along the coasts by 1977.

The middle range radio-navigational systems RSVT-1, BRAS, CHAIKA, MARS-75 were mounted in 1960-1970. These systems cover all the regions of the Russian Arctic, and may be used only by ships equipped with special receivers. The above systems do not meet the needs of international shipping.

The use of Russian and American satellite navigation systems for ship positioning is also possible in the Arctic. Particularly, the trials of GPS NAVSTAR performed by CNIIMF showed a bright outlook for this system especially for its use with differential reference.

3.3 Hydrographic support to navigation

The hydrographic support to navigation along the NSR is carried out by the State Hydrographic Office of the Ministry of Transport of Russia Department of Marine Transport, its Hydro bases and Pilot Services.

The hydrographic support includes:

- a) survey, research and collection of data for charts and sailing Directions;
- b) providing ships with charts, sailing directions and information for their updating;
- c) maintenance and arrangement of aids to navigation;
- d) pilotage;
- e) informing navigators about changes in navigational situation.

All above purposes have been accomplished on the NSR by the State Hydrographic Office through the network of hydro bases and marking services.

The main volume of work on hydrographic measurements in the Arctic has been executed by specialized hydrographic vessels equipped with sonars, radio-navigational systems, systems of collecting and processing information and with other means necessary for hydrographic surveys.

The surveys conducted have generally allowed to provide the issue of nautical charts of high quality. However, all of them fell until recently into restricted documents. After the governmental permission for navigation of foreign vessels on the NSR had been issued, the first open charts were published.

3.4 Meteorological and oceanographic support

The role of meteorological and oceanographic information for Arctic navigation was in due time appreciated by scientists. At their urgent request in 1911 the Russian Government decreed the construction of meteorological radio stations and the first 3 stations came into operation in 1914. In 1933 professor V. Ju. Vise presented the following data: "5.5% of vessels sailing along the Northern Sea Route during period from 1873 till 1931 could not perform their tasks due to ice impediment to navigation. Having taken only the above period, during which the radio meteorological service in the Kara Sea had already been in operation (1914-1933), we could see that there were no cases, when the vessels could not reach their aim due to ice obstacles."

Meteorological and oceanographic forecasts for the NSR are very important because of difficult meteorological and oceanographic conditions. The absence of ice information caused the failure of several Arctic campaigns. That is the reason why in 1911 the Russian Administration decreed the construction of meteorological and oceanographic broadcasting stations.

The experience of long standing teaches to make navigational decisions on the basis of the ice maps of the real and prognostic situation and meteorological data. The necessary data are provided by the air, satellite and vessel ice survey.

The airborne ice survey, in particular carried out by helicopters based on board icebreakers, is the most effective means of ice survey. It ensures the rapid data collection and gives the possibility to assist ships under hard ice conditions. Oceanographers shall participate in airborne ice surveys.

The spaceborne ice survey gives a short-time view of vast sea spaces, but its efficiency may be limited by visibility conditions. The use of infrared, microwave and radar equipments does not provide the needed completeness of ice information.

The ice survey carried out from ships provides an accurate and detailed round-the clock information but only for a narrow area of 5-10 miles in width and 100-250 miles in length; the collection and processing of the data are directed by the local divisions of the State Committee for Meteorology and Oceanography. The generalized ice information is communicated to the vessels and organizations concerned.

Navigators may receive the facsimile ice map from the nearest meteorological broadcasting center.

In Russia the collection and transmission of ice data are carried out by the marine territorial departments of the Federal Service of Russia for Hydrometeorology and Environmental Monitoring (GOSGYDROMET). The integrated ice information is promptly communicated to the vessels and organizations concerned.

In the USSR the order of supply of vessels with recommendations about suitable and safe routes of navigation was organized, and realized by hydrometeorological services through their forecasting departments. The calculation of the most suitable and safe route and transmission of recommendations to the captains of vessels was executed by both the Hydrometeorological Centre (GYDROMETCENTER) of the USSR, located in Moscow, and local Arctic hydrometeorological centers.

4 RESULTS OF ANALYSIS OF INFORMATION SUPPORT TO MERCHANT SHIPPING ON THE NSR

4.1 Conceptual approaches

The analysis of information support to navigation on the NSR is performed within the framework of Subroutine 1 "Natural conditions and ice navigation". This paragraph gives only a conceptual approach to analysis of information support and brief results of the analysis.

First of all we state, that in addition to routine information, the navigation along the NSR needs specific information, describing geographical, ecological and political conditions of the Russian Arctic.

