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U.S.S.R.

April 1974

NATIONAL INTELLIGENCE SURVEY

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NATIONAL INTELLIGENCE SURVEY PUBLICATIONS

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APPROVED FOR RELEASE: 2009/06/16: CIA-RDP01-00707R000200090035-8

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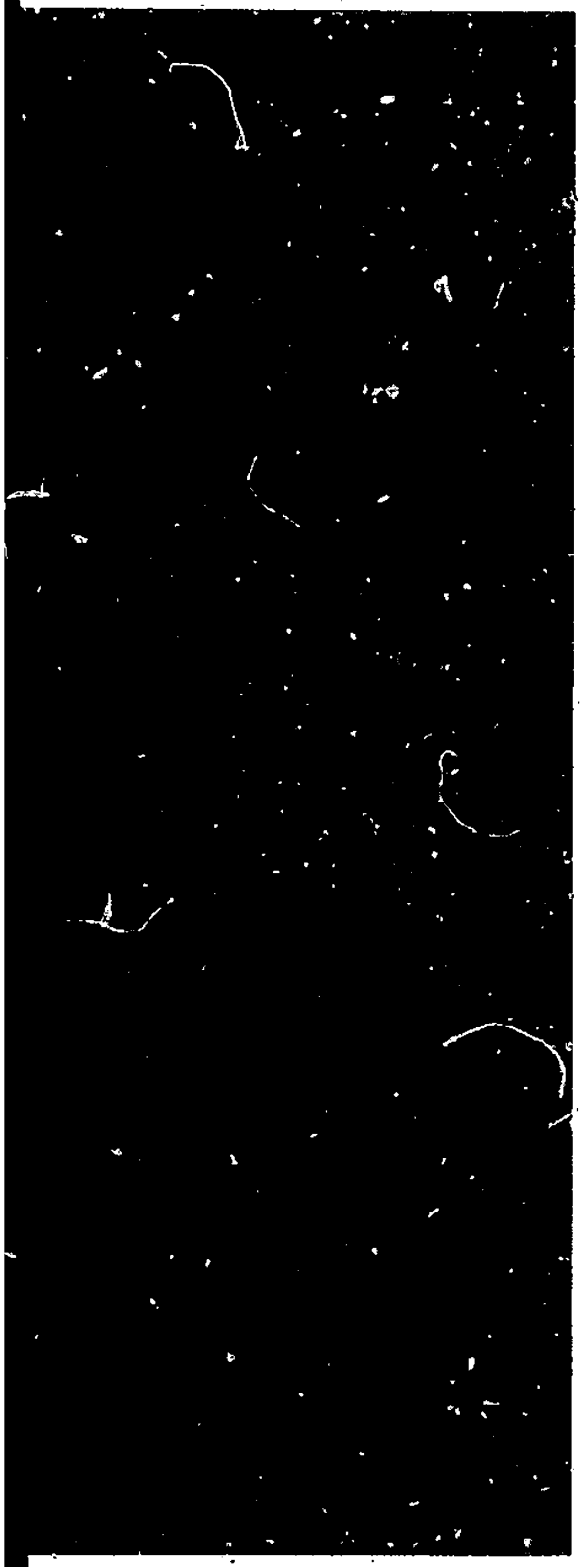
This chapter was prepared for the NIS by the Defense Intelligence Agency. It includes a contribution on merchant marine from the Department of the Navy. Research was substantially completed by November 1973.



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CONTENTS

This chapter supersedes the transportation and telecommunications coverage in the General Survey dated March 1971.

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FIGURES

Transportation and Telecommunications

A. Appraisal (C)

The transportation and telecommunications (telecom) systems of the U.S.S.R. have not yet reached a stage of adequacy for all sectors of the national economy and are undergoing improvements in varying degrees. The transportation industry, in particular, is suffering from poor bureaucratic planning and inept operating practices.

Major developments in telecommunications and in virtually every mode of transportation are taking place through the government's continuing Five Year Plans. Progress in the growth and development of better facilities, however, is perhaps at a rate slower than Soviet planners anticipate or desire. The continental expanse of the Soviet Union, with its vast areas of sparse population and much of its terrain and climate hostile to the construction and maintenance of transport and telecom facilities, is apparently the main hindrance to this progress. Development of transportation and telecom facilities is especially difficult or virtually impossible in the Siberian Arctic and sub-Arctic regions where foundations are seasonally unstable because of swamps, permafrost, and miry tundra soils.

