THE NORTHERN SEA ROUTE AS A TRANSPORT PROBLEM

BY
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THE NORTHERN SEA ROUTE AS A TRANSPORT PROBLEM

I

THE QUESTION of establishing connections between the Atlantic and Pacific oceans by a northern sea route has for many years caught the imagination of men. As early as the 16th Century persistent attempts were made to penetrate to China and India by way of the so-called Northeast Passage, that is, along the northern shores of Europe and Asia. The merchants of England and Holland tried stubbornly to conquer this passage.

It should be noted that in connection with the opening of a sea route to India at the end of the 15th Century, Spain and Portugal proceeded to monopolize it for themselves, refusing to permit ships of other nations to navigate it. This impelled the argonauts and merchants of England and Holland to seek other —northern—sea routes to India and China.[1]

It must be emphasized that the maritime expeditions of the 16th Century to the northeast had purely commercial purposes. In England there was even established a special society of merchant-explorers for the discovery of new countries, lands, and islands, which subsequently received the name of "Muscovite Company" because the ships of this company had commercial connections with the northern cities of the Muscovite state.

The first important expedition set forth to discover a northern sea route in 1553. It consisted of three ships: "Bona Esperanza", "Edward Bonaventura", and "Bona Confidentia", all under the command of Hugh Willoughby. This expedition ended unsuccessfully. The ships were unable to penetrate beyond Novaya Zemlya. One of the ships of the expedition, the "Edward Bonaventura", commanded by Chancellor, reached the North Dvina River and established the first maritime commercial connections in history between England and the Muscovite state. The

[1]Described in more detail in *Die Polarforschung*, by Kurt Hassert, Cologne, 1907.

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attempt of the other ships of this expedition to winter on the Murmansk shore of the Kola Peninsula (at the mouth of the Varsina River) ended in tragedy. Sixty-two persons perished, mainly from scurvy.

These first failures did not end the attempts to conquer the Northeast Passage. Holland offered a prize of 25,000 guilders for the discovery of such a passage, and at the end of the 16th Century sent out three expeditions. One of the leaders of these expeditions was the famous navigator Barents. The Dutch expeditions were no more successful than the English. None the less, the 17th Century also saw the organization of a number of expeditions by different navigators to open up the Northern Sea Route. The Dutch whaler Fleming, according to some authorities, actually succeeded in reaching the Kara Sea twice. However, the general results of all the expeditions of the two centuries were discouraging. The ships invariably encountered the obstacle of impassable ice, and not one of them reached either China or India. This led to a certain disillusionment, and up to the 19th Century the idea of conquering the Northeast Passage was abandoned.

The Dutch and English expeditions of the 16th and 17th Centuries met at sea the ships of Russian merchant navigators. We may consider it an established fact that as early as the 16th Century daring Russian navigators had established regular commercial relations in their unseaworthy little vessels with the mouth of the Siberian river Ob. There have even been preserved data as to the number of ships which, at the beginning of the 17th Century, sailed from Pomorye to the center of the Ob region—to the city of Mangazia, on the Taz River.

However, the Muscovite Government, through a series of measures, reduced the trade between Pomorye and Ob to a minimum, and finally put a stop to this trade altogether. There have been preserved many documents which explain the motives that impelled the Muscovite Government to prohibit commercial navigation to the mouths of the Siberian rivers by the Northern Sea Route. This ban at first had only foreigners in view, but later was applied to Russians as well. An edict of the Tsar, dated June 30, 1624, forbade people engaged in trade or industry to travel from Pustozersk and Archangel "by the great sea" to

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the Taz River and Mangazia. In this edict it was frankly stated that this measure was directed against foreigners who, carrying on trade with the Siberian cities, did not stop at the intermediate ports (Archangel and others) and paid no duties. And the Russian mariners could also thus avoid payment of duties. These were the motives that caused the Tsarist Government to crush trade between the northern ports of Europe and the Ob and Enesei. Mangazia, trade center of the Ob basin, fell into decline and finally ruin.

II

Not until the 19th Century, as has been pointed out above, was the question of a maritime connection between the northern ports of European Russia and the Siberian rivers raised again. Siberian capital sought an outlet to the sea, sought cheap freight rates by sea for the export of its grain and raw materials and the import of industrial goods. The voyages of the Norwegian merchants at the beginning of the second half of the 19th Century demonstrated that the southern part of the Kara Sea was accessible. The Tsarist Government, under pressure from the Siberian capitalists, began to stimulate trade and gradually to restore those privileges which had been abrogated back in the 17th Century. On July 15, 1879, the Council of Ministers granted permission for the importation, duty-free, of certain foreign goods through the ports of the Ob and the Enesei. Then followed a broader decree of the Council on May 21, 1888, which officially permitted the importation of foreign goods duty-free to Siberia through the Arctic Ocean.

In 1862, P. N. Kruzenshtern made his unsuccessful attempt to cross the Kara Sea to the mouth of the Enesei River, but in 1874 an Englishman, Captain Wiggins, made his way through the Kara Sea to the mouth of the Ob River. In 1875, A. E. Nordenscheld reached the Enesei with his ship "Proven". In 1876, Nordenscheld again reached the Enesei, with the ship "Imer", carrying goods, and Wiggins carried freight to Kureika on the Enesei the same year, in the ship "Thames".

Following this there were a number of voyages at irregular intervals under the leadership of Wiggins, carrying freight to the mouths of the rivers Ob and Enesei.

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These successful voyages to the Siberian rivers impelled Nordenscheld to make the attempt to traverse the entire northern route from the Atlantic to the Great Ocean. He decided to make the voyage of which the English and Dutch companies had dreamed back in the 16th Century. His voyage was successful. In 1878, Nordenscheld was able to get through the Barents Sea to Koliuchin Bay, where he wintered, with his ship "Vega". The following year, 1879, he triumphantly entered the Pacific Ocean. The voyage of Nordenscheld was the *first through passage* by the Northern Sea Route to be accomplished with one wintering.