Such information can be submitted only on the basis of serious scientific researches founded on long-term experimental observation of hydrologic and meteorological parameters of region and systematic hydrographic works. The international navigation requires scientific-methodical information. Its development should contribute to the modernization of other kinds of information support.

The main kinds of information support to navigation are:

- meteorological and oceanographic forecasts and operative data (for the NSR, in the first place, about ice conditions), without which it is impossible to carry out the perspective planning and operative management of fleet and a separate vessel;
- detailed data about navigational-hydrographic conditions of navigation in each particular region, and also their operative updating;
- specific information, received from pilots;
- detailed information about manoeuvring characteristics of vessel;
- information about real capabilities of the NSR infrastructure in the region of navigation of vessel for each particular moment, because the level of admissible risk of navigation under ice conditions is determined by capabilities of infrastructure;
- information about organization of navigation in an area, which allows to know when and to whom it is possible to address on any arising questions;
- contents of legal documents, regulating merchant shipping in the area of navigation.

4.2 Available information support

The scientific and methodical support to navigation in the Arctic rendered by AARI, CNIMF, SHO, Joint-stock Company "LENMORNIPROEKT", HDNO, design and operational organizations is in general adequate for completion of any task.

The available information support to navigation, hardware in use, methods and language of information cannot be directly applied to support international navigation and are in need of adequate modification and addition by modern organizational and technical components.

Meteorological and oceanographic support to navigation in the Arctic seas is sufficiently effective system and requires only proper conditions of maintenance.

Hydrographic-navigational support already permits without specific difficulties to execute the international navigation in the Arctic.

The operative navigational information includes Notices to Mariners (NAVIM), coastal warnings (PRIP) and Notices to Mariners concerning Areas of Navigation (NAVAREA), transmitted by radio on frequencies, announced to mariners in navigation guidelines. Moreover operative navigational information is passed to vessels by MOH, hydrographic bases, ice breakers and pilots.

The existing system needs maintaining. Moreover the information should be presented in English.

The icebreaker support permits to ensure the longest time of navigation in the Arctic.

The main kind of pilotage is the pilotage in the mouths of the Arctic Rivers - Yenisey, Hatanga and Kolyma. As a rule the pilotage services meet their duties, though the weak points are the language of communication and training of ice captains.

The port services, except for icebreaker support and pilotage, are represented by tugboat assistance at berthing, by lighters and self-propelled barges for unloading vessels at the road, portal, floating and automobile handling equipment.

The information about port services is placed in pilot books.

The supply of transport vessels, especially under foreign flag, in the Arctic is extraordinary hindered in connection with the reduction of supply of the Arctic ports. Obviously the situation can essentially be improved only after organization of normal navigation as a precondition of improvement. In the Russian Arctic the international search and rescue system COSPAS-SARSAT is in operation with overlapping by earth radio centers.

The problems of merchant shipping along the NSR are settled by the NSRA, which is a structural division of the Marine Transport Department of the Ministry of Transport of the Russian Federation. The vessel traffic is regulated by MOH of West and East sectors of the Arctic.

The existing organization has quite come up to expectations and can be kept on provided that MOH is properly manned with experts.

The legal support to navigation is represented in Russia by non-abrogated laws and departmental acts of the former USSR, which in many cases are not suitable for modern activity.

4.3 Improvement of information support

The primary proposals on improvement of information support to international merchant shipping on the NSR are directly contained in the results of analysis.

The advantages of GPS NAVSTAR receivers are so evident that there is no doubt about the necessity of their installation on board the ships sailing the Arctic Seas.

The operational and economic advantages of GPS NAVSTAR over short, middle and long range radionavigational systems are obvious.

The continuity and high accuracy of vessel position fixing, provided by the satellite NAVSTAR system, especially in differential mode, could not be realized by hand-operated plotting on common paper chart. The effective use of GPS NAVSTAR is possible only in combination with videoplotter and electronic chart.

The navigational complex, which, with high precision system being used, displays a current observed position of the vessel in real time scale on electronic chart containing all necessary navigational and hydrographic data including preliminary plotting, alarms about deviation of the vessel beyond the outer limits of the route, registers the necessary data about navigation, represents the top-class information system which is a technical base of new technology of navigation.

It stands to reason that the Program of introduction of electronic navigation in the Arctic shipping shall be accepted.

It is assumed, that hereinafter the work on improvement of information support will be continued on the basis of: new experience of actual navigation of vessels sailing under different flags in the Arctic region, new ship and shore navigational and communication equipment, development of infrastructure.