Distribution of the transportation and telecom systems is uneven. The best developed and most heavily utilized portions of these systems lie in European U.S.S.R. with Moscow[1] as a focal point; in sharp contrast, the remaining area (approximately 60% of the U.S.S.R.) is serviced by a sparse pattern of transport routes and telecom facilities (Figure 35). The east-west oriented Trans-Siberian rail line (Omsk to Vladivostok) provides the sole overland connecting link between the eastern and western transportation networks. In European U.S.S.R. the railroads and highways, and to a lesser extent the waterways, parallel each other in many areas. In the central and eastern parts of the U.S.S.R. the transportation lines tend to form a complementary pattern; this is especially characteristic of the central Soviet regions where several north-south oriented giant river systems feed into the Trans-Siberian rail route from the north, while a number of roads connect with the railroad from border connections to the south.

Except for the lack of rail connections with Norway, overland international connections via rail or highway are made with all adjacent countries. Inland waterways provide direct connections only with Communist China, Mongolia, Afghanistan, Iran, Romania, Poland, and Finland; however, the inland fleet, using its river/seagoing vessels in combination with smaller river craft can navigate to the remaining adjacent countries via the Black Sea or the Danube River.

The transportation and telecom systems are state owned and are controlled by various ministries of the Soviet bureaucracy. Traditionally, government policies have favored the development of railroads as the backbone of the overall surface transportation complex. As a result, the nation's transportation system lacks the desired balance and coordination between the various modes; the railroads are overburdened, waterways are underutilized, and roads are qualitatively underdeveloped. There are, however, manifestations of a gradual change in government emphasis relative to transportation facilities. Soviet

[1]For diacritics on place names see the list of names on the apron of the Terrain and Transportation map and the map itself.

rail managers are increasingly siphoning off more of the traffic normally handled by rail to other modes—the passengers to air or bus transport, and some freight to rivers, trucks, and pipelines. In line with this trend, the government is gradually expanding its automotive industry, paving more roads, enlarging truck and port terminals, and constructing more pipelines.

Over the years the railroads have continually outperformed all other modes of transport combined, in terms of long-haul traffic. This dominance is reflected in statistics for 1972 which indicate that of the total 2,193.1 billion short-ton-miles accomplished by the three major surface transportation modes, railroads accounted for over 86%, highways 8%, and inland waterways less than 6%. The railroads are also the chief means of passenger travel and, although their share of this traffic has been declining, in 1972 accounted for over 60% of the passengers transported.

The highway system, while more extensive than the railroads and waterways, is only 15% paved. Used mainly for short-haul and feeder services, motor transport is gradually assuming more of the rail short-distance traffic, and trucking now accounts for over 80% of the freight moved by surface transport facilities.

Soviet inland waterways, despite their limited areal distribution and lack of east-west oriented routes, are growing in importance to the national economy—especially in the movement of raw materials to developing industries. An expanding river/seagoing fleet is increasing the international-traffic capability of inland waterway vessels.

The rapidly growing pipeline system is an important adjunct to the other surface transport modes but remains inadequate for national requirements—the oil industry still relying on rail and waterway carriers for the transport of significant amounts of crude oil to refineries and industrial consumers; in 1972, for example, the railroads accounted for about 44.5% of the total petroleum transported.

Civil air transport accounts for a comparatively small amount of domestic passenger and cargo traffic but is nevertheless significant for long-distance travel and for providing services to isolated communities of the interior that are not reached by other modes of transportation. Aeroflot, the sole Soviet civil airline, is the world's largest and flies to 66 countries in all continents except Australia. The Aeroflot fleet is estimated to total over 7,700 aircraft, most of which are light aircraft including helicopters and special purpose types used for training or utility and liaison services. The civil air fleet is not expected to expand further; the probability is rather the opposite since the current trend is to replace Aeroflot's lighter aircraft with modern aircraft of greater capacities. Airfields in the Soviet Union are fairly well distributed and adequately serve the needs of both commercial and military aircraft.