In 1893, during the construction of the Siberian railroad, a large expedition was sent through the Kara Sea to the Enesei, carrying rails. In spite of a series of mishaps, the ships got through to their destination, and the rails were delivered. The successful delivery of the rails again aroused the interest of Russian and foreign capital in the Northern Sea Route. Special societies began to be formed for sea trade with Siberia. However, in the beginning of the 20th Century the privilege of importing goods duty-free to Siberia was revoked, which upset the plans of the trading companies and terminated their activities.

During the Russo-Japanese War, the Northern Sea Route was again utilized for shipping freight to Siberia, since the single rail line was overloaded by military needs. In 1905, a fleet of twenty-two ships (including tug boats, lighters, etc.) was sent by sea to the Enesei and reached its destination without mishap.

Before the World War, foreign capital again turned its attention to the Northern Sea Route. The Stolypin Ministry had under consideration a project to establish free ports at the mouth of the Ob and the Enesei. In 1912 a stock company was formed, predominantly with foreign capital, for trade with Siberia. This company sent one or two ships annually to the Kara Sea. Within five years it increased its capital from 80,000 to 2,500,000 rubles. This company existed until the Revolution of 1917.

After the Russo-Japanese War, the Tsarist Government came to understand the significance of the Northern Sea Route. Attempts were made to study the entire passage. For this purpose two small icebreakers were constructed, the "Taimyr" and the "Vaigach". These ships were sent from East to West, from

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the Pacific Ocean to the Barents Sea. The ships set forth in 1914, but had to spend the winter locked in ice and reached Archangel only in 1915. This was the second through passage, after Nordenscheld's, with a stop-over of one winter.

The third through passage, which continued for two years, with two winters spent in the ice, was that of the eminent Arctic explorer Roald Amundsen, on the schooner "Maud", in 1918-20.

Such, in the briefest of outlines, is the history of the main steps in the struggle for the Northern Sea Route prior to the establishment of the Soviet Government. The voyages, as is evident from the foregoing, had little success. Comparatively optimistic conclusions were reached only with regard to navigating the Kara Sea.

To be sure, pessimists considered even the Kara Sea inaccessible. As late as 1863, the famous Polar explorer F. Litke wrote that communication by sea with the Siberian rivers belonged in the "realm of the impossible". However, experience refuted this point of view. In the official report of the Northern Sea Expedition to the River Enesei, organized by the Russian Ministry of Ways of Communication, it was stated definitely that navigation of the Kara Sea to the mouths of the Siberian rivers was *possible.* The report demanded only that the conditions and peculiarities of navigation in this sea be studied. Furthermore, the report pointed out the necessity of stimulating trade operations by the Northern Sea Route by establishing duty-free delivery of goods and other privileges.

As regards the possibility of *through* voyages, even such outstanding Arctic explorers as Nordenscheld were skeptical. Nordenscheld stated definitely that in certain years, when ice conditions were favorable, the navigation of the entire Northern Sea Route was possible. But at the same time, Nordenscheld emphasized that, judging by the information available to him he was forced to conclude that the Northern Sea Route could not play any appreciable role with respect to trade. The special difficulties lay, first of all, in the negligible extent to which the Arctic seas had been studied. In spite of various trips of exploration, very little had really been done in this respect. For example, the Russian Government organized a "Great Northern Expedition", which worked in the 18th Century (1734-1744).

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The members of this expedition achieved important results. The first survey was made of the Arctic coast line of Asia, the existence of the straits between America and Asia was finally established, and other additions were made to existing knowledge. However, we must not lose sight of the fact that much of the data gathered by this expedition remained unused and was preserved untouched in the archives until recent years.

The establishment of the International Polar Year on the initiative of Karl Weiprecht marks an important stage in the development of Arctic exploration. The chief purpose of the Polar Year was to undertake a systematic study of the Arctic. To this end the proposal was made to a number of countries to establish polar stations. However, even after Weiprecht's proposal, which was made in 1881, the study of the Arctic proceeded unsatisfactorily. The funds provided for scientific work were very limited, there was no unified direction of the work in the Arctic, not nearly enough stations were established, there was no connection between them, and so on.

The Second International Polar Year, established fifty years later (1932-1933), also failed to accomplish the necessary results; that is to say, the countries which took part did not develop the work on a sufficiently large scale. Only the U.S.S.R. carried on an extensive campaign of exploration. Soviet Arctic stations were established in the extreme North, on Franz Josef Land, North Land, and at other points; and scientific observations were taken over a vast region from Greenland to the Sea of Okhotsk.

III

Only under the Soviet Government has the study of the Arctic been undertaken on an adequate scale. Even in the difficult year of the Civil War, in 1919, a Commission for the Study of the North was established[2]; and the Arctic Institute, which grew out of this commission, laid the basis for a planned, methodical study of the North Polar seas and the Arctic regions.

Before the Revolution there were altogether only four polar stations on the territory of what is now the Soviet Arctic. During

[2]In 1920 the "Commission for the Study of the North" was renamed the "Northern Scientific Trading Expedition".

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the period from 1918 to 1932 fifteen polar stations were built, under the Soviet Government. Since the establishment of the Northern Sea Route Administration (1933-35), 31 more stations have been built (8 in 1933, 13 in 1934, 10 in 1935).

Simultaneously with the establishment of these stations, extensive exploration of the Polar seas has been carried on by the icebreakers "Sedov", "Sibiriakov", "Rusanov", "Malygin", and others, and also by hydrographic ships. These polar expeditions, in which geo-physicists, hydrologists, hydrographers, meteorologists, biologists, geologists and other scientists took part, made a systematic study of Arctic regions previously unknown. In 1930 a pilot's navigation manual of the Kara Sea, compiled by the well known scientist N. I. Evgenov, was published.

Using all this published material as a guide, the icebreaker "Sibiriakov", under the leadership of Otto Yulevich Schmidt and with V. I. Voronin as captain, in 1933 made the trip from the White Sea to the Pacific Ocean *in the course of one navigation season,* without stopping over for the winter. This was a major victory in the Arctic. The goal of men's efforts for many centuries had been achieved by a Soviet ship. The "Sibiriakov" made the voyage from Archangel to the Bering Straits in two months and four days.

