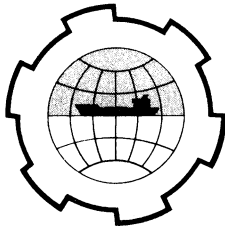


PORT AND OCEAN ENGINEERING UNDER ARCTIC CONDITIONS
TECHNICAL UNIVERSITY OF NORWAY



THE NORTHERN SEA ROUTE AND INTERNATIONAL
SEABORNE TRADE AND SHIPPING IN 1970's

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1. Introduction.

About twenty years ago a German author asserted that the Arctic Ocean would be the Mediterranean of tomorrow (Ernst Herrmann: Das Nordpol-armeer - das Mittelmeer von morgen; Berling 1949). So far this idea has not been a matter of fact. One of the two main links in the Arctic Ocean binding up the Atlantic and the Pacific is the Northern Sea Route or the North-east-passage from White Sea to Bering Strait.

The Development of the Northern Sea Route to an important artery in the international trade organism depends on a number of factors of economic, technical and political character. We ought not to neglect or forget the political factors, although we are either economists or engineers. That would be a serious mistake or a case of obscurantism.

In the 1950's and 1960's there was an increase in the operations in the Northern Sea Route. Probably 200 to 400 ships sailed each summer in this area carrying between one and two million tons of freight, according to Terence Armstrong. The main traffic is to and from the Yenisey river, where important nickel resources and mines exist at Noril'sk and huge timber plants at Igarka. Next in importance is the sea trade to Pevek and the Kolyma river from the Pacific. Here too, we find important mines. There was no significant through traffic from east to west or vice versa. But each summer a large convoy of river vessels was escorted along the sea route to destinations on Siberian rivers.

During the same period the service area on the Northern Sea Route diminished according to the enormous growth of air transport in Siberia and by the extension of the rail link to the Lena river. Terence Armstrong asserts that more and more, the lines of communication from north Siberian settlements run southwards, by river, to the railroad or airports. The Northern Sea Route tends now to be

used only to serve locations in northern Siberia, which are also remote from the rivers, Ob, Yenisey, and Lena. The seaborne volume of cargo carried on the sea route do, nevertheless, increase from year to year.

One of the two principal shipping lines active on the Northern Sea Route, Severnoye parakhodstvo, with headquarter in Murmansk, stated at the end of the season 1969 to have 141 modern vessels with a combined capacity of 600,000 tons. It expected a further 15, mainly diesel-electric, in 1970. The average size of each freighter was just over 4,000 tons dw.

The first convoy in 1969 into Dudinka on the Yenisey arrived on 15 July. The port, which serves Noril'sk handled over two million metric tons of cargo during the season. About half travelled by sea and half by river transport down the Yenisey. The first convoy into Igarka, further upstream than Dudinka, probably arrived about 22 July, according to "The Polar Record". The last ship out of Igarka left on 6 November. About 650,000 metric tons or 216,700 standards of timber was shipped during the season by 132 deep sea ships.

Timber was also carried down Lena to Tiksi, whence it was freighted along the coast and some was exported to Japan. The planned volume of timber down the river was 28,000 standard. The first river vessels reached Tiksi on 31 July.

The usual convoy of river vessels bound from their places of manufacture in western USSR or eastern Europe to destinations in Siberia was scheduled to take place also in 1969. A floating power station was also moved by sea from Tyumen, where it was built, to the mouth of Kolyma - a considerable sea passage.

2. Main Factors in Developing The Northern Sea Routes.

The most important factors in the developing of the Northern Sea Route in the last ten years are the following:

Economic factors

1. The increased domestic and foreign seaborne trade of the USSR as well as the growth of the merchant marine of the USSR. Soviet Union has been more dependent of an exchange of commodities with foreign countries.

2. The increasing utilization of the vast economic resources of Siberia and the Far Eastern Region.
3. The growing fast trade between USSR and Japan and between Japan and Western Europe.

Technical factors

1. The increased number of big and strong icebreakers.
2. The experiences of the icebreaker-tanker Manhattan (1969).
3. The backward position of many ports and harbours in Northern Soviet, inefficient cargo handling and lack of informations about conditions concerning shipping operations.

Political factors

1. The closing of the Suez Canal in 1967.
2. The offer in 1967 to foreign shippers to use the Northern Sea Route and the withdraw of the offer next year.
3. The growing tension between USSR and China.
4. The increased drain in informations on the Northern Sea Route since 1967. (No data revolution concerning the Northern Sea Route).
5. Plan of doubling the seaborne transport of the Northern Seas in 1966-1970 and probably a new increase up to 1975.

The sudden changes in the official policy concerning the general use of the Northern Sea Route, the lack of informations and the general uncertainty among foreign shippers and investors do more than any other factors hamper the interest in and the use of the Northern Sea Route.

3. Facts about Soviet Shipping.

Table 1. Shipping in USSR. Home and foreign trade.

	1969	1965	1960	1950	1940	1929	1913 ⁺)
Freight carried (mill.tons)	148,7	119,3	75.9	33,7	31.2	9.1	15.1
Shipping (1,000 mill. ton-kms.)	601.3	388.8	131.5	39.7	23.8	10.4	20.3
Passengers transported (Mill.)	..	..	14.5	3.2	3.1	1.5	3.7
Passengers transported (1,000 mill.pass.-kms.)	1.7	1.5	1.3	1.2	0.9	0.4	1.0

+)Present borders.

Source: Narodnoe chosjajstvo, SSSR v 1969 godu. Moscow 1970.

Table 2. USSR. Foreign Seaborne Trade. Mill. tons.

	1968	1967	1966	1965
Loaded	101	98	90	79
Unloaded	11	10	12	13
	112	108	102	92

Source: United Nations Statistical Yearbooks.

The seaborne trade in USSR - domestic and foreign, excluding river and canal trade - was approximately about 160 million metric tons in 1970, of which about 130 mill. tons in foreign trade. The volume was more than doubled from 1960 to 1967. The foreign seaborne trade consists of (1968) 101 mill. tons loaded in Soviet ports and 11 mill. tons unloaded in Soviet ports from abroad. In ports of the Soviet Northern Seas about 7 mill. tons was loaded and only 0,1 mill. tons unloaded. More than half of the shipments from Soviet ports altogether was tanker cargoes, while the import of wet cargoes was insignificant. The dry cargo shipments consists of five main items: timber, grain, ore, metals and chemicals.