The Soviet merchant marine, which early in 1973 ranked fifth in number of ships and eighth in deadweight tonnage among the merchant fleets of the world, plies shipping routes reaching over 100 countries. Expansion of the fleet has slowed in recent years in contrast to the rapid rate of ship acquisition during the 1960's; this slowdown may be attributed in part to the government's efforts to develop prototypes of more sophisticated ships, and also to the increasing exportation of Soviet-built vessels. Soviet seaborne trade, which it is estimated totaled 150 million tons in 1972, is supported by some 180 major and minor ports adequately distributed along the various seacoasts. Of growing significance is the establishment of container facilities at some of the major ports.

The Soviet telecom complex is basically extensive and comparable in many respects to systems found in the more advanced nations of the world. But satisfactory telecom services are still lacking in many communities; for example, on a per capita basis there are now only about five general-purpose telephones per 100 persons. The government is, however, aiming to establish a modern and versatile telecom system for the entire country.

The Soviet's current Five Year Plan (1971-75) has provided for significant improvements to the transportation and telecom systems. Among the major projects underway or planned are the following:

Railroads—construction of some new lines, double-tracking the remaining single-track trunk lines, acquisition of some new motive power and rolling stock, expansion of electrification.

Highways—Increasing the amount of paved routes, construction of bypasses or circumferential highways around some major cities, establishment of more fueling and repair stations, improving truck terminals.

Inland waterways—Expansion of some of the port facilities, development of new ports, installation of new handling equipment especially for container operations, continue modernization of the river fleet.

Maritime ports—Development of some new ports; improve existing facilities including reconstruction of wharves and construction of special berths for container ships; modernization and expansion of several shipyards.

Merchant marine—Continue fleet modernization, acquisition of 550 new ships.

Pipelines—Construction of additional crude-oil lines, extension of CEMA (Friendship) system.

Civil Air—Replacement of older aircraft with larger, modern types; expansion of international services.

Telecommunications—Modernization and expansion of facilities including new intercity communications and TV relay networks, automation of intercity telegraph and telephone facilities, expansion of local telephone services, improve broadcasting facilities, expand color TV.

B. Strategic mobility (S)

The transportation systems of the U.S.S.R. could provide substantial support for internal military logistical operations, but any large-scale movement of forces would be severely limited by the uneven areal distribution of routes, physical deficiencies of the networks, and various environmental factors. Regionally, European U.S.S.R., which has the heaviest concentration of overland routes, affords military forces the greatest degree of mobility; in contrast the sparsity of the surface transport networks elsewhere in the U.S.S.R. would impose severe limitations on force movements.

Owing to the enormity of the U.S.S.R., great distances would generally be involved in the movement of troops and supplies, especially if logistical support lines had to extend from European U.S.S.R. to the central and far eastern regions.

The railroads would be the mainstay of any internal overland military supply movement, with the highways and inland waterways playing supplementary roles. The most strategic and high-capacity rail lines are those extending from Moscow and Leningrad to the Baltic and Black Sea areas, those that afford international connections with neighboring countries, and the Trans-Siberian line and its extensions. Because of many bridge crossings, most of the east-west rail trunk lines are highly vulnerable to interdiction. Except for Finland and Mongolia, cross-border movement from the U.S.S.R. into the adjacent countries is complicated by the differences in rail gages, which necessitate transloading delays of up to 6 hours for troop trains moving with equipment.

The capability of the highway system to support major military operations is severely limited by the insufficient number of paved arterial routes. Most roads are inferior types having low supporting characteristics. European U.S.S.R., which has the greatest density of roads and most of the paved mileage, affords considerable flexibility of movement for motorized forces. In the central and eastern regions of the country, the sparse and poor-quality roadnets have extremely limited capacities, and road movement for large-scale military operations would be generally confined to deployment to or from railheads along the Trans-Siberian rail route. Like the railroads, the major points of interdiction on the roadnet are the bridges over the numerous watercourses. The Caucasus, the Urals, and other mountainous regions are also areas where motor convoys would be vulnerable to interdiction.

Adverse climatic conditions—heavy snows, ice conditions, freezing temperatures, the spring thaw, and seasonal rains and floods—would seriously hamper overland military operations.