After the voyage of the "Sibiriakov", the Soviet Government, on the initiative of Comrade Stalin, proposed the formation of the Chief Administration of the Northern Sea Route which would undertake the study of this route with the aim of insuring its navigability and of transforming it into a regular artery for maritime transport.

In 1932 the voyage of the "Chelyuskin" was organized. The story of this voyage has been widely reported in the press. The "Chelyuskin" was a freighter with certain features of an icebreaker, but was not adapted for independent navigation through the heaviest Arctic ice. During the above-mentioned voyage, in 1933, the assistance of icebreakers was necessary. However, since the icebreaker "Krassin" was busy conducting ships to the Lena (one of its three propellers was broken), this icebreaker could not follow the "Chelyuskin". In the Sea of Chukotsk the "Chelyuskin" was crushed in an ice-drift and sank.

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In 1934, the icebreaker "Litke" (in command of D. S. Duplitsky, with Nikolaev as captain) completed the Northern Sea Route from East to West.

In 1935, the Northern Sea Route was traversed by numerous ships and *the through passage was successfully made by four freight boats*—two from Murmansk to Vladivostok, two from Vladivostok to Murmansk.

These successes were the result of the tremendous work that has been done in the Soviet Arctic in recent years, work which was greatly intensified after the formation of the Northern Sea Route Administration. This work will be described below. At this point let us consider for a moment the great differences of opinion called forth by the question of the possibility of transforming the Northern Sea Route into a regular trade route. There were many skeptics on this point. The answer to these skeptics was found in the achievements of 1934—the success of the first Lena expedition (of which more later), and the remarkable passage of the icebreaker "Litke" from Vladivostok to Murmansk in one season. These prophets of defeat were to be found even in 1935. At the moment of preparation for the navigation season of 1935, an article by Theodore Adamheit appeared in the German military magazine *Deutsche Wehr,* of February 14, 1935 (No. 7). This author, while acknowledging the successes in navigating the Kara Sea, denied absolutely that there was any possibility of a *through* passage via the Northern Sea Route. He wrote: "Any thought of economic connections between Europe and Central Asia through the Northern Sea is impracticable at the present time." The best answer to this categorical statement are the results of 1935 and the remarkable through passages made by four ordinary freighters, which were conducted safely through the most difficult sections by icebreakers.

1935 saw the beginning of the exploitation of the Northern Sea Route for commercial trips throughout its whole extent. This was undoubtedly an important achievement. Below are tables which give a picture of the conquest of the Northern Sea Route by all the ships which completed through voyages. (See pages 26-27.) These tables show graphically the importance of recent achievements.

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IV

In appraising the Northern Sea Route as a transport artery, it is necessary to discuss briefly the so-called Kara, Lena and Kolyma expeditions.

The Kara Sea has been used extensively for sea-borne trade only under the Soviet regime. In 1920, the Soviet Government organized under the Siberian Revolutionary Committee the so-called *Northern Sea Route Commission* (*Komseverput*). This commission was given the task of establishing regular trips through the Kara Sea to the Ob and Enesei rivers. In the same year, 1920, these trips began. Ten ships and three lighters carried 10,000 tons of grain from the Ob to Archangel.

The *Komseverput* set about studying and equipping a sea route, establishing ports on the Ob (Novy Port, north of the Bay of Nahodka), on the Enesei (Igarka), and others, building up a river fleet on the Ob and Enesei, and so on. We have already noted that in 1930 a navigation manual of the Kara Sea was published. The route was equipped with navigation signals and lighthouses. Since 1930, aviation has been used to observe ice movements. The presence of a small number of meteorological and radio stations has made weather predictions possible. If we add to this that the help of icebreakers is assured to conduct the ships through the more difficult sections, then it is easy to understand why during the whole period of operations in the Kara Sea not a single ship has been lost, and the trips have been conducted under normal conditions.

During the first years of operations in the Kara Sea, imports predominated. Beginning with 1926, the share of imports declined, and the ships of the Kara expeditions were mainly engaged in export operations. While the first trips carried a varied assortment of goods for export—wool, oil-cake, flax, hemp, horse-hair, etc., subsequently lumber became the chief export cargo.

When the Northern Sea Route Administration was organized (1933), the Kara operations immediately came under its control. The general growth of freight turnover through the Kara operations may be seen from the following table:

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TABLE 1. KARA SEA OPERATIONS

Year	Number of ships	Freight (in tons)
1920	10	10,000
1921	5	13,317
1922	5	13,627
1923	1	1,100
1924	3	10,670
1925	4	13,184
1926	5	19,168
1927	6	24,428
1928	8	29,378
1929	26	73,560
1930	46	158,505
1931	16	66,814
1932	28	96,308
1933	30	108,964
1934	28	112,337
1935	37	137,460*

*Including 16,460 tons for Dickson and Igarka.

The extent to which the Kara Sea operations have approximated normal sea trade is evidenced by the freight rates. The cost of exporting one standard of lumber almost halved in a period of ten years. In 1924 the rate was 100 shillings per standard, in 1934, 54.1 shillings.

After the formation of the Northern Sea Route Administration, voyages to the mouth of the Lena began to develop as well as the Kara Sea operations. These operations were much more difficult from the point of view of navigation than the Kara Sea operations. The ships, sailing from Archangel or Murmansk to the Lena, had to round the Taimyr Peninsula and pass through the Vilkitski Straits, uniting the Kara Sea with the Laptevykh Sea, one of the most ice-bound sections of the Arctic. In 1933 three ships were sent from Archangel to the Lena, which discharged about 8,000 tons of cargo at the ports of the Laptevykh Sea (Tiksi and Nordvik). This flotilla, headed by the icebreaker "Krassin", piloted an oil-burning ship for the Lena River (the "Piatiletka") and also a lighter. The ships reached the Lena, successfully delivered the river steamer and the lighter and their cargo, but were forced to winter on the return trip.