The researches on development of navigational control system of the NSR and of co-operation with foreign partners are thought to be very actual.

Naturally, the following works on information support to navigation will take into account the results of the other Sub-Programmes Projects completion .

4.4 Economic aspects

As it was mentioned above the advantages of GPS receivers are so evident that there is no doubt about necessity of their installation on board the ships sailing the Arctic seas.

The sailing distances can be shortened by 1.5-2.0% due to accurate routing and its adequate realization by means of the GPS and by the use of ECDIS; economical efficiency of the vessel

increases accordingly. The mean efficiency of the mean vessel is about \$1 000 000, the saving will be about \$15000 - 20000. This sum is nearly equal to the cost of an ECDIS set.

Navigation under adverse conditions, when the required volume of information to be processed by navigator is too great to take an adequate decision, the speed of vessel shall be slowed down to a safe speed to meet the requirements of the Conventions. The use of ECDIS allows the navigator to waste no time for fixing positions, plotting, calculating courses and drifts etc. and in this way to maintain full speed without violation the requirements of the Conventions.

The fall of a normal mean speed of vessel in the Arctic seas (when the adverse sailing conditions take about 20% of the time) is about 25% of the full speed with the traditional navigational technology used. The use of ECDIS will permit to increase the mean speed, and that will give a saving of about 1.5% (\$15000), whenever the radar information is added to electronic chart the saving will come up to 2.5% i.e. \$25000 a year.

The use of ECDIS may help also to resolve the problem of reducing ship's crew, which is actual for ship's owners all over the world.

Summing up, we can tell that the introduction of electronic navigational technology has been fully proved to be economically sound.

5 REGULATIONS FOR NAVIGATION ON THE SEAWAYS OF THE NSR

The regulations for navigation on the seaways of the NSR were approved by the Minister of Merchant Marine of the USSR on the 14th September, 1990. The Regulations shall, on the principle of equal rights for vessels of all States, regulate navigation through the NSR in order to ensure safe navigation and to prevent, reduce, and keep under control marine environment pollution from vessels, since the specifically severe climatic conditions that exist in the Arctic Regions and the presence of ice during the most part of the year, bring about obstacles, or increase danger to navigation, while pollution of sea or the Northern Coast of Russia might cause great harm to the ecological balance or upset it irreparably, as well as inflict damage on the interests and well-being of the North peoples.

Last years the following Russian ports were open for foreign vessels in the Russian Arctic: Arkhangelsk, Igarka, Mezen, Murmansk, Narjan-Mar, Onega and Provideniya (HDNO of the Ministry of Defence of Russia, Notices to Mariners, issue 1, 1994).

The instruction of Government of the Russian Federation of June 26, 1993 #1153 permitted the foreign oil tankers delivering fuel for Arctic regions in navigation of 1993 to visit the following Arctic ports and places: Amderma, Uedinenija, Dikson, Vilkitskogo, Zhelanija, Cheluskin, Anabar, Hatanga, Indigirka, Kolyma, Jana and some others. It is assumed, that the instruction of the Government of Russia will be prolonged for the navigation of 1994.

The lifting of many restrictions in economic relations between Russia and the USA is connected with the opening of a large number of seaports of Russia for merchant shipping. As a result of an international agreement, American vessels are now permitted to call at the following Russian ports: Kaliningrad, Vladivostok, Vanino, Taganrog, Korsakov, Magadan, Nikolajev-on-Amur, Anadyr and Dudinka.

We can state with satisfaction, that although during all soviet period the NSR was closed for foreign vessels, the last Regulations for Navigation on the Seaways of the Northern Sea Route - developed in September 1990 and put into force in July 1992,- proclaim, that the NSR is open for vessels of all flags. The Rules provide conformity of vessel to technical, operational and other stipulated requirements and warranty of indemnification for damage in case of environmental pollution.

The Owner or Captain (Master) of a vessel intending to navigate through the Northern Sea Route shall submit to the NSRA (MOH) a notification and request for pilotage through the Northern Sea Route in compliance with the form and time stated in the Guide to Navigation through the Northern Sea Route.

The NSRA (MOH) shall consider the submitted request and inform about the possibility of piloting through the Route and about other circumstances to be taken into consideration by the Owner or Captain (Master).

To navigate the Northern Sea Route, a vessel shall satisfy special requirements while the Master,

or a person who performs his duties, shall be experienced in operating the vessel in ice. If those persons have no such experience, or when the Captain (Master) requests so, the NSRA (MOH) may assign a State Pilot to the vessel to assist in conducting it through the Northern Sea Route.