The inland waterway system provides an important, but slower, means of transporting both troops and supplies. Because of military exigencies, Soviet waterways probably would play a minor role in any initial reinforcement or logistical movement; however, over a prolonged supply and resupply period of operations, they could serve as effective long-distance lines of communication over which large tonnages of military equipment and supplies—including POL—could be transported at a sustained rate of delivery. The major Soviet waterways are amply equipped with night navigational aids allowing for 24-hour operations and have relatively modern river fleets and port facilities, some of which could be readily made available for military use. Soviet inland waterway cargo craft are capable of transporting various types of military hardware and supplies including such items as tracked vehicles, armored trucks, personnel carriers, missiles, and components too large for transport by other modes. Additionally, numerous units of the inland fleet could easily be converted into hospital ships, troop carriers, antiaircraft barges, patrol craft, and minesweepers. The Greater Volga waterways system provides extensive high-capacity routes for logistical movements from interior points deep within European U.S.S.R. to maritime and river ports along the Baltic, White, Black, and Caspian Seas where cargoes would, as necessary, be transloaded to oceangoing vessels and transshipped to overland modes of transportation. A major weakness of the inland waterways system is the winter ice conditions, which prevent navigation for periods of from 2 to 9 months—these periods depending on the geographic locale. Serious interdiction or complete stoppage to through traffic movements could be achieved by destruction of the vulnerable dam and lock installations.

The Soviet merchant fleet would provide substantial sealift logistic support for military operations; its cargo vessels have a combined lift capability of more than 7.8 million long tons, and its passenger ships—excluding the combination cargo/passenger types—could transport over 24,000 troops. The 278 merchant tanker vessels could provide for a sealift of over 4.5 million tons of POL. The maritime interregional sealift capability could be augmented by the inland waterways river/seagoing fleet of from 300 to 400 vessels whose capacities range

from 1,850 to 5,000 tons; additionally, vessels of the sizeable fishing fleet could be converted to carry troops and military equipment. The maritime fleet is adequately dispersed in the Baltic and Black Seas and along the coasts of the Arctic and Far East regions. Marine movement is restricted in some areas—especially along the Arctic seacoast—during seasonal periods of fast ice conditions.

Mobilization of Aeroflot personnel and equipment for military purposes would entail relatively minor technical and administrative adjustments. The carrier's military potential is enhanced by the fact that many of the different types of Soviet-manufactured transport aircraft are in common use by both military and civil aviation. Transition from a civil to a military role would require only minor modifications. In addition, a substantial number of Aeroflot flight personnel are reservists in the air forces, and all employees are believed to hold mobilization assignments. The Ministry of Civil Aviation and several of his deputies are military officers. Personnel and equipment of civil airfields, air traffic control centers, and aircraft maintenance and overhaul bases are readily available and provide equipped installations for rapid conversion to military use. If all heavy and medium transports in the civil fleet were made available to the military, it is estimated that military cargo airlift capability would increase by 25% and troop airlift more than double. Most Aeroflot aircraft are not particularly well suited for military use because they are not rear loading and cannot be used for the transport of large vehicles. However, nearly all of them could be—and on several occasions some have been—used for transporting troops.

The telecom systems could adequately support military operations. Owing to the many facilities available for alternate routing and the special measures taken to protect telecom systems, total disruption of services by military action would be difficult.

C. Railroads (S)

The 84,500-route-mile U.S.S.R. railroad network, owned and operated by the government, occupies the primary position in the Soviet transportation industry, handling most of the long-haul freight transportation. In many areas the railroads are hard-pressed to handle freight traffic requirements, particularly during the harvest seasons. To cope with the problem, the government is investing heavily in modernizing railroads and equipment and in constructing new lines. The present network—compared with the U.S. 212,000-route-mile system—comprises the second largest railroad complex in the world. Most of the trackage is in the west; eastward the network gradually becomes a series of individual lines running to Siberia, Central Asia, and the Soviet Far East. The network density is lower than that of any other developed country in the world—only 0.96 mile of mainline track per 100 square miles of territory. Moscow, the largest rail center, has 11 lines radiating in all directions and is served by two circumferential lines. Foremost among other rail centers are Leningrad, Sverdlovsk, Khar'kov, and Chelyabinsk. The highest freight densities occur on lines joining the Donets Basin with Moscow, Leningrad, and regions of the Ukraine, and on those connecting the Kuznetsk Basin with the Ural mountains. The highest freight-flow intensity on a single line is probably that along the Omsk-Novosibirsk sector of the Trans-Siberian railroad.