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In 1934, a second Lena expedition, also consisting of three ships, was organized. The cargo amounted to 7,500 tons. This second Lena expedition was sent out from Murmansk and was conducted by the icebreaker "Yermak", which was also responsible for conducting the river boat "Partisan Shetinkin" through the sea. Due to more favorable ice conditions, and especially to the results of past experience, better organization of ice breakers and carefully managed airplane scouting, the expedition ended successfully. The ships reached the Lena with the river steamer, unloaded their cargo, and returned, bringing with them also the ships of the first Lena expedition which had been forced to winter in the ice.

In 1935, five ships were sent to the Lena. These ships carried over 13,000 tons of freight and 126 passengers.

Navigation of the Lena thus became a normal and regular operation, whereas Nordenscheld had considered the return in one navigation season of ships going to the mouth of the Lena as absolutely impossible. It should be noted that in 1934 and 1935 the Vilkitski Straits were not entirely opened. In those years the icebreaker "Yermak" was able to cut a canal through the ice, in order to insure the passage of ships from the Kara Sea to the Laptevykh Sea.

The Kolyma expeditions were those leaving from Vladivostok (or some other Far Eastern port) to one of the points on the coast of Chukotka or the Kolyma region. As regards ice conditions, this section of the Northern Sea Route is one of the most difficult. In the East Siberian and Chukotsk seas there are heavy ice packs of many years' formation. The ships of the Kolyma expedition were forced to winter there on the average every three or four years. This was due, chiefly, to the limited knowledge of the region, the absence of weather information, radio connections, airplane service, and a powerful icebreaker. Only in the last two years has the equipping of this sector of the route been started.

It should also be considered that the Kolyma expeditions are sometimes delayed because of the difficult conditions of unloading, especially at the Kolyma, where the ships must anchor in the open sea six miles from shore.

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The history of navigation to the Kolyma River dates back more than twenty years. The first steamer was sent there as early as 1911. The cargo was extremely varied—food products, building materials, machinery, equipment, and industrial goods. From 1911 to 1919, one ship annually carried freight to the mouth of the Kolyma (except for 1917 when no ship was sent). In the years from 1920 to 1922 there were no trips on account of the Civil War. In 1923 one Soviet ship from Vladivostok reached the Kolyma, and since that year there have been annual Kolyma trips. These trips sometimes continued as far as Tiksi Bay. The year 1932 saw an appreciable increase in these trips. A flotilla of seven ships with cargo amounting to 11,000 tons reached the Kolyma. In 1933, about 7,000 tons of freight was delivered at the Kolyma, in 1934 a little under 7,000 tons. In 1935 the trips to the Kolyma and the Chukotka Peninsula were entirely successful. Over 16,000 tons of freight were delivered (including 3,900 tons delivered by the ships making the complete through passage), and 290 passengers were carried. Six ships took part in the operations.

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TABLE 2. NORTHEASTERN ARCTIC TRIPS
Voyages from Vladivostok to the Kolyma, the Lena, and Wrangel Island

Year	No. of Ships	Destination	Length of Stay in Arctic Ocean (days)	Amount of Freight (tons)
1911	1	Kolyma	22½	460
1912	1	"	30	296
1913	1	"	37	321
1914	1	"	(wintered at Cape Schmidt)	500
1915	1	"	54	about 300
1916	1	"	41	" 300
1917	1	"	43	" 300
1918	No voyages			
1919	1	"	(wintered at Koliuchin Bay)	" 300
1920-22	No voyages			
1923	1	"	23	381
1924	1	"	(wintered at Cape Shelaurov)	300
1925	1	"	26	515
1926	1	"	21½	440
1926	1	Wrangel Island	15	280
1927	1	Kolyma	23	505
"	1	Lena	28	no data
1928	1	Kolyma	53	399
"	1	Lena	(wintered at Shelaurov Is.)	about 300
"	1	Kolyma	(sank at Cape Bellings)	750
"	1	Wrangel Island	7	no data
1929	1	Kolyma	(wintered at Cape Schmidt)	about 500
"	1	Wrangel Island	36	no data

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TABLE 2. NORTHEASTERN ARCTIC TRIPS (CONTINUED)

Year	No. of Ships	Destination	Length of Stay in Arctic Ocean (days)	Amount of Freight (tons)
1930	1	Kolyma	58	700
1931	2	Kolyma	(wintered at Chaunskaya Bay)	no data
"	1	From Lena to Kolyma	6	no data
1932	2	From Lena to Kolyma	Two river steamers conducted by the Sibiriakov	—
"	1	Wrangel Island	Returned without reaching destination	812
"	7	Kolyma	Wintered at Chaunskaya Bay	10,890 and navigation equipment
"	1	From Kolyma for coal to Lena and returned to Kolyma	29	2,213 and cattle
1933	4	Kolyma	Part wintered at Cape Bellings	7,001
"	1	Shelaurov Island Cape Schmidt	60 (coaling of wintering ships)	2,605
"	6	From Lena to Kolyma	Towed river boats for Kolyma	Bldg. materials, cattle
1934	3	Kolyma	24-56	6,793
"	2	Cape Schmidt and " Shelagsky	Supplies for Polar Stations	—
1935	4	Kolyma	Supplies—28-34-51	8,645.1*—Cattle—Forage
1935	2	Cape Schmidt Cape Serdtse-Kamen Cape Dzhenretlen Cape Vankarem	Supplies for Polar Stations	4,266
"	1	Wrangel Island**	Replacing wintering party 10	

*In addition, the through ships delivered 3,907 tons to Kolyma.
**The icebreaker "Krassin".

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Table 2 (pp. 13-14) gives a picture of the development of the Kolyma trips.

In 1934 and 1935 considerable work was carried on in making hydrographical, hydrological, meteorological, and ice studies of the region. An aviation base was established, a network of polar stations was equipped with radio, and the powerful icebreaker "Krassin" was sent out. Thus conditions for navigating the eastern section of the Arctic were greatly facilitated.