It should not be permitted to navigate the Northern Sea Route to vessels that have not aboard a certificate of financial security with respect to the civil liability of the Owner for damage inflicted by polluting marine environment and the Northern Coast of Russia.

The Rules are to be published by the HDNO in Russian and English languages.

Important chapter "Principles, object and goals of regulations" is incorporated in the Rules. So the Rules provide in whole a legal background for international shipping on the NSR.

Among the most important legislative and normative acts of Russia, which have come recently into force and are of great significance for maintenance of international navigation in the Arctic seas, in the first place, we should mention the Decree of the Government of the Russian Federation of March 7, 1995 #237 "About execution of work on application of global navigation satellite system "GLONASS" for civil users".

These Decree orders the Ministry of Defence of Russia, Russian Space Agency and Ministry of Transport of Russia "...to ensure the deployment of the "GLONASS" system and the beginning of its operation in total in 1995 for servicing domestic ... and foreign civil users pursuant to the present obligations".

These Decree orders also "... to create and produce ... stations of transmission of differential corrections..., to create the information service on the system "GLONASS" and American system GPS NAVSTAR..., to submit... to IMO the necessary materials for preparations of agreement about the use of the system "GLONASS" as an element of international global navigating system for civil users...".

The research of the first year showed that the joint use of the Russian and American satellite systems of the first and second generations is rather promising. It was confirmed by comparative tests of several satellite receivers of GPS NAVSTAR, carried out by CNIIMF. Especially promising is the differential mode of their usage.

The tariffs on transit goods, norms of foreign vessel tax, requirements to documentation relating to characteristics of vessel, operational standards, etc. were formerly developed and came into force.

The tariffs include payment for icebreaker pilotage, pilotage services, foodstuffs and fuel supply, taxes.

As the experience of first international trips has shown, the organization of operative communication between vessel and MOH in the Arctic or the NSRA in Moscow leaves much to be desired, so that since the navigation of 1994 on the NSR the specified instructions on Communication have begun to act.

At present all rules of law, regulating navigation on the NSR, and their changes are certainly published in Notices to Mariners and broadcasted together with operative navigation information.

TABLE 1

RADIO-METEO CENTERS AND RADIO STATIONS IN THE ARCTIC¹

Position	Frequencies-coast, kHz	Frequencies-Vessel, kHz
Dikson	322.6	454
Hatanga	460	468
Isl. Heisa	457	468
Tiksi	2182	468
Pevek	540	425
Cape Shmidta	326	468
Provideniya	417.5	454

¹Shortened version

7 CATALOGUES OF NAVIGATION CHARTS AND EDITIONS ON THE NSR

Now the applied in the USSR system of representation of information about navigation charts inherited by Russia and about guidelines has been undergoing essential changes.

Formerly all charts and editions of HDNO, intended for civil users, including foreign consumers were listed in Catalogue #7007.

In 1992, in connection with significant increase of charts in number, with lifting of restrictions for users, this Catalogue was issued in two parts: part 7007.1 - the Arctic and Atlantic Oceans and 7007.2 - the Indian and Pacific Oceans.

However the sudden immediate lifting of restrictions involving thousands of numbers of charts has resulted in enormous volume of Catalogue updatings. In 1994 HDNO had to issue the Addition to Catalogue 7007.1 (# 7007.1 D), where the charts open for users after September 25, 1993 were placed.

After issuing the Addition, updatings were announced both for the main Catalogues and for the Addition.

All this has caused a significant inconvenience and at the end of 1994 the HDNO decided to create a uniform system of catalogues in five parts: part 1-4 - one for each ocean, part #5 for special editions.

The first was published "The Catalogue of charts and editions. Arctic Ocean." (#7107), which supersedes Catalogues 7007.1 and 7007.1 D and incorporates all information about charts and editions for the Arctic Ocean and seas. The catalogue was announced by Notices to Mariners of February 18, 1995 (issue #8).

The information in the Catalogues is as of March, 12, 1994. The Catalogue needs regular updating, the NSR part is mainly to be updated.

The data on Catalogue updating is published in each fourth issue of Notices to Mariners by HDNO. Here are two examples showing the number of updatings. Issue # 8 of Notices to Mariners of February 18, 1995 contains 104 updatings (97 for charts, 7 for editions). Issue 12 of March 18, 1995 contains 48 updatings (40 for charts, 8 for editions).

8 PROVISION OF THE NSR NAVIGATION WITH NAUTICAL CHARTS

Now the transit navigation along the NSR, as well as calling at open Arctic ports is actually provided with nautical charts.