The gage of the track on most Soviet railroads is 5'0" as compared to standard gage (4'8½") used in the United States and most of the other countries of the world. Most narrow-gage trackage on the Russian mainland is 2'5½" gage, and the relatively small network on the island of Sakhalin is predominately 3'6" gage. As of 1 January 1973, the mainland network totaled 84,506 route-miles of which 82,269 miles were broad-gage lines and 2,237 miles narrow gage. About 72% of the broad-gage net is single track; most of the remainder is double track. Roughly 26% of the network is electrified (Figure 1), and about 61% uses mostly diesel traction. Steam traction, in use in only 13% of the system, is disappearing rapidly.

International connections are made with the rail systems of all adjacent countries except Norway. Afghanistan has no rail system, but the border is crossed by a short broad-gage extension of a U.S.S.R. branch line. Except for the 5'0"-gage networks of Finland and Mongolia, all international connections are with standard-gage (4'8½") systems and transloading is necessary. The 24 change-of-gage points connecting the U.S.S.R. rail network with the systems of the Eastern European Communist countries use the densest concentration of transloading facilities in the world. Other transloading sites are located on both sides of borders with Turkey, Iran, Communist China, and North Korea. All goods moving through the transloading zones usually must be transferred to the cars of the receiving country since rolling stock trucks are interchanged only on relatively few freight cars and on certain Russian passenger coaches. Development work on an automatic dual-gage wheelset, carried on for many years, may have been discontinued.

FIGURE 1. Electrification on the Trans-Siberian railroad (Line 8) near Lake Baykal (U/OU)

Since most of the railroad network traverses plains and lowlands, grades are generally low; the steeper grades and most tunnels are situated in mountainous areas along the southern edges of the country. Rail operations are affected by great variations in climate, ranging from the winters of Siberia to the subtropical summers of Turkestan. Snow clearance during the long winters is often a major problem. Characteristics of selected principal rail lines are tabulated in Figure 2 and the lines are shown on Figure 31.

The standard rail is of the T-section type; the R-50 (103.8 pounds per yard), R-65 (130.8 pounds per yard), and the R-75 (151.4 pounds per yard) are the principal rails used on main lines. Lighter rails, ranging from 67.4 to 87.8 pounds per yard, are used elsewhere. Rails are produced by Soviet rolling mills in lengths of 41 and 82 feet. For "seamless" track the 82-foot rails are prewelded into 2,625 foot lengths. Wooden crossties predominate and continue to be used throughout the system; prestressed reinforced-concrete ties, which are preferred, are used in most new mainline construction and in reconstruction of important routes. As of 1 January 1973, roughly 10,000 miles of line had been placed on concrete ties.

Because of numerous waterways the railroad system has many bridges. Steel-truss construction is most common for larger bridges, and steel girder and concrete slab for smaller bridges. Double-track bridges are uncommon; in following a generally worldwide practice, the Soviet rail planners add second tracks (and second bridges) only when increased traffic justifies the expenditure. Tunnels are located mostly in the Caucasus and Sayan Mountains, on the Trans-Siberian line sections around southern Lake Baikal, and between Ulan-Ude and Khabarovsk. The Amur river tunnel at Khabarovsk, built as a backup facility for the single-track bridge situated just south, is the only known underwater railroad tunnel in the U.S.S.R. Railroad ferries cross the Amur (Komsomol'sk-na-Amure–Pivan'), the Caspian Sea (Baku-Krasnovodsk), and Kerch' strait (Krym-Kavkaz). Longstanding plans call for additional routes across the Caspian and for a connection with the island of Sakhalin (Sovetskaya Gavan-Kholmsk).

The manual-block system of train control is employed on about 60% of the broad-gage network; automatic block, supplemented by Centralized Traffic Control, is used on about 33,600 route miles, including the most important lines. Locomotives operating within automatic-block territory are usually equipped with cab signals and automatic-train-stop devices. The principal means of railroad communications is the telephone; all railroad stations are connected by an independent railroad telephone network, and a separate telephone system enables the Ministry to set up conferences with the 26 regional railroads. Strategically placed radio stations supplement the telephone lines and serve as backup facilities in the event of line failure.

Most Soviet locomotives are powered by diesel fuel or electricity. The relatively few steam locomotives still in service use mazut (a petroleum residual) or coal. Provision of water presents no difficulty.