The Kara, Lena and Kolyma operations constitute a considerable part of the freight turnover of the Arctic.

It is important also to call attention to the intensive development of coastwise trade, especially between the Lena and the Kolyma. In particular, a considerable amount of machinery, equipment, building materials and also several steamers and barges have been delivered to the Lena and the Kolyma in recent years. Coastwise trade is also developing between other points on the Arctic coast.

V

If we follow the course of the Northern Sea Route from west to east, we find that conditions of navigation through the ice vary in the different sections. The Barents Sea is accessible to all kinds of ships during the navigation season. The southern section of the Kara Sea represents certain difficulties with regard to ice conditions. However, the long years of navigation by freight ships to the mouths of the Ob and the Enesei have confirmed the fact that, with the help of icebreakers to cut a passage through the ice packs, regular voyages in this section can be assured.

Great difficulties are in the way of pushing farther east and north along the northwestern shore of the Taimyr Peninsula. Ice conditions in that region are very severe, and in order to make navigation possible, scouting by airplanes and the assistance of icebreakers is essential. This applies especially to the Vilkitski Straits which in some years are not open at all, or open up very late. In 1934-35, as was pointed out above, the opening of the Vilkitski Straits was hastened by the icebreaker "Yermak" which cut a canal of considerable length through the ice.

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The Laptevykh Sea presents comparatively favorable conditions for navigation as regards ice conditions. During the navigation season ships can go from the Laptevykh Sea to the Kolyma without any difficulty whatever. Further to the east conditions are more difficult, and beginning at Chaunskaya Bay or thereabouts ships are apt to encounter heavy ice packs, many years old.

What were the measures taken in the Arctic to insure such achievements as the through passage of four commercial vessels in 1935? First of all the Soviet Government directed special attention to the study of the Arctic, to the development of scientific research work. We have already mentioned the numerous expeditions of the Northern Sea Route Administration. These expeditions, richly equipped, including skilled specialists among their members, explored regions of the Arctic formerly considered inaccessible, and reached high latitudes. Special mention should be given to the work of the "Sibiriakov" in 1933, the "Sedov" in 1934, the "Sadko" in 1934 and 1935, the "Taimyr" in 1933-35, the "Malygin" in 1935, the "Krassin" in 1933-35, and the "Yermak" in 1934-35.

The activities of the Arctic Institute and the Hydrographic Commission of *Glavsevmorput* (Northern Sea Route Administration), and of the Oceanographic and Hydrological Institutes greatly increased our knowledge of the polar seas and territories. A very important role was played by the numerous polar stations, the far-flung outposts on the northern front for studying and mastering the Arctic. These polar stations carry on meteorological and ice observations, aerological work, and work on the earth's magnetism, also in hydrology, in some places in geology, and so on. There have already been established in the Arctic two permanent active weather bureaus (Dickson and Cape Schmidt). These polar stations are equipped with entirely modern receiving and transmitting radio equipment, which transmit scientific observations, give service to ships and airplanes during the navigation period, and also transmit messages.

The Barents Sea has been studied quite completely. More than 12,000 soundings of its depth have been taken, and a relief map of its bottom has been made. The material collected in recent years has made it possible to draw a similar map of the Kara Sea. Data of this kind has also been collected for making

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maps of the other Arctic seas. A large amount of material has been collected on the oceanographic characteristics of the Arctic seas. The work in hydrology has been very successful. The work of Professor Shuleikin, Professor Zubov and Professor Vize in studying the effect of the Atlantic currents on the Barents Sea has made it possible to find methods for long-term ice prognostications of the greatest importance to navigation. The development of this work offers rich prospects.

Systematic hydrological studies along the meridian of the Kola Peninsula, made annually by Soviet scientific research organizations, work which began in 1912, have made it possible to determine the monthly temperature of one of the currents of the Gulf Stream, called the North Cape Stream. Observations over many years of ice conditions in the Barents Sea have made it possible to establish a definite connection between the variations in the average temperature of the North Cape Stream and the condition of the ice in the Barents Sea. Professor N. N. Zubov has formulated the well-grounded proposition that if the average temperature of the North Cape Stream in May is established with sufficient accuracy it is possible to predict the general ice conditions in the Barents Sea for the entire navigation season. Even more interesting results have been obtained from a study of the data secured by the Norwegian scientists by hydrological studies of the Atlantic current northwest from Segnefiord and west of Lofoten, and by comparing this material with the results of the work on the Kola meridian. Variations in the temperature of the Atlantic stream, determined by observations of the section northwest from Segnefiord, affect the temperature of the stream at Lofoten within a year, and at Murmansk (Kola meridian) within two years. This makes it possible, provided observations are carried on over a long enough period—a year at the very least—to determine in advance the ice conditions of the Barents Sea and even in part of the Kara Sea.[3]

Certainly this does not cover all the factors which determine the ice conditions in these seas. An important role is also played by meteorological conditions during the approach of cold weather in autumn and during the spring period. In this con-

[3]For further details see the article by Professor Zubov on "Problems of Long-Range Ice Predictions" in the journal *Soviet Arctic*, No. I, pages 24-30.

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nection, interesting conclusions may be drawn from the work of Professor Multanovsky who has made long-range weather predictions over a number of years.

It should be noted that in determining conditions for navigation great significance attaches not only to a study of hydrological and ice conditions, but also to hydro-biological work. The work of a number of Soviet scientists, notably V. G. Bogorov in 1934-35, has demonstrated the possibility of determining when a ship is approaching heavy ice by the quantity and composition of the plankton.

The large amount of hydrographic work that has been done has greatly facilitated navigation. The manual of the Kara Sea already referred to has been extended and corrected in the last few years.