Table 3. Foreign seaborne trade in USSR by regions, 1966. Mill. tons.

	Loaded	Unloaded
NORTHERN		
dry cargo	6.7	0.1
BALTIC		
dry cargo	9.9	3.9
tanker	11.4	..
BLACK SEA, DANUBE		
dry cargo	20.3	7.1
tanker	26.2	0.1
FAR EAST		
dry tanker	4.8	1.1
tanker	0.8	..
TOTAL	90.3	12.3
dry cargo	41.9	12.2
tanker	48.4	0.2

Table 4. Shipments from USSR 1969, Mill. tons.

WET CARGO	70.5
DRY CARGO	78.2
of which	
TIMBER etc.	10.0
ORES	11.2
MINERALS (SAND etc.)	14.2
COAL	8.8
METALS	6.4
CHEMICALS	5.6
GRAIN	5.3
MACHINERY	2.7
OTHER	14.0

Source: Narodnoe ... 1969.

Table 5. River- and canal-transport in the Soviet-Union.

	1969	1965	1960	1950	1940	1928	1913 ⁺
Freight carried (mill.tons)	332.7	269.4	210.3	91.5	73.1	18.3	35.1
Of which:							
Timber	89.5	97.1	89.4	50.6	40.2		11.0
Sand, stone, cement, etc. (mineral buildingmat.)	163.2	107.8	70.3	11.7	7.6		1.5
Anthracite	17.9	14.4	11.0	4.4	2.2		0.9
Grain	5.6	5.6	6.8	4.6	5.2		6.1
Ores	5.0	3.4	2.0	0.6	0.1		-
Metals	1.5	1.1	1.0	0.7	0.5		0.6
Oil and oil products	30.3	25.0	18.4	11.8	9.7		5.4
Shipping (1,000 mill. ton-kms.)	160.1	133.9	99.6	46.2	36.1	15.9	28.9
Passengers transported (mill.)	142.5	133.9	118.6	53.6	73.0	17.8	11.5
Passengers transported (1,000 mill.pass.-kms.)	5.5	4.9	4.3	2.7	3.8	2.1	1.4

+) Present borders.

Source: Narodnoe v 1969, godu op.cit.

Table 6. The "small" coasting trade of the Soviet Union. (Mill.tons).

	1969	1965	1960	1959	1958	1955	1940
Dry cargo, in all	35.9	34.2	29.2	28.2	26.6	20.2	10.3
Of which:							
Sand, stone, cement, etc. (Mineral buildingmat.)	12.8	11.8	9.3	8.5	7.7	2.6	0.7
Anthrasite	4.7	5.1	5.7	5.9	5.8	5.0	1.6
Ores	6.0	6.4	5.7	5.4	5.2	5.0	1.5
Wood and timber	1.9	1.9	2.2	2.4	2.4	2.2	1.3
Metals	0.9	1.0	0.6	0.5	0.4	0.4	0.1
Other	9.6	8.0	5.7	5.5	5.1	5.0	5.1
Wet cargo (oil etc.)	..	..	..	10.5	17.6	..	..
Tanker trade, "big" coasting trade							

"Big" coasting, i.e. trade between the four separated Soviet sea-areas:

Black Sea, Baltic Sea, Arctic Ocean - White Sea and Pacific Ocean. "Small" coasting, i.e. coasting trade within each of the above-mentioned four sea-areas. "Small" coasting is rather important in the Black Sea and even more in the Caspian Sea, where the tanker trade from Baku to Astrakhan is predominant.

Source: Narodnoe ..., op.cit.

In 1967 about 58 per cent of the direct shipments from Soviet by volume was between USSR and industrially developed capitalist countries, 25½ per cent between USSR and socialist countries and 16½ per cent between USSR and developing countries.

The number of calls by Soviet ships in foreign ports represented in 1967 38,4 per cent in North-Western Europe and 10 per cent of the Western part of Pacific Ocean (Japan, China etc.).

The program for the 9 5-years plan 1971-75 is to increase the sea-borne trade by 40 per cent, while the river and canal trade has to expand by 24 per cent and the railway transport by some 23 per cent. The 40 per cent increase means about 64 mill. metric tons more in seaborne trade in 1975 than in 1970, hence the total seaborne trade in 1975 will amount to 224 mill. tons. But still the seaborne trade of USSR will be less than 5 per cent of the world total in 1975.

After so many decades of stagnation in the seaborne trade and shipping of USSR the expansion in the 1960's is really remarkable. The tonnage of the Soviet merchant marine increased from 3,2 mill. GRT in 1960 (1,2 mill. GRT in 1939) to 14,8 mill. GRT in 1970 and 15,2 mill. GRT as of January 1, 1971. USSR is no 6 among the leading shipping nations today, as to no 13 in 1960.

Table 7. Merchant Fleet of USSR. 1st July 1971. In 1,000 GRT.

	NO.	TONNAGE	Per cent of World Total
Oil Tankers	454	3.614	3.7
Ore and Bulk Carriers	22	222	0.5
Bulk/Oil Carriers	-	-	-
General Cargo (incl. Passenger/Cargo)	1507	6.202	8.6
Container Ships (Fully Cellular)	-	-	-
Passenger Liners	10	182	6.0
Liquefied Gas Carriers	2	7	0.4
Chemical Carriers	2	2	0.4
Total	1.997	10.229	4.4
All Fishing Types	3.563	4.902	54.2
Research Ships	98	177	55.3
Miscellaneous	917	886	11.5
GRAND TOTAL	6.575	16.194	6.6

Source: Lloyd's Register of Shipping.

Table 8. USSR. Merchant Fleet strength as of January 1, 1971.

Type of Vessels	Vessels of 100 Tons gross and over					
	Steamships		Motorships		Total	
	No.	Tons gross	No.	Tons gross	No.	Tons gross
Passenger and Pass./ Cargo Vessels	11	79.859	192	405.743	203	485.602
Dry Cargo Vessels	230	1.142.869	1.589	6.001.704	1.819	7.144.573
- Tankers	37	960.506	388	2.428.146	425	3.388.652
Service and Auxiliary Vessels	213	107.018	485	226.503	698	333.521
Fishing Vessels	194	287.485	2.694	2.975.766	2.888	3.263.251
Technical Vessels	62	75.892	267	211.857	329	287.749
- Others	8	34.456	242	277.603	250	312.059
- Total	755	2.688.085	5.857	12.527.322	6.612	15.215.407

Source: Morskoi Flot, Moscow, Nr. 4/1971.