If before 1992 in the region from Murmansk to the Bering Strait, there were 26 charts available for civic users, in 1993 - 106 charts, at the end of 1994 the number of charts came up to 229. The information about navigation charts for the NSR as of February 18, 1995 is given thereafter.

The general charts (scales 1:2 000 000 - 1:500 000) - 27 admiralty numbers (region from Murmansk to the Bering Strait). In 1995, 8 charts more were to be issued for this region (see Fig.1).

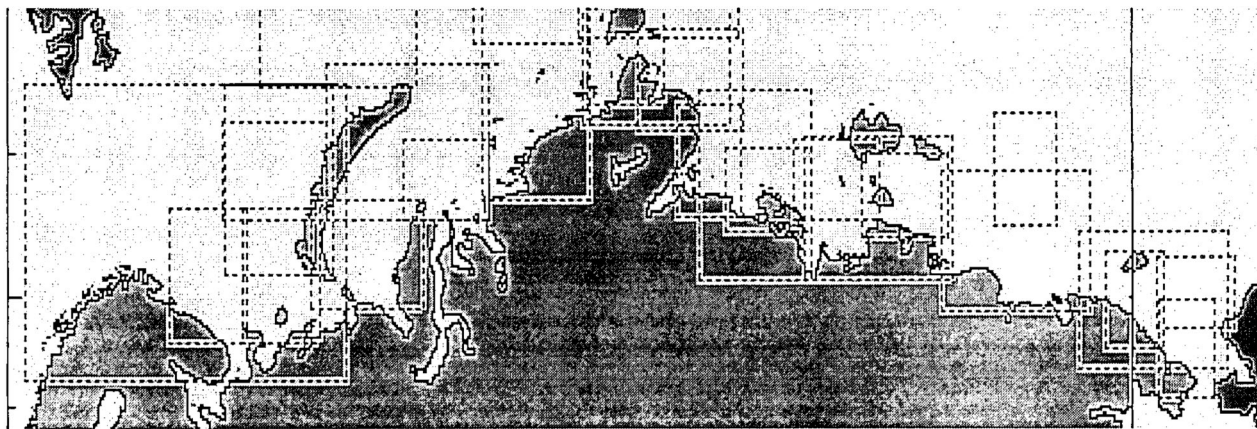


Fig.1

The routes, special charts and sailing plans (scales of 1:250 000 - 1:1 000) - 127 admiralty numbers (region from the Novaya Zemlya Straits to the Bering Strait). In 1995 thirty-three more charts on this region were issued.

The scientific research, aimed at improvement of information support of the NSR navigation with a view to provide safe operation of ships and pollution prevention, was continued in 1995-1996. A basis of the research was the International Safety Management (ISM) Code, which had been put in force in Russia by the order of the Ministry of Transport.

The documents are being developed and some other arrangements stipulated by the ISM Code are being made with participation of CNIMF. A Safety Management System (SMS) of the Russian Federation, which should comprise regional SMS, in particular the SMS of the NSR, is intended to be established.

The plans of improvement of information support of the NSR navigation have made provision for tests of the differential subsystem of the satellite navigation system - GPS NAVSTAR - and electronic chart.

Basic components of new navigation technology make provision for decision of commercial aspects of the NSR navigation at substantially new level.

Russia, where after the October Revolution of 1917 a unitary system of economy control was applied, has proved to be prepared in the best way for introduction of the ISM Code.

If in the West the absolute majority of problems of navigation are regulated by companies, in the USSR they were adjusted by the state by means of many hundreds of normative acts. The majority of these acts have remained in force in Russia. The organization of navigational and watch work on board, regulations for log book record keeping, preparation for actions and action in emergencies, account on and investigation of sea accidents, prevention of marine pollution from ships and a set of other specific large and small problems have been reflected in the existing normative-legal base of merchant shipping of Russia. The fulfillment of the requirements of these normative acts was enforced by state bodies.

The CNIMF had to take into consideration these circumstances while developing the concept of state management of safe operation of ships and pollution prevention for Russia and making normative acts for regulation of the implementation of the ISM Code in the Russian Federation.

The following four normative acts have been submitted for approval to the Minister of Transport of the Russian Federation:

- the Statute of Safety Management System (SMS) of Russia;
- the Statute for the certification of companies and ships on conformity to the requirements the SMS of Russia (on conformity to the requirements of Chapter IX of SOLAS-74);
- the Statute of recognized organization acting on behalf of the Administration in the certification or in the survey of companies and ships on their conformity with the requirements of the ISM Code;
- Guidelines for the survey.