The western sections of the Soviet Arctic (the Barents and Kara Seas) have been most carefully studied from a hydrographic point of view. Much less has been done in the central and eastern sections. Let us take, for example, a portion of the central section, from Cape Cheliuskin to Tiksi Bay (Laptevykh Sea). Cartographic material fully meeting the requirements of hydrography (procured during navigation by instrumental surveys, with triangulation, etc.) covers altogether only 2 per cent of the coast line. Material procured by sea observations (the Cook and Diumulen methods) covers about 34 per cent. Of the remaining 64 per cent of the coast line we have only winter surveys, with either no connections between the triangulation points or unsatisfactory connections. For large areas of the seas of the central and eastern sections we have the depth for only one stretch (in the case of Laptevykh Sea, westward from Kotelny Island).[4]

Thus at the present time special attention is concentrated on studying the Laptevykh, East Siberian and Chukotski seas. For this purpose a hydrographic expedition has been organized, well equipped with scientific instruments and with the necessary specialists.

The progress of this work makes it possible to count definitely on the publication of a navigation manual of the whole Northern

[4]See the article by Y. D. Chirihkin, "Studies of the Laptevykh and East Siberian Seas". *Collection of Articles on the Hydrography of the Northern Sea Way, No. II, Leningrad,* 1935, pp. 59-72.

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Sea Route within the next few years. It should be noted that the work of recent years has made it possible for navigators to pass through Kara Gates (one of the straits uniting the Barents Sea with the Kara).

Great success has been accomplished in the marking of channels, placing of navigation signals, lighthouses, buoys, and so on. The development of radio service has made it possible to establish even more important ways of marking the course with new types of signals, radio lights, etc.

A role of prime importance in the Arctic is played by aviation. For many years ice reconnoitering by airplanes has been of inestimable service to ships. Aviation is of special importance in the eastern section of the Soviet Arctic. The creation of an active all-year-round aviation base makes it possible to develop even more extensive ice observations and other scientific work. Aviation is of such vital importance to the Soviet Arctic, especially as regards its services to navigation, that it is necessary to describe its development there, even though this can be done only briefly. The first Soviet aviator appeared in the Barents Sea in 1924 (the flight of the pilot Chukhnovsky to Novaya Zemlya in the airplane "U-20"). From 1926 to 1929, the aviator Babushkin rendered great service to the hunting and trapping industry of the White Sea by locating the lairs of animals by airplane scouting. During the period 1925-30 a number of extremely interesting flights were made: for example, the flight of Kalvitz in 1926 to Wrangel Island; the flight of Lukht and Koshelev from Cape Schmidt to Wrangel Island in 1927; the flight of Chuknovsky and Babushkin in 1928 in the rescue operations connected with the Nobile disaster; the flight of Galyshev and Slepnev in 1930 along the shore of the Chukotka Peninsula, and others. We have already referred to the fact that in 1930 regular scouting commenced over the Kara Sea (by the pilot Alekseev and others). But Soviet aviation in the Arctic achieved special successes after the formation of the Northern Sea Route Administration. Flights were made thereafter not only in summer, but in winter as well; regular lines were opened on the Ob, Enesei and Lena rivers (the Yakutsk Tiksi section), and so on. Airplane bases organized on the shores of the Arctic Ocean (Franz Josef Land, Cape Chelyuskin, Cape Schmidt) made

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it possible to develop extremely interesting work of scientific importance. In addition, the aviation base at Cape Schmidt guarantees regular ice scouting for the Kolyma expeditions. The whole world heard of the exploits of Soviet airmen in rescuing the members of the Cheliuskin expedition—the aviators A. V. Liapidevsky, V. S. Molokov, M. V. Vodopianov, I. V. Doronin, S. A. Levanevsky, N. P. Kamanin, and others.

The following facts will give a picture of the growth of the uses of aviation in the Arctic. In 1933, flying hours in the Arctic amounted altogether to 1,413 hours (1,261 in summer and 152 in winter), and the distance covered was 231,094 kilometers (202,209 in summer, 28,885 in winter). But in 1934, both flying hours and distance almost doubled, amounting to 2,766 flying hours (2,131 in summer, 635 in winter) and 452,467 kilometers, (summer, 357,027; winter, 95,440). In 1935, the achievements were still more striking—8,954 flying hours, of which 2,800 were in winter; 1,480,726 kilometers were covered: of these 462,000 in winter. The steady growth of winter flying deserves special note.

The aviation lines of *Glavsevmorput* (to the Ob, Enesei, Lena and elsewhere) insure the transport of a large quantity of freight. The work done in this direction by the Arctic airlines in 1935 amounted to the striking figure of 376,904 ton-kilometers. Under conditions of the Far North it is feasible to transport such things as metals, equipment, footwear, clothing, and so on, by air.

It should be emphasized that the ships of the first and second Lena expeditions (1933-34) were able to reach their destinations only because of accurate and timely observations of ice movements. During the season 1934-35, airplanes from the center (Moscow) made winter flights to the most remote Arctic points. Farikh, for example, flew to Vaigach Island, Molokov to Dickson Island, Lindel and Vodopianov to Cape Schmidt.

Heavy aircraft, of the hydroplane type, were used for the most part for ice scouting in the Arctic to aid navigation. Smaller hydroplanes were also found very useful in a number of cases for scouting over a small radius. The extent to which navigation in the Arctic has improved may be gauged by the improve-

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ment in the weather service and the growth in other types of service enumerated above.

In 1932 the "Sibiriakov" lost its radio contact with the mainland when she entered the Laptevykh Sea, since there were no stations there with which she could connect. But by 1933, during the period when the "Chelyuskin" was caught in an ice drift, a whole network of radio stations had been established which were in constant communication with the ship. During 1934 and 1935, the radio network was still further extended. New and powerful radio stations were established at Archangel, Dixon Island, Tiksi, Yakutsk, and Anadyr.