In 1972 the railroads carried 3,477.7 million short tons of freight and produced 1,891.8 billion ton-miles. During the same year they carried 3,053.4 million passengers and produced 170.6 billion passenger-miles. Suburban passengers, mostly commuters, purchased about 90% of all tickets sold and accounted for approximately 27% of the passenger-miles. In 1970 gross and net weights of freight trains amounted to 2,837.3 and 1,611.5 short tons, respectively; freight car turnaround was 5.5 days, and the average length of haul was 535 miles. Chief commodities normally transported are coal and coke, petroleum, ores, ferrous metal products, lumber and other building materials, and grain.

FIGURE 2. Selected principal railroad lines (S)
(5'0" broad gage. Direction of maximum grades na)

LINE NO.	LOCATION AND LENGTH (SEE MAP, FIG. 31)	PHYSICAL CHARACTERISTICS*	OPERATIONS	REMAPKS
1	Moscow–Leningrad; 403.9 miles..	All double track. Max. grade, 0.5%. Min. radius of curvature, 2,865 ft.	Electrified; automatic block. Average train speeds, excluding stops: 35 m.p.h. (freight); up to 60 m.p.h. (passenger).	5 major bridges, 480–1,020 ft. long.
2	Moscow–Brest (Poland border); 683.5 miles.	All double track. Max. grade, 0.8%. Min. radius of curvature, 2,200 ft.	Electrified Moscow–Borodino (75.2 miles). Automatic block. Average train speeds, excluding stops: 30 m.p.h. (freight).	6 major bridges, 330–550 ft. long.
3	Moscow–Vadul Siret (Romania border); 935.8 miles.	Single track, 227.5 miles; double track, 708.3 miles (Moscow–Zhmerinka). Known max. grades: Fastov–Kazatin, 2.0%; Vinnitsa–Zhmerinka, 0.9%. Known min. radius of curvature: Kazatin–Vinnitsa, 656 ft. Zhmerinka–Oknitsa: max. interval between passing tracks, 8.1 miles.	Electrified Moscow–Kazatin (640.6 miles). Automatic block Moscow–Zhmerinka. Average train speeds, excluding stops: Moscow–Kazatin, 30 m.p.h. (freight).	10 major bridges, 420–3,060 ft. long.
4	Moscow–Sevastopol; 958.1 miles..	Single track, 48.5 miles; double track 909.6 miles. Known max. grades: Kursh–Simferopol, 0.8%; Simferopol–Sevastopol, 1.2%. Known min. radius of curvature: Kursh–Simferopol, 2,099 ft.; Simferopol–Sevastopol, 984 ft. Simferopol–Sevastopol: max. interval between passing tracks, 6.8 miles.	Electrified; automatic block Moscow–Simferopol; manual block Simferopol–Sevastopol. Known train speeds, excluding stops: Moscow–Simferopol, 35 m.p.h. (freight).	7 major bridges, 350–2,000 ft. long; 4 tunnels, 950–2,000 ft. long.
5	Bakhmach–Odessa; 413.8 miles...	Single track, 334.3 miles; double track, 79.5 miles (Kolosovka–Odessa). Known max. grade, Grebenka–Zolotonosha, 0.8%. Known min. radius of curvature (Grebenka–Zolotonosha) 2,100 ft. Serviceable length of shortest passing track, about 2,000 ft.	Electrified Pomoshnaya–Odessa (170.2 miles). Manual block Bakhmach–Pomoshnaya; automatic block Pomoshnaya–Odessa. Known average train speeds, excluding stops: Pomoshnaya–Kolosovka, 30 m.p.h. (freight); Kolosovka–Odessa, 35 m.p.h. (freight).	2 major bridges, 1,650 and 3,700 ft. long.
6	Moscow–Baku; 1,587.6 miles.....	All double track. Known max. grades: Rostov–Prokhladnyy, 1.2%; Prokhladnyy–Baku, 0.7%. Known min. radius of curvature: Otrozhka–Rostov, 2,099 ft.; Rostov–Baku, 1,049 ft.	Electrified: Moscow–Mineralnyye Vody (1,069.4 miles), Derbent–Baku (152.8 miles). Automatic block. Average speeds, including stops, 30 m.p.h. (freight).	19 major bridges, 390–1,900 ft. long.
7	Ryazan–Omsk; 1,654.7 miles.....	All double track. Known max. grades: Kinel–Kurgan, 1.0%. Known min. radius of curvature: Kinel–Kurgan, 885 ft.	All electrified. Average train speeds, excluding stops, 35 m.p.h. (freight).	12 major bridges, 492–4,720 ft. long.