The first document defines the SMS of Russia (worked out by the authors of this paper) as a national part of global safety management system that is the system of international and national organizational structures and documents as well as ships, their masters and crews integrated by uniform national policy in the field of safe operation of ships and pollution prevention.

The objectives of the SMS of Russia consist in maintenance of safety at sea, accident and loss of life prevention as well as the prevention of any harm to the environment and property.

In the document the ways of achievement of the objectives in view have been specified, the organizational structures and the components of the SMS of Russia included in some part of the system have been named (competent state bodies; research, design and other organizations and experts acting on behalf of the Administration; Shipping companies and other organizations, the activity of which involves merchant shipping activity; masters and ship's crews; normative-legal base of navigation; information support system; SMS of companies; SMS of ships; database).

It has been also specified, that delegation by the Administration of powers to organizations in the certification or in the survey of companies and ships on compliance with the requirements of the SMS of Russia should be carried out by a formal written agreement between the Administration and an organization based on the provisions of the IMO Resolution A.739 (18) "Guidelines for the Authorization of Organizations acting on behalf of the Administration" adopted on November 04, 1993.

The Right of organizations to the certification or to the survey of companies and ships should be certified by the Document of Compliance of recognized organization issued by the Administration for the period of 5 years. The recognized organizations should be surveyed by the Administration or on behalf of it by another organization on compliance with the specified requirements. In the document the normative-legal base of the SMS of Russia has been defined; the base includes the documents which regulate safety management problems and marine environment protection against pollution from ships including international tools, regional agreements, contracts of Russia with other states, national legislative and normative acts etc. In the Statute the requirements to the SMS of companies and to the SMS of ships have been defined.

The second of the new normative acts - the Statute for certification - includes the patterns of Documents of Compliance and Safety Managements Certificates issued to companies and ships which successfully passed the survey.

Third document - the Statute for recognized organization - gives in detail the requirements of the Administration to the organizations authorized by the Administration to act on its behalf in the certification or in the survey of companies and ships.

At last, the Guidelines for the Survey are a code of the requirements of the Administration to companies and ships which they should meet to be issued the certificates of an international form. Taking into account essential changes in modern technology of navigation, the CNIIMF was entrusted to prepare in 1996 a new edition of the "Recommendations for organization of

navigation service on ships under the Department of Marine Transport of the Ministry of Transport of the Russian Federation" (RNS-96). Taking account of the experience of previous editions of the recommendations for organization of navigational service published in 1989, 1982, 1977, the practice has shown high efficiency of this normative document.

The purpose of RNS-96 is to familiarize Russian navigators, who have rather high general and special theoretical background, with the most acceptable experience of organization of navigational service on sea-going transport ships as an indispensable condition of accident-free operation of the fleet. The purpose of RNS-96 is also to offer navigators the technology of realization of the requirements of the international and Russian national normative documents concerning navigation; the technology is based on generalized experience in the use of modern equipment and methods.

The reasons for republication of the RNS have been seen in made and forthcoming essential changes in organization of navigational service on ships, in nautical-hydrographic support of navigation and technology of navigation including: reduction of navigators on ships; putting into operation the systems of the second generation and their differential subsystems; wide application on ships of "electronic charts" realizing capability of the satellite navigation systems; expansion of criteria of "safe speed" by means of installation of modern navigating systems on the bridge etc.

CNIINF is now responsible for creation of the number of the above mentioned and other documents regulating merchant shipping. The continuation of work on the INSROP program would make it possible for INSROP participants to be among the first readers of it.

10 CONCLUSIONS

The main categories of information support to Arctic navigation are as follows:

- hydrometeorological forecasts and operative data (for the NSR, in the first place, data on ice conditions), without which the perspective planning and operative management of fleet and of a single vessel are impossible;

- detailed data on navigational hydrographic conditions of sailing in each particular region, and also their operative updating;

- specific information, received from pilots;

- detailed information on manoeuvring characteristics of vessels;

- information on real capabilities of the NSR infrastructure in the region of navigation of a vessel at any moment as far as they determine the degree of admissible risk to navigation in ice;

- information on organizational support to navigation in the region in order to know to whom and when addressing any arising questions is possible;

- contents of legal documents, regulating merchant shipping in a region.

Thus the NSR navigation needs specific information, describing geographical, ecological and political conditions in the Russian Arctic.

The scientific and methodical support to the Arctic navigation realized by AARI, CNIIMF, SHO, Lenmomiiproekt, HDNO and other scientific, design and operational organizations, is sufficient for completion of any work.