The ships now sail the Arctic seas with the aid of tested and corrected maps, they receive regular information by radio on weather and ice conditions, and can get their bearings at any moment from any of the numerous radio stations along the route. At certain sections of the route the powerful icebreakers "Lenin", "Yermak", "Litke", and "Krassin" stand ready to help at difficult moments by guiding ships through heavy ice, cutting channels, and so on. Airplanes guarantee a general survey of the ice conditions of the region at any time, constantly following, as they do, the movements of the ice which in view of the special meteorological conditions of the Arctic undergo rapid changes. All these measures guarantee the success of navigation. Certainly in the future the scientific work in the study of the Arctic and equipment of the polar seas with all the attainments of modern science—radio, airplanes, icebreakers, navigation signals, and so on—must be continued on a greatly enlarged scale.

To all this we must add a few words about the people who work in the Arctic. The "Chelyuskin" epic showed us what outstanding aviators, sailors, radio operators, and polar workers have been developed in the land of Soviets. In the last few years a powerful group of enthusiastic, selfless, stoical, and hardy people have been gathered together in the Arctic work. These people, who are the finest flower of Soviet citizens, utilizing the techniques which Socialist industry provides for them, have conquered one after another the fortresses of the Arctic. It can be stated with conviction that the problem posed by Stalin—to transform the Northern Sea Route into a normal, active trade artery—will be fulfilled. The guarantee of this is to be found in the

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solid army of polar workers who are ever more thoroughly mastering problems of technique as applied to the Arctic, and in the further development of technical equipment for their work.

The Tsarist Government had the most powerful icebreakers in the world built abroad, in England, but was unable to make use of them. Moreover, the Tsarist Government was of the opinion that icebreakers were worthless in the Arctic. The Soviet workers in the Arctic have been able to use icebreakers in the North Arctic Ocean with great success. In order to guarantee the maximum amount of safety to Arctic navigation, the Soviet Government has approved a plan for the construction of new icebreakers. These icebreakers are being designed and built in Soviet plants. The construction of freighters with reenforcements against ice is also under way. In view of the tremendous importance of aviation in the Arctic, airplanes of a special type, adapted to work in the Far North, are under construction. Ports and coal bases are being established at Igarka, Dickson, Tiksi, and so on. Modern technique is to be found everywhere. On the wide expanses of the Arctic tundra one may meet now-a-days, side by side with the reindeer, aero-sleighs, *Vezdyehodi* (automobiles on skis and with caterpillar wheels)—all the achievements of modern science are reaching the Arctic.

VI

There has been a considerable amount of information in the press about the natural riches of the Far Northern regions. The prospecting for these riches is carried on over an extensive area by energetic and experienced geologists. The Far North is already yielding much valuable mineral wealth. During the First Five-Year Plan the exploitation of the rich resources of the Kola Peninsula, with its large supplies of apatite, was undertaken. Mines, cities, electrical stations have grown up there. During the same period the Baltic-White Sea Canal was built. On the wide expanses of Pechora and Ukhta oil wells have been drilled, and coal is being mined. Lead and zinc are being mined on Vaigach Island. Icelandic spar and graphite have been found

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on the shores of the Enesei. Beyond the Arctic Circle a great lumber center, Igarka, has grown up, and huge new enterprises have been built on Kamchatka, Sakhalin, and at Anadyr. During the Second Five-Year Plan the construction of large enterprises has been undertaken for the mining of nickel on the Kola Peninsula; nickel, cobalt and rare elements on the Enesei; gold mining has been undertaken on a vast scale in the Kolyma district; anthracite mining has commenced in the Enesei and Lena regions; fluorspar at Amderma on the Yugorsk Peninsula, salt at Nordvik, and so on. Geological prospecting has confirmed the assumption as to the presence of oil in the Khatanga region, and oil wells have been sunk in this section which also has abundant salt deposits, the industrial importance of which cannot be doubted. There are unquestionably large deposits of mixed metal ores and deposits of anthracite coal on the Chukotka Peninsula, where tin has also been discovered. All this offers the richest prospects for the industrial development of the Far North.

Transport plays a very important role in the matter of the industrialization of the northern regions, and in the near future river transport will be particularly important. The mighty network of Siberian rivers covers some 73,000 kilometers, more than half of which distance is unquestionably navigable. In the last few years a river fleet has been under construction at an intense rate of speed, and an even larger number of rivers have been opened to navigation. By the end of 1934 regular navigation routes covered about 15,000 kilometers. The rivers of the Siberian North have a meridianal direction. The transport of freight to the ocean will grow more and more as the process of industrializing the north leads to further development of the Northern Sea Route. In 1935 a considerable amount of freight was carried over the Northern Sea Route.

We shall not attempt here to describe the whole freight turnover the northern ports—Murmansk, Archangel, Onega, Mezen and others, with foreign ports and with the ports of the U.S.S.R. (Leningrad and other ports). We shall mention merely the cargoes transported to the eastern, central and western sectors of the Arctic, under severe ice conditions, and also cargoes transported on the through trips. In addition, we shall note the transport of coal from Spitzbergen.

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Summing up, thus, the freight carried on the through passages, the freight of Spitzbergen and the polar stations, the freight for Novaya Zemlya and the mouths of the Siberian rivers (the Ob, Enesei, Lena and Indigirka), the freight carried from the Far East to Chukotka and Kolyma, and so on, we find that in 1935 altogether 550,000 tons of freight was transported.

The question arises as to the cost of transport by the Northern Sea Route. At present it is quite high. Thus the freight charges for transporting a ton of grain from Leningrad to Vladivostok in 1935 amounted to 275 rubles, that is, 50 per cent more than rail charges. To be sure, this figure includes the so-called special expenses, such as the cost of icebreaker and airplane services, radio and meteorological expenses, which in that same year came to 135 rubles per ton. However, in connection with the more complete mastery of the Northern Sea Route, changes in the navigation period, the increase in the average speed of the ships, and the speeding up of loading and unloading, this is changing. Already the transport of freight to Yakutia by the Northern Route has become cheaper than by railroad. There is a similar prospect with regard to shipping freight to Chukotka and Kamchatka. Thus the transport of a ton from Moscow to Yakutsk by railroad (through Irkutsk) and further along the river Lena, comes to 430 rubles. Transport of a ton of freight by the Northern Sea Route, including the special expenditures, comes to about 250 rubles.