Table 9. USSR Steam- and Motorships (excl. Fishing vessels, Fish carriers and Fish factories) in Size Groups.

1st July 1971

		1,000 GRT	Per cent of World total
100-	499	220	5.5
500-	999	180	6.0
1,000-	1,999	560	10.0
2,000-	3,999	2,250	17.0
4,000-	5,999	1,280	12.0
6,000-	7,999	580	3.0
8,000-	9,999	2,000	9.0
10,000-	14,999	2,020	5.7
15,000-	19,999	1,440	2.2
20,000-	29,999	685	2.4
30,000-	39,999	1,037	5.2
40,000-	49,999	-	-
50,000-	59,999	-	-
60,000-	69,999	-	-
70,000-	79,999	-	-
80,000-	89,999	-	-
90,000-	99,999	-	-
100,000-	109,999	-	-
110,000-	119,999	-	-
120,000-	129,999	-	-
130,000-	139,999	-	-
140,000	and above		
		16,194	4.4

Source: Lloyd's Register of Shipping.

Table 10. USSR Merchant Fleet 1948-1971. In 1,000 GRT.
1st July

	Tonnage	Yearly increase	
1948	2,097	1948-49	21
1949	2,118	1949-50	7
1950	2,125	1950-51	103
1951	2,228	1951-52	32
1952	2,260	1952-53	32
1953	2,292	1953-54	79
1954	2,371	1954-55	135
1955	2,506	1955-56	130
1956	2,636	1956-57	73
1957	2,709	1957-58	257
1958	2,966	1958-59	189
1959	3,155	1959-60	274
1960	3,429	1960-61	637
1961	4,066	1961-62	618
1962	4,684	1962-63	750
1963	5,434	1963-64	1,523
1964	6,957	1964-65	1,281
1965	8,238	1965-66	1,254
1966	9,492	1966-67	1,125
1967	10,617	1967-68	1,445
1968	12,062	1968-69	1,643
1969	13,705	1969-70	1,127
1970	14,832	1970-71	1,362
1971	16,194		

Source: Lloyd's Register of Shipping.

4. The Economic Resources of Siberia.

In the Northern Seas the seaborne trade has also increased considerably. F.i. had the overseas cargo trade to foreign countries increased by 160 per cent between 1958 and 1965. The main cargoes shipped in this region are timber, ore and coal. There has been some improvement in port facilities, as f.i. the number of gantry cranes, the area of roofed warehouses, the introduction of the package methods in timber transport and of containers. For the time being there is no indication that the seaborne trade in the Northern Seas will grow faster in the next five years to come than for USSR in total.

In the Northern Seas the growth in seaborne trade has not been connected with a throughtraffic from Atlantic to Pacific or vice versa, but with the shipments from ports of Western Siberia to the west and from ports in eastern Siberia to the east. The Northern Sea Route has not yet developed to a real passage to shorten the transport distance between Northern Europe and Japan, China etc. And I doubt if such a traffic of significant volume would ever come. However, the many joint projects and plans in the last two years between USSR and Japan, USSR and France etc. to develop economic resources of eastern Siberia, build modern harbours and ports for bulkcarriers and efficient handling of coal, ore, pulp etc. are important indications of a new Soviet policy in the Northern regions.

In its 4.5 million square miles - roughly the size of the United States and western Europe put together - Siberia holds over 85 per cent of the Soviet Union's known resources of coal, 75 per cent of its iron ore, 65 per cent of its lead and tin, huge but undetermined deposits of copper, nickel, tungsten, zinc and other metals. The gold of Siberia's north-east has probably already made the USSR the world's second largest gold producer, and the diamonds discovered in the 1950's west of the river Lena have made it second in these too. The recently discovered oil and gas fields along the rivers Ob and Irtysh are regarded as the largest in the world. If we add to these timber and the possibilities of hydro-electric power, both estimated at 80 per cent of the USSR's resources, and it is no surprise that the USSR believe Siberia will be the largest source of raw materials, and a major one for western Europe and Japan, by the end of the century.

The real important obstacle in the development of Siberia is the climate. The soil freezes for hundreds of feet down. Pneumatic drills bounce off the ground. Steel splinters like glass, tyres explode and mechanical equipment lasts one third as long as in any normal climate.

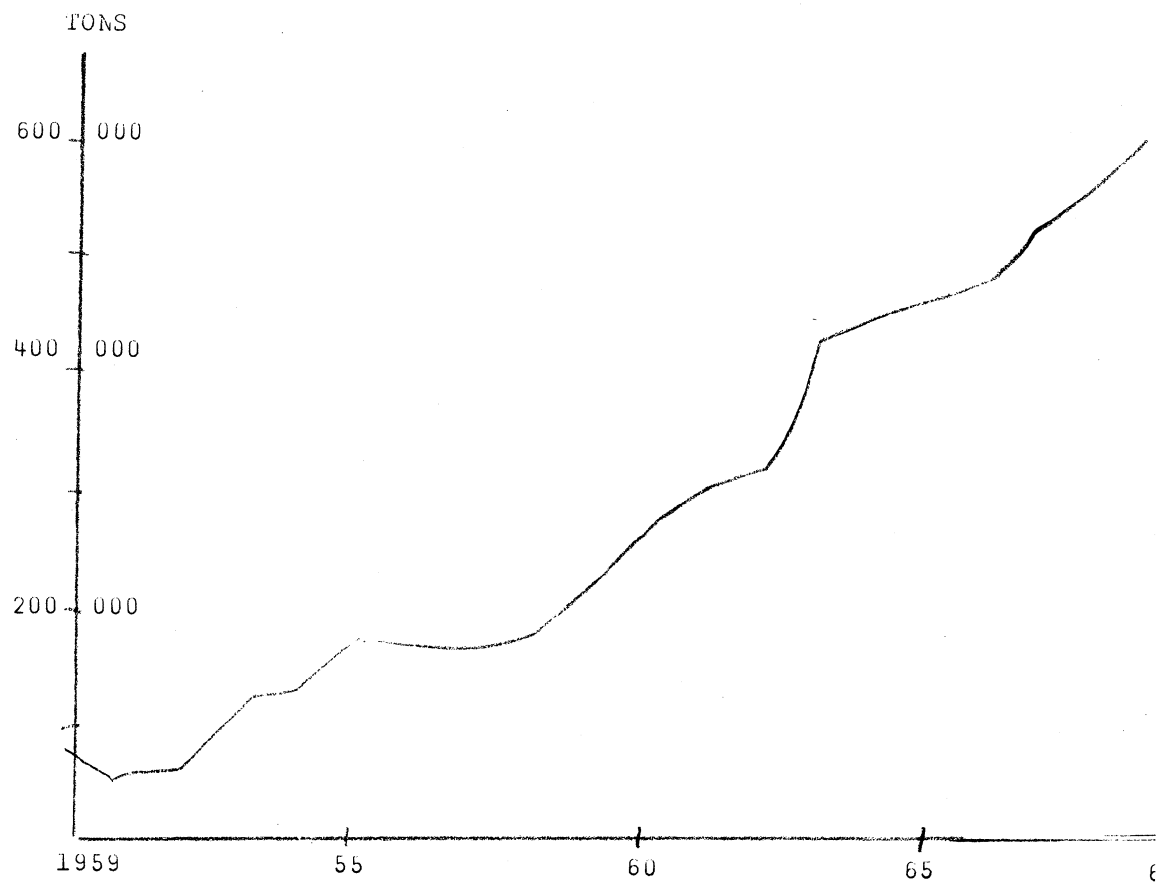
Siberia's resources has until now been confined to timber and some non-ferrous metals. But now oil is becoming more and more important. The oil resources in Tiumen-Ob area produced in 1969 22 million tons. By 1975 the figure is expected to reach 100-120 million, and by 1980 230-260 million tons. The ultimate potential is estimated at around 500 million tons, near today's total United States output.