Hydrometeorological support to navigation in the Arctic seas is a quite adequate system which requires only appropriate maintenance.

At the present time the navigational-hydrographic support already permits, without specific difficulties, to execute the international navigation in the Arctic.

The operative navigational information includes the navigational warnings to mariners (NAVIM), coastal warnings (PRIP) and NAVAREA, transmitted on radio frequencies, published for seafarers in navigational guides. In addition, operative navigational information is given to ships by MOH, hydrographic bases, ice breakers and pilots. The existing system needs to be maintained.

The icebreaker support ensures the widest range of time for the Arctic navigation. The main kind of pilotage is the pilotage in the entries of the Arctic rivers. The pilotage service can in general fulfil their duties.

The port services, except for icebreaker and pilotage services, include tug assistance, lighters and self-propelled barges for road unloading, portal, floating and automobile cranes. The information about port services is placed in pilot books.

The international system of search and rescue COSPAS-SARSAT functions in the Russian Arctic. This system is overlapped by earth radio centers.

The merchant shipping operation on the NSR is executed by NSRA. The traffic is regulated by MOH of West and East sectors of the Russian Arctic. The existing organization is satisfactory and can be used.

The necessity to equip the vessels, sailing the Arctic seas, by GPS NAVSTAR receivers is unquestioned.

The continuity and high accuracy of vessel position fixing provided by GPS NAVSTAR, especially in its differential mode, are impossible to realize by hand-operated plotting on conventional marine chart. The effective use of GPS NAVSTAR is possible only in complex with videoplotters and electronic chart systems. Such a complex represents the information system of higher class and is a technical base of new navigational technology.

It is assumed, that hereinafter the work on perfection of information support will be continued on the base of experience of actual navigation of ships flying different flags and with due regard to new navigational and communication equipment and development of infrastructure.

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LIST OF ABBREVIATIONS

AARI	- Arctic and Antarctic Research Institute
CNIMF	- Central Marine Research and Design Institute
COSPAS-SARSAT	- International Search and Rescue System
ECDIS	- Electronic Chart Display Information System
GLONASS	- Global Navigation Satellite System
GOSGYDROMET	- Federal Service of Russia for Hydrometeorology and Environmental Monitoring
GPS NAVSTAR	- Satellite Global Positioning System "NAVSTAR"
D-GPS	- Differential GPS use mode
GYDROMETCENTER	- Hydrological and Meteorological Center
SHO DMT	- State Hydrographic Office of Department of Marine Transport
HDNO	- Head Department of Navigation and Oceanography of the Ministry of Defence of Russia
INSROP	- International Northern Sea Route Program
IMO	- International Maritime Organization
ISM Code	- International Safety Management Code
LENMORNIPROEKT	- Coastal and Berthing Structures Design Institute
MOH	- Marine Operations Headquarters
NAVAREA	- Notices to Mariners concerning Areas of Navigation
NAVIM	- Notices to Mariners
NSR	- Northern Sea Route
NSRA	- Northern Sea Route Administration
PRIP	- Coastal Warnings
RNS	- Recommendations for Organization of Navigational Service on Ships
SMS	- Safety Management System
TRANSIT	- Satellite Positioning System

REVIEW of the International Northern Sea Route Programme (INSROP) Working Paper
Sub-Programme III: Trade and Commercial Shipping Aspects
Project III.12.1 Improve Information on Navigating the NSR
1996

Reviewer: James W. St. John,
Science and Technology Corporation
9650 Santiago Road, Suite 2, Columbia, MD, 21045, USA

This is an important compilation of information necessary for navigation through the Northern Sea Route (NSR) and ongoing issues for improvement. The data presented is valuable and not generally known in the western body of literature. It makes a valuable contribution toward understanding how to organize and manage navigation on the NSR.

The paper reviewed is a summary of the results from the work in 1993, 1994 and 1995. The authors considered many issues on the NSR such as legal and cartographic support, communication, meteorological support, availability of ice conditions data, arrangements and regulations for navigation on the NSR. The western reader can find answers to many questions about how the NSR administration functions and what kind of information and services are available.

The report reviewed is presumably addressed to ship owners and ship operators. The whole work may benefit by having an explanation of the differences between issues considered in the INSROP project 1.1.2 "Operational Aspects" previously reviewed and this current paper.