It can be stated most emphatically that the prospects for navigation of the Northern Sea Route are exceptionally good. At the present time it is not yet possible to determine accurately the direction and the type of freight which in the next few years will be transported by the Northern Sea Route. However, even now our economists of the north have a sound basis for estimating the probable flow of goods as follows:

1. The transport by sea of grain from Western Siberia to supply the northern sections of the European part of the U.S.S.R., especially for the rapidly growing industrial centers of the Kola Peninsula.
2. The shipping of lumber from Yakutia, in addition to lumber from the Ob and the Enesei, to the west and to the east (especially the Yakytian Larch).

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3. The shipping of Khibinsk apatite to the regions of Western Siberia, Eastern Siberia, Krasnoyarsk Region, and Yakutia.
4. The shipping of Khibinsk nepheline for the Ural-Kuznetsk Combinat.
5. The shipping of salt from Nordvik and Yakutia to the Far East.
6. Extensive transport of coal, in view of the tremendous development of coal mining in the Pechora and Enesei districts and in other districts, and also in connection with the enterprises under construction in the polymetal industry.
7. A large amount of industrial goods will be shipped by the Northern Sea Route.

Preliminary estimates indicate considerable growth of freight shipment by the Northern Sea Route in the next decade.

The possibility of utilizing the Northern Sea Route for international commerce is not excluded. The distance from Murmansk to Vladivostok is 6,250 miles, while from Leningrad to Vladivostok it is twice as long—12,700 miles. The Northern Sea Route is the shortest route connecting the ports of the U.S.S.R. with the ports of the Pacific Ocean. This circumstance might play a decisive role under certain conditions. But the development of international trade over the Northern Sea Route is a matter for the future and depends on a number of factors which could not be considered fully enough in this paper.

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THROUGH PASSAGES OF SHIPS

FROM THE NOVOZEMELSKIE

(first date arrival,

Ship	Year	Direction	Passage Through Different Points: Novozemelskie Straits	Mouth of Enesei Igarka Port	Dickson Island (or its meridian)	Cape Chelyuskin (or its meridian)
1. *Vega*	1878	East	1.VIII	—	6-10/VIII	19-20/VIII
(Nordenscheld)	1879	East	1.VIII	—	—	—
2. *Maud*	1918	East	25.VII	—	31.VIII	9.IX(*)
(Amundsen)			17.VIII	—	4.IX	
	1919	East	—	—	—	—
	1920	East	—	—	—	—
3. *Taimyr* and *Vaigach*	1913	East	—	—	—	1.IX(**)
(Vilkitsky)	1914	East	—	—	—	2.IX(*)
	1915	East	—	—	30.VIII	—
					8.IX	
4. *Sibiriakov* (Schmidt) Capt. Voronin	1932	East	31.VII	—	11.VIII	15.VIII
5. *Chelyuskin* (Schmidt) Capt. Voronin	1933	East	13.VIII	—	24-25.VIII (meridian)	2.IX
6. *Litke* (Duplitsky) Capt. Nikolaev	1934	West	17-18.IX(3)	—	2.IX	22-24.VIII(4)
7. *Anadyr*	1935	West	8.IX	27.VIII	24.VIII	17.VIII
(Milovzorov)				2.IX	6.IX	22.VIII
8. *Stalingrad*	1935	West	12.IX	27.VIII	24.VIII	17.VIII
(Melekhov)				6.IX	8.IX	22.VIII
9. *Vanzetti*	1935	East	28.VII	—	2.VIII	17.VIII
(Fedotov)			29.VII		12.VIII	18.VIII
10. *Iskra*	1935	East	29.VII	—	2.VIII	17.VIII
(Biutner)					12.VIII	18.VIII

NOTES: (*) Wintering period.
(**) Forty miles short of destination.
(1) Broken propeller.
(2) Drifted from September 18th to October 1st.
(3) Twelve days' aid to Kara Expedition ships.
(4) Before this ten days were spent in conducting ships of the Lena Expedition.
(5) Drifted eleven days.

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STRAITS TO THE BERING STRAITS

second date departure)

Meridian of the mouth of the Lena	Meridian of the mouth of the Kolyma	Chaunskaya Bay	Cape Schmidt (Northern)	Koliuchinskaya Bay	Cape Dezhneva	Duration of Passage in days (there and back)			
						Dickson—Cape Chelyuskin	Cape Chelyuskin—Koliuchinskaya Bay	Cape Chelyuskin—Cape Dezhneva	Novozemelskie Straits—Cape Dezhneva
27-29/VIII	3.IX	6.IX	10-8/9(*)	28.IX	—	9	39	—	—
—	—	—	—	18.VII	20.VII	—	—	—	—
—	—	—	—	—	—	5	—	—	—
—	—	—	—	—	—	—	—	—	—
15.IX	—	9.X(*)	—	—	—	—	—	—	—
—	—	6.VII	—	—	21.VII	—	—	—	—
20.VIII	16.VIII	9.VIII	—	—	5.VIII	—	—	—	—
30.VIII		24.VIII	—	21.VIII	6.VIII	—	12	27	—
	—	—	—	—	—	—	—	—	—
27.VIII 30.VIII	3.IX	5.IX	7.IX	10-16.IX(1)	1.X(2)	4	26	47	62
IX	12.IX	13.IX	16.IX	18.IX	—	8	16	—	—
4.VIII 10.VIII	30-31.VII	29.VII	26.VII(5)	14-15.VII	13.VII	9	38	40	66
4.VIII 14.VIII	19.VII 29.VII	—	12.VII	11.VII	—	7	36	—	—
2.VIII 14.VIII	19.VII 29.VII	—	12.VII	12.VII	—	7	35	—	—
19.VIII	25.VIII	27.VIII	28.VIII	29.VIII	—	16	12	—	—
19.VIII	25.VIII	27.VIII	28.VIII	29.VIII	—	16	12	—	—

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