In the western part of the Northern Sea Route the timber trade from The Kara Sea, i.e. the port of Igarka at the river Yenisey, is the most important in volume. It was approximately 83,000 metric tons shipped in 1950, 270,000 tons in 1960 and about 650,000 tons in 1969. Later information are lacking (The Polar Record 1968 and 1969).

5. Icebreaking Capacity

As to technical factors, the growth in the Soviet icebreaker fleet is the most important fact for the development of the large and rich deposits in the northern regions. Today USSR has a total strength of its icebreaker fleet of about 239,000 HP or 39 per cent of the world total. USA has 117,000 HP and 20,0 per cent, Canada 16.0 per cent and Finland 11.0 per cent. The Wärtsilä group in Finland have built 5 of the largest icebreakers of the Soviet (Moskva, Leningrad, Kiev, Murmansk, and Vladivostok in the years 1960-69 of about 15,340 tons in displacement) and will now build 3 more and bigger diesel icebreakers of 136 meter in length each and 36,000 HP each. When finished it will enable an even better service for the merchant ships sailing in the waters of the Northern Sea Route. The flagship of the Soviet icebreaker fleet, the nuclear-turbo-electric Lenin of 39,000 HP, has not been reported in action during the last⁴ years and is probably out of service. And there are no plans of more nuclear-turbo-electric icebreakers to be built. It would be important for all to know the Soviet experience of the nuclear Lenin.

IGARKA timber export



USSR has still the largest icebreaker fleet in the world, according to an article of Jerzy Tarkowski in "Svensk Sjöfarts Tidning", November, 1970, but the Nordic countries (Denmark, Finland, Norway and Sweden) occupy second place when taken together.

Table 11. Icebreaker Fleet's Total Strength in Various Countries^{*)}

Country	Icebreaker Fleet's Total Strength in 1,000 HP	Percentage of World Icebreaker Fleet
Soviet Union	239	39.0
U.S.A.	117	20.0
Canada	95	16.0
Finland	66	11.0
Sweden	32	5.3
Denmark	24	4.0
Japan	14	2.3
Argentina	8	1.3
Germany, Federal Republic of	7	1.1
Total	602	100.0

^{*)} Icebreakers of 6,000 HP and over.

The following table gives information of the three main types of Soviet icebreakers in service:

Table 12. Details of Selected Icebreakers from Various Countries.

	Soviet Union		
	"Kapitan" class (3)	"Lenin"	"Moskva" class (5)
Built	1954-1956	1956	1960-1969
Max.Length (m.)	83.16	134.1	122.1
Max.Breadth (m.)	19.4	27.56	24.5
Draft (m.)	6.2-7.0	8.6-9.6	9.5-10.5
Deck Height (m.)	9.53	16.1	14.0
Displacement (tons)	4,500-5,300	15,298-	13,240-
		17,177	15,360
Propulsion Type	Diesel- electric	Nuclear- turbo-electric	Diesel- electric
No. Main Engines & H.P.	6x2,000	4x11,000	8x3,250

Table 12.cont.

Soviet Union			
	"Kapitan" class (3)	"Lenin"	"Moskva" class (5)
No.Bow Engines and H.P.	2x3,500	2x10,000	1x11,000
No.Stern Engines and H.P.	2x3,500	1x20,000	2x5,500
Total Output Bow and Stern Shafts	10,500	40,000	22,000
Speed in Open Water (knots)	15	18	18.3

In May 1970 the Finnish ship yard got an order from Soviet for three icebreakers to be delivered to Sudoimport in 1974, 1975 and 1976. The vessels will be 136 meter in length, have diesel-engines of 36,000 H.P. for each ship. It is only the nuclear driven icebreaker "Lenin", which have stronger engines (39,200 H.P.) , but "Lenin" has not been reported in action since 1969.

Only a year before the new big contract at Wärtsilä shipyard the last icebreaker in the "Moskva" class was delivered, i.e. the icebreaker "Vladivostok". (The earlier delivered breakers were "Murmansk", "Kiyev", "Leningrad" and "Moskva".)

6. The Opening and Closing of the Northern Sea Route for Free International Trading.

The most astonishing event in the post-war period is the opening in 1967 of the Northern Sea Route to all foreign shippers in the world and the sudden closing again the next year. There have never been given any information as to this change in mind of the authorities. Was the change only motivated by political considerations or also of technical considerations?