Another general comment addresses the report arrangement. The volume contains, for some reason, two sections 2, 3, and 4 and this creates some difficulties for the reader. Also, there are many areas throughout the report where abbreviations are used, especially for systems or organizations, where the abbreviation is not fully explained when it is first used. The reader may have no idea what is being discussed unless he is familiar with the system or organization from other sources. Abbreviations should be explained even for those obvious to western readers such as GPS.

Specific comments for individual sections of the paper are given below:

Section 2.1 beginning on page 6.

It is clearly stated in this section that all the captains are obliged to follow the directions of the Marine Operations Headquarters (MOH). It would be helpful to describe the responsibilities of MOH as well as information on support and services provided by MOH.

Section 2.1, beginning on page 6.

Compulsory icebreaker escort is provided in some straits. It is important to know how the icebreaker service is organized along the rest of the NSR. This section should describe how the system works at present and what changes are planned. The section "Trade and Commercial Shipping Aspects" may be an appropriate place to describe the commercial regulations relating to the icebreaker escort and complete MOH services.

Section 2.4, beginning on page 11.

Some very important proposals are listed in this section. The changes suggested are significant compared to the current practice and will require both investment and legislation. It is not clear from the text to whom the proposals are addressed. Were the proposals just developed within INSROP or are they already being considered by Russian authorities.

Section 2 : "Arrangement of Arctic Navigation" (p.26) is completely presented in Section 2.1 : "Organization of Shipping along the NSR" on pp. 6-8. Section 2 can be removed.

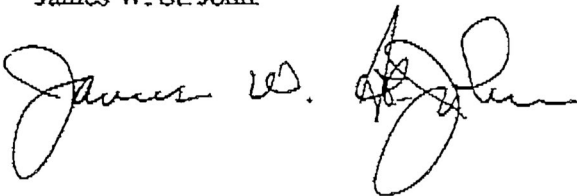
Section 2.3 on page 10 has the same heading and presumably the same objective as the Section 3 on pages 27-28. It makes sense to remove duplications and combine both sections.

The entire text of the Section 3.3: "Hydrographic Support to Navigation" (page 16) is included in Section 5 on page 30-31: "Navigational-Hydrographic Support Purposes"

Section 8, on page 35 has words missing at the end of the first paragraph.

This INSROP Report, "Improve Information on Navigating the NSR" by Dr. A. Baskini et al. is recommended for publication after editorial changes and recommended reorganization. The report contains valuable information for Northern Sea Route navigation. I appreciate the opportunity to provide comments on this report.

James W. St. John

A handwritten signature in black ink, appearing to read "James W. St. John". The signature is written in a cursive, flowing style with some loops and flourishes.

AUTHORS' REPLY TO THE REVIEWER

Dear James. W. St. John,

Thank you very much for the detailed and comprehensive analysis of our work. We tried to answer most of your questions by changing the text according to your proposals. All editorial recommendations are fulfilled.

I would like additionally to answer the question about the responsibilities of the Marine Operations Headquarters. The responsibility of MOH is similar to the pilot's responsibility during a ship's pilotage - he is only advisor and it is the ship master who bears total obligations.

Secondly I would like to inform that all proposals listed in the Report were presented to the Russian Administration.

On behalf of the contributors, yours sincerely

Vladimir Ja. Vasilyev

Friday, 23 May 1997

The three main cooperating institutions of INSROP



Ship & Ocean Foundation (SOF), Tokyo, Japan.

SOF was established in 1975 as a non-profit organization to advance modernization and rationalization of Japan's shipbuilding and related industries, and to give assistance to non-profit organizations associated with these industries. SOF is provided with operation funds by the Sasakawa Foundation, the world's largest foundation operated with revenue from motorboat racing. An integral part of SOF, the Tsukuba Institute, carries out experimental research into ocean environment protection and ocean development.



Central Marine Research & Design Institute (CNIIMF), St. Petersburg, Russia.

CNIIMF was founded in 1929. The institute's research focus is applied and technological with four main goals: the improvement of merchant fleet efficiency; shipping safety; technical development of the merchant fleet; and design support for future fleet development. CNIIMF was a Russian state institution up to 1993, when it was converted into a stock-holding company.



The Fridtjof Nansen Institute (FNI), Lysaker, Norway.

FNI was founded in 1958 and is based at Polhøgda, the home of Fridtjof Nansen, famous Norwegian polar explorer, scientist, humanist and statesman. The institute specializes in applied social science research, with special focus on international resource and environmental management. In addition to INSROP, the research is organized in six integrated programmes. Typical of FNI research is a multi-disciplinary approach, entailing extensive cooperation with other research institutions both at home and abroad. The INSROP Secretariat is located at FNI.

POLAR CIRCLE