8	Moscow–Vladivostok; 5,776.9 miles.	Single track, 318.7 miles; double track, 5,458.2 miles (221.8 miles Moscow–Kanilov, 5,236.4 miles Kotelnich–Vladivostok). Ruling grade, 2% in each direction (Irkutsk–Sludyanka). Min. radius of curvature: 738 ft. (Omsk–Novosibirsk). Danilov–Kotelnich: max. interval between passing tracks, 9.3 miles.	Electrified: Moscow–Sverdlovsk (1,129.6 miles); Nazyvayevsk–Petrovskiy–Zavod (2,002.6 miles); Ussuriysk–Vladivostok (69.6 miles). Automatic block on most of line. Average train speed, excluding stops, 30 m.p.h. (freight).	83 major bridges, 296–8,550 ft. long; 4 tunnels, 2,900–18,480 ft. long.
9	Moscow–Kotelnich; 503.9 miles...	All double track. Gorkiy–Kotelnich: max. grade, 0.7%; min. radius of curvature, 1,738 ft.	Entire line electrified; automatic block. Average train speed, excluding stops. 35 m.p.h. (freight).	6 major bridges, 500–3,680 ft. long.
10	Zaudinskiy–Naushki (Mongolia border); 153.5 miles.	All single track. Max. grade, 1.2%. Min. radius of curvature, *na*. Max. interval between passing track, 16.7 miles.	Manual block. Average train speed, excluding stops, 25 m.p.h. (freight).	Broad-gage connection continues into Mongolia; transloading facilities at China border (Erh-lien). 4 major bridges, 650–1,850 ft. long.
11	Degtyanevka–Sovetskaya Gavan; 499.0 miles.	All single track. Max. grade, 0.8%. Min. radius of curvature, *na*. Max. interval between passing track, 13 miles.	....*do*.....	11 major bridges, 300–2,000 ft. long.
12	Baranovskiy–Khasan (Korea border); 147.3 miles.	All single track. Max. grade, 1.5%. Min. radius of curvature, *na*. Max. interval between passing tracks, 13.6 miles.	....*do*.....	14 major bridges, 400–1,770 ft. long.
13	Ussuriysk–Rassypnaya Pad (China border); 72.1 miles.	All single track. Max. grades, 1.5%. Min. radius of curvature, *na*. Max. interval between passing tracks, 11.1 miles.	....*do*.....	1 major bridge, 420 ft. long.
14	Tarskaya–Zabaykalsk (China border); 220.6 miles.	All single track. Max. grade, 1.7%. Min. radius of curvature, 905 ft. Max. interval between passing track, 13 miles.	...*do*.....	2 major bridges, 770–1,300 ft. long.
15	Uglovoye–Tikhookeanskaya; 108.1 miles.	All single track. Max. grade and min. radius of curvature, *na*. Max. interval between passing track, 11.8 miles.	Entire line electrified. Average train speed, excluding stops, about 25 m.p.h. (freight).	3 major bridges, 340–380 ft. long. 1 tunnel, 720 ft. long.
16	Danilov–Arkhangelsk; 480.3 miles.	Single track, 80.2 miles; double track, 400.1 miles. Max. grade, 0.8%. Min. radius of curvature, 1,700 ft. Max. interval between passing tracks, 12.4 miles.	Double track, automatic block Danilov–Obozerskiy. Average train speeds, excluding stops: Danilov–Obozerskiy, 30 m.p.h. (freight). Obozerskiy–Arkhangelsk, 25 m.p.h. (freight).	3 major bridges, 350–3,500 ft. long.
17	Leningrad–Vayenga; 917.1 miles..	Single track, 784.9 miles; double track, 132.2 miles. Known max. grades: Leningrad–Volkhovstroy, 0.8%; Volkhovstroy–Murmansk, 1.5%. Known min. radius of curvature: Leningrad–Volkovstroy, 1,968 ft.; Volkovstroy–Petrozavodsk, 1,395 ft.; Petrozavodsk–Murmansk, 1,049 ft. Volkhovstroy–Belomorsk: max. interval between passing tracks, 12.0 miles.	Double track and electrified Leningrad–Volkhovstroy (75.2 miles), Kandalaksha–Apatity (57.1 miles). Automatic block throughout. Average train speeds, excluding stops, 30–35 m.p.h. (freight).	14 major bridges, 330–1,244 ft. long.