According to "The Polar Record", No. 90 1968:

"The Soviet Government inaugurated a new policy in 1967 by inviting foreign shippers to use the through route, pointing out that they should save up to thirteen days sailing time on a voyage from, say, Hamburg to Yokohama. A brochure was circulated, explaining the

advantages and setting out the rates which would be charged for icebreaker and pilot services. The rates vary with size of ship, time of year, and ice-classification, and run from R1'68 to R6'36 per net registered ton. In the case of a ship of 5,000 nrt with good ice classification (corresponding to Soviet class "UL"), the charge would be £4,900 after devaluation, at whatever time in the season. If the classification were lower (Soviet class "L"), the charge would be the same between 20 August and 1 October, but would rise to £7,000 before or after that period. As a demonstration, the Soviet freighter Novovoronezh, 3,700 grt, loaded at Havre, Antwerp, Rotterdam and Hamburg, passed through the route and arrived at Yokohama on 25 August, twenty-seven days after leaving Hamburg. The portion of the route between Novaya Zemlya and Bering Strait was done in ten and a half days, and four icebreakers afforded escort at different times. The return voyage of Novovoronezh is also believed to have been made through the Northern Sea Route, but no details were released. The ship was trading normally in western Europe by late November. Although this demonstration coincided happily, from the Soviet viewpoint, with the closing of the Suez Canal, no foreign shippers accepted the Soviet offer in 1967.

7. The Economics of Shipping in Polar Seas.

The opening of the Sea Route has already demanded and will demand enormous additional investments in constructions and materials, i.e. to harbours and improvements of the harbours, docks and ship repair-yards, ice-breakers, light-houses and beacons, polar stations, meteorological stations, etc. The annual running expences keeping the Sea Route open will be large, because of the immense extent of the Sea Route. A fleet of ice-breakers and a large number of people will be demanded for ice-breaking service, air-reconnaissance of the ice, meteorological service, lighthouse service, etc.

An open question will be the ^{/total} duties which the Soviet Government will demand from the vessels for the ice-breaking service, convoying, etc.

Another open question is how long the sailing time through the Sea Route generally will be, and how long time it might take under favourable circumstances respectively unfavourable circumstances, and for how long the vessels possibly must wait for being convoyed by ice-breakers.

Most of the vessels that hitherto have sailed to and from the western part of the Sea Route, that is the White Sea and the Kara Sea, have not been specially built for this trade, as they only sails here for some months of the year. The most common vessels in this trade were timber vessels of about 3,000-4,000 dwt., generally coal-fired, at a service-speed of between 7 and 10 knots. During the last years the Soviet Government itself, however, has built a number of special vessels for this trade.

Ice strengthened vessels reduce the costs of ice-breaker assistance, insurance and maintenance, but costs more to purchase and takes less cargo than ordinary vessels (appr. 10 per cent). Some vessels also are built as combined ice-breakers and cargo vessels. The Soviet have arrived at the conclusion that propellers of steel are better than propellers of brass, and further that reversible blades are to prefer as it is easier to replace destroyed propeller blades than the complete propeller.

Better ice-breaker assistance reduces the number of days per run, and better ice-breaker patrolling and ice warning reduce the insecurity and the risk and therefore the insurance charges. The insurance charges fell considerably in the time between the wars. In 1914 the premium for vessels was 8 per cent and for cargo 6 per cent. Already in 1929 the rate fell to respectively 2,75 per cent and 0.8 per cent. The vessels sailing the Kara Sea, however, must dock both before and after calls at the Kara Sea.

The shipping season which will be extended, will make possible a larger utilization of the harbour capacity (a whole-year basis). The transported quantity of goods is of great importance to the economy of the Sea Route, because of the large fixed costs which are connected with the opening of the Sea Route. Larger traffic lowers the cost per tonn/km. And lower taxes and freight again lead to larger transported quantity of goods if there is sufficient natural resources in the district; all other factors constant.

The Sea Route looked upon as a thoroughfare between the Atlantic and the Pacific Ocean, the distance between Murmansk and Vladivostok is found to be less than half of the distance via Suez, viz.: 5,805 to 12,829 nautical miles.

Also the distance UK/Continent and the East is shorter via the Sea Route and the Bering Strait.

The Northern Sea Route also means a reduction of transport distances within the Soviet Union. The table below shows a saving of nearly 50 per cent of the transport distance from Moscow to Tiksi.

The Northern Sea Route:		Overland and river route:	
Moscow-Archangel railroad	1,133 km.	Moscow-Irkutsk	
Archangel-Tiksi sea route	4,158 km.	Trans-Siberian railroad	5,031 km.
		Irkutsk-Yakutsk	
		highway	354 km.
		river	2,465 km.
		Yakutsk-Tiksi river	1,671 km.
Total	5,291 km.	Total	9,421 km.

When the Northern Sea Route is compared with the already existing transport arteries, it is not sufficient only to look at the distances in nautical miles. The time also is very essential. In open waters without danger of ice a vessel may keep higher speed than in waters with ice. Are the ships going to be convoyed by ice-breakers through the Sea Route the waiting time for the convoy service has to be taken into account. In addition to the time-costs through the Sea Route, which may be enough to eliminate its advantages in the sailing distance, the direct separate costs come in addition to the ice-breaker and convoy service, ice strengthenings, ice insurances, etc.

In an important paper by Thornton Sherman in "The Polar Record" (1969) the economics of that part of the shipping industry engaged in carrying cargo in ice-infested seas is analyzed and outlined. He presents modern types of polar ships, makes cost comparisons, in particular of insurance costs, makes financial analysis etc.

There are three major types of ice-strengthened ships:

1. Dan-class vessel. About 2,000 tons deadweight and cargo space of about 2,700 cu m capacity, 2,000 ihp, reversible pitch propeller, heavy lift derricks, accommodation for forty passengers. Examples are the Danish vessels Thala Dan and Nella Dan.

2. Lena-class. About 7,000 tons deadweight and cargo space of about 10,800 cu m capacity, diesel electric propulsion, 7,000 shp, heavy lift derricks, accommodation for ninety passengers. Examples are the Soviet vessels Lena, Ob', Angara. These ships are capable of moving through ice of some 2 m thickness.
3. Conventional ships strengthened for use in ice but which require ice-breaker escort in all but very thin sea ice.

In Antarctic waters, the United States, Argentina and Japan use icebreakers to escort conventional thin-skinned and lightly strengthened vessels. The Soviet Union uses its vessels of the Lena-class. Other nations mainly use Dan-class vessels chartered from Lauritzen Lines.

In Arctic waters the United States and Canada convoy conventional thin-skinned vessels with icebreakers and use Dan-class vessels. The Danish Government mainly uses Dan-class vessels for transport in Greenland waters. The USSR employs all three types for the Northern Sea Route.

With the exception of government-owned vessels and the shipping lines that operate in the Baltic Sea and St. Lawrence River during the winter months, polar shipping operates on a "time charter" basis.

The charter hire rate prevailing during the early 1960's for polar ships of 2,000 tons deadweight was about \$45,000 per month. In contrast, the prevailing time charter rate for conventional unstrengthened vessels of 2,000 tons deadweight was \$16,500 per month. For larger ice-strengthened ships of 3,000 tons deadweight the rate was about \$84,000 per month. For small sealing vessels of about 600 tons deadweight the rate was approximately \$14,000 per month.

The ships are generally in operation eleven months in a year, leaving one month for repairs and inter-charter movements; therefore, expenses shown below are for twelve months and income is for eleven months.

Comparative profitability of polar and unstrengthened ships.

		Polar ship (<u>Dan</u> -class) 2,000 tons dwt		Not strengthened 2,000 tons dwt	
Annual gross income		\$495,000		\$181,500	
Less:					
operating expense		\$132,000		\$132,000	
depreciation		\$69,000		\$47,000	
total expense		\$201,000		\$179,000	
Net income		\$294,000		\$2,500	
Cost of vessel		\$1,390,000		\$940,000	
Return on investment		net income cost		negligible	
		21 per cent			

The figures above indicated that the net income related to the cost of the vessel, or "return on investment", was 21 per cent for polar ships and negligible for conventional vessels during the early 1960's.

Other factors being equal, investment flows to the fields where the highest returns are earned for the least risk. That being so, one would expect that, if polar shipping were particularly profitable, expansion in that speciality trade would take place. In fact, this expansion did occur. J. Lauritzen Lines, the only private enterprise in the polar trade, gradually liquidated its investment in conventional cargo ships and invested heavily in polar vessels and tankers to build a fleet of polar ships, which grew from nothing in 1950 to 63,000 tons deadweight in 1965. In 1955 Lauritzen had five polar vessels which comprised 6 per cent of the fleet's total deadweight capacity of 198,410 tons; by 1960 the firm had nineteen polar vessels, 23 per cent of the fleet's total deadweight capacity of 277,155 tons.

There is today only one privately owned shipping company serving the polar trade. This situation might be altered if charterers encouraged other private operators to enter the field by granting long-term charters at attractive rates.

8. Conclusions.

It is a growing economic interest moving from the colonial areas in Africa and Asia to virgin areas under the seas (approximately 70 per cent of the world surface is under the ocean) and to the virgin Arctic and Antarctic areas. The Arctic areas either in Soviet or in Canada-USA or in Denmark (Greenland) - Norway (Svalbard) have enormous resources, although much is not yet discovered. Siberia is of course, far the largest area in the North.

Of this reason and because of shorter passage between the North Atlantic and the North Pacific through the Northern Sea Route, there is a great and growing demand for access to the Northern Sea Route. The better the economic and cultural relations between the countries and governments in the areas mentioned, the stronger the demand for access to the Sea Route would be.

There are, however, a lot of important obstacles for a fast growth: the limited depth of the water in the Northern Sea Route, the ice, fog, unsatisfactory ports and harbours etc. and the insufficient investments in icebreakers, ship repair yards etc. But there are possibilities of innovations in navigation, ship types, control of ice and fog etc.

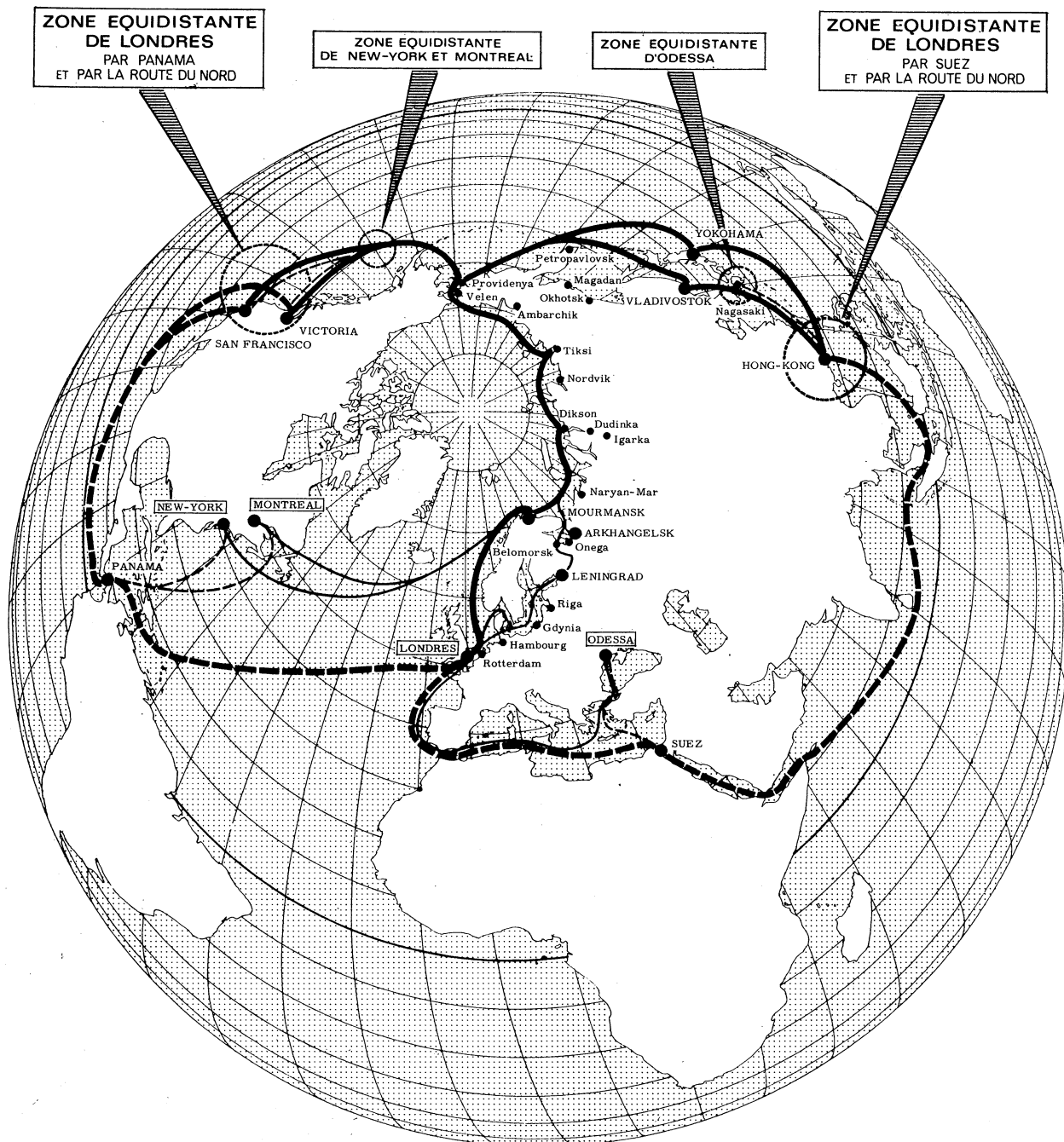
For traditional shipping nations as Norway, trading between foreign countries on timecharters or tramping there are opportunities for the building and operating of modern polar vessels, which might sail for the Russians in the summer months and for Canadians, Americans, Japanese or others in other parts of the year. There are other opportunities too, in joint projects of investments in mines, timber plants, ports, shipyards etc. and in trading and carrying of products from the mines, plants etc., as the Japanese and Russians have agreed on.

An important "take off" in the development of the Arctic areas and the Northern Sea Route is likely to come once in the 1970's or in any case in the 1980's.

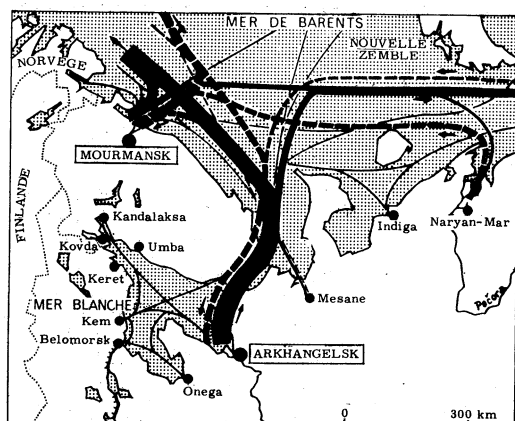
Literature.

- Armstrong, Terence: Farming on the Permafrost. "The Geographical Magazine", London, March 1968, p. 961-967, ill.
- Armstrong, Terence: Labour in Northern USSR. "The Polar Record", Vol. 13, no. 87, 1967, p. 769-774.
- Armstrong, Terence: The Northern Sea Route in - 1964, 1965, 1966, 1967. "Inter-Nord", no. 8, 9, 10, 11. Paris 1966, 1967, 1968, 1970.
- Northern Sea Route, 1967, 1968, 1969. "The Polar Record", vol. 14, no. 90, 1968, pp. 332-3. Vol. 15, nos. 94 and 95, 1970, pp. 51-52, 195-6.
- Armstrong, Terence: Russian Settlement in the North. Cambridge 1965. Pp. xii, 224, ill.
- Armstrong, Terence: The Russians in the Arctic. Aspects of Soviet Explorations and Exploitation of the Far North, 1937-57. London 1960. 182 s., ill. (Northern Sea Route, 90-107).
- Armstrong, Terence: Soviet Northern Development, with some Alaskan Parallels and Contrasts. Fairbanks, Alaska 1970. Pp. 37.
- Armstrong, Terence: Soviet Sea Fisheries since the Second World War. "The Polar Record", vol. 13, no. 83, 1966, p. 155-186.
- Bekier, E.: Der Nördliche Seeweg. "Jahrbuch der Schifffahrt". DDR 1969. Berlin 1969, p. 25-32.
- Borowicz, Sławomir; Katowski, Edward: 50 lat żeglugi morskiej ZSRR. (50 years of the U.S.S.R. Shipping). "Zeszyty Naukowe Wyższej Szkoły Ekonomicznej w Sopocie", nr. 39, ser. B 1968 r., p. 63-72.
- Bø, Oddvar: The Soviet Union in International Shipping. Bergen 1970. Pp. 59.
- Golovko, Arseni G.: With the Red Fleet. The War Memoirs of the Late Admiral. London 1965. Pp. 248, ill. (Northern Sea Route, s. 13, 83, 131).
- Gordijenka, Pavel: Die Polarforschung der Sowjetunion. Düsseldorf 1967. Pp. 350, ill. (Nördlicher Seeweg, 12, 14, 70, 77 ff., 87, 123, 186, 209, 229, 272, 280, 285, 288 f., 291, 303).
- Frachtschiffe für den Holztransport. Entwurfsüberlegungen in der Sowjetunion im Hinblick auf die Paketholz-Verschiffung. "Hansa", Hamburg 108. Jahrg. 1971, nr. 12, p. 1209-1212, ill.
- Hanson, Philip: The Soviet Union and World Shipping. "Soviet Studies" vol XXII, July 1970, no. 1, p. 44-60.
- Hermann, Ernst: Das Nordpolarmeer - Das Mittelmeer von Morgen. Berlin 1949. Pp. 344, ill.

- Lassiter, J. B.; Devanney, J. W.: The Economics of Arctic Oil Transportation. Cambridge, Mass. 1970. (7) p.
- Memmen, Emil: Schiffsweg durch die Arktis. "Hansa", Hamburg 1970, 107. Jahrg., no. 6, pp. 405-409, ill.
- Miroshenko, I.; Kraev; Maslov, V.: The Fleet in the Near Future. (in Russian). "Morskoj Flot", no. 9 1970, p. 3 ff.
- Orudzhev, S. A.; Fain, Y. B.: How West Siberian reserves are being developed. "Oil and Gas International", vol. 11, no. 6. June 1971, p. 92-103, ill.
- Rapport från Sovjet. "Svensk Sjöfartstidning", nr. 23, 1971, 11. juni, p. 23-25, 28, ill.
- Rondière, Pierre: Siberia. London 1966. Pp. 215.
- Sherman, Thornton A.: The Economics of Shipping in Polar Seas. "The Polar Record", vol. 14, no. 91, 1969, p. 479-487.
- Siberia: Western Keys for the Soviet Treasure-House. "Vision", no. 5 1971, pp. 29-33, ill.
- Soviet Merchant Ships 1945-1968. With a foreword by Laurence Dunn. Havant, Hampshire 1969. Pp. XVI, 280, ill.
- Sovjets sjöfartsprogram för 70-talet. "Svensk Sjöfartstidning" nr. 43 1970, 30. okt., pp. 20-21, ill.
- Svendsen, Arnljot Strømme: The Northern Sea Route and its Future Importance to International Sea Transport and Shipping. Bergen 1963. Pp. 63.
- Sydow, Kristian von: Sovjetisk sjöfartspolitik. "Svensk Sjöfartstidning" nr. 27 1969, 4. juli, p. 18-21, 40, ill.
- The Timber Trade Federation of the United Kingdom: Year Book of Timber Statistics 1970. London 1971. Pp. 37.
- USSR Far-Eastern Steamship Company: Ships in Service (1970). Pp. 52, ill.
- Morflot informiert 1970. Pp. 96, ill.
- Tanker Fleet of the USSR. Pp. 50, ill.
- The Soviet Merchant Marine Today and Tomorrow. Moscow 1967. Pp. 47, ill.
- Vad händer i Sibirien? "Svensk Sjöfartstidning", nr. 2 1971, 15. januar, p. 21.
- Young, Edgar P.: Soviet Merchant Fleet rocks world shipping routes. "The Journal of Commerce; Annual Review 1969", p. 263-279, ill.



Au départ de Londres, vers l'Ouest américain ou vers l'Extrême Orient



TRAFFIC DES PORTS
DE MOURMANSK ET
ARKHANGELSK

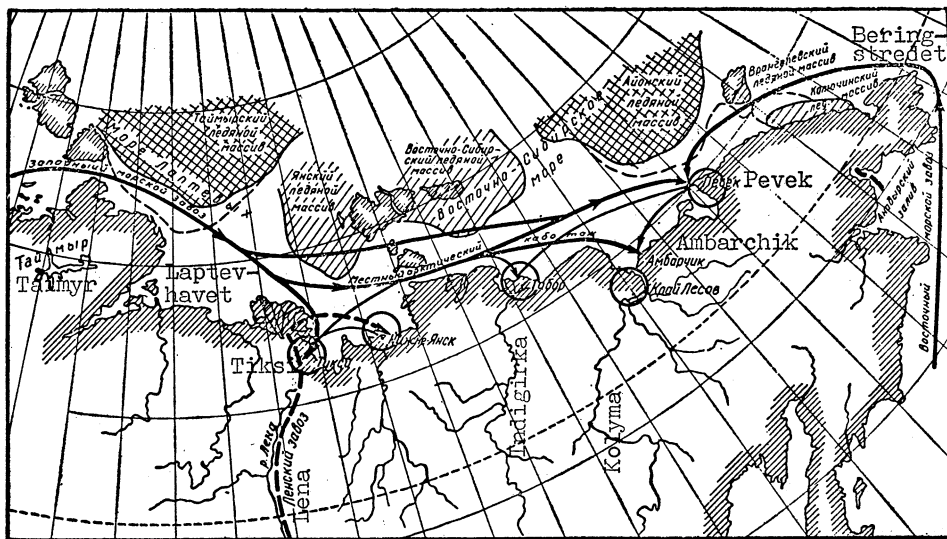
Lignes maritimes

— passant par Panama ou Suez
— empruntant la route du Nord

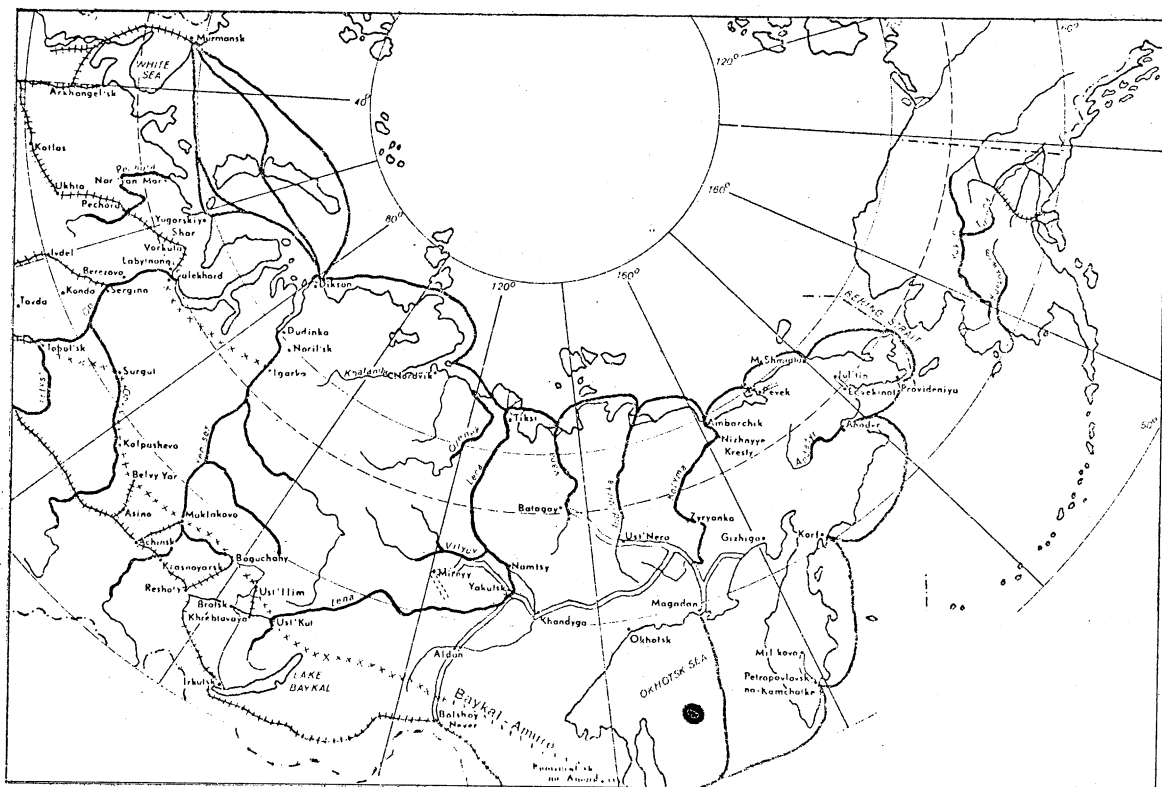
La distance est la même pour les 2 lignes maritimes au passage du trait plein au trait tiré

— lignes au départ d'Odessa, Montréal et New-York.

CARTE E.P.H.E.



Icebreakers from west open the Northern Sea Route to Tiksi and Ambarchik in July-August, while icebreakers from east reach Pevek in July.



International Boundary
Railroads -

existing

under construction or planned

Roads

Waterways used for transportation