Footnotes at end of table.

FIGURE 2. Selected principal railroad lines (S) *(Continued)*

LINE NO.	LOCATION AND LENGTH (SEE MAP, FIG. 31)	PHYSICAL CHARACTERISTICS*	OPERATIONS	REMARKS
18	Novosibirsk–Arys; 1,559.6 miles..	Single track, 895.5 miles; double track, 664.1 miles. Known max. grades: Novosibirsk–Semipalatinsk, 0.8%; Semipalatinsk–Arys, 1.4%. Known min. radius of curvature, 1,740 ft. Novosibirsk–Semipalatinsk sector, 984 ft. Semipalatinsk–Arys. Semipalatinsk–Chu: max. interval between passing tracks, 11.8 miles.	Double track: Novosibirsk–Berdsk (24.2 miles), Talmenka–Semipalatinsk (308.8 miles), Chu–Arys (331.1 miles). Electrified Novosibirsk–Barnaul (141.6 miles). Manual block. Average train speeds, excluding stops, 20–25 m.p.h. (freight).	8 major bridges, 395–2,080 ft. long. Passing track entry applies to Semipalatinsk–Chu sector.
19	Magnitogorsk–Tayshet; 1,994.6 miles.	Single track, 1,272.7 miles; double track, 721.9 miles. Max. grade, 0.6%. Min. radius of curvature, 1,312 ft. Tselmograd–Barnaul: max. interval between passing tracks, 25.4 miles.	Double track Magnitogorsk–Tselinograd (597.7 miles), Barnaul–Artyshta (124.2 miles). Electrified Magnitogorsk–Tselinograd (597.7 miles), Barnaul–Tayshet (804.8 miles). Automatic- and manual-block operations. Average speeds, excluding stops, 30–35 m.p.h. (freight).	21 major bridges, 470–2,900 ft. long; 2 tunnels, 7,879 and 8,236 ft. long.
20	Petropavlovsk–Chu; 940.7 miles..	Single track, 715.8 miles; double track, 224.9 miles. Max. grade, *na*. Min. radius of curvature, 1,312 ft. Petropavlovsk–Tselinograd: max. interval between passing track, 29.3 miles.	Double track Tselinograd–Zharyk (224.9 miles). Electrified Tselinograd–Karaganda (149.7 miles). Automatic- and manual-block operations. Average train speeds, 25–30 m.p.h. (freight).	2 major bridges, 420 and 890 ft. long.
21	Michurinsk–Gudermes; 978.0 miles.	Single track, 640 miles; double track, 338 miles. Max. grade, 1.1%. Min. radius of curvature, 1,312 ft. Pushkino–Astrakhan: max. interval between passing tracks, 12.4 miles.	Double track, automatic block Michurinsk–Pushkino sector. Average train speeds, excluding stops, 20–25 m.p.h. (freight).	9 major bridges, 520–5,410 ft. long.
22	Pushkino–Tashkent; 1,480.7 miles.	Single track, 1,326.7 miles; double track, 154 miles. Known max. grades: Dzhusaly–Arys, 0.8%; Arys–Tashkent, 1.6%. Known min. radius of curvature: Dzhusaly–Arys, 2,296 ft.; Arys–Tashkent, 1,968 ft. Yershov–Iletsk: max. interval between passing track, 10.5 miles.	Double track Pushkino–Yershov (57.7 miles), Arys–Tashkent (96.3 miles). Manual block throughout. Average train speeds, excluding stops, 20–25 m.p.h. (freight).	6 major bridges, 500–2,400 ft. long.
23	Shepetovka–Mostiska (Poland border); 214.9 miles.	All double track. Max. grade, 0.8%. Min. radius of curvature, 1,436 ft.	Electrified throughout. Average train speeds, excluding stops, 30–35 m.p.h. (freight).	1 major bridge, 440 ft. long.
24	Lvov–Chop (Czechoslovakia and Hungary borders); 165.3 miles.	All single track. Max. grade, 2.5%. Min. radius of curvature, *na*. Max. interval between passing tracks, 6.8 miles. Dual gage (5′0″ and 4′8½″) Mukachevo–Chop.	Electrified throughout. Average train speeds, excluding stops, 20–25 m.p.h. (freight).	5 major bridges, 330–875 ft. long. 1 tunnel, 5,500 ft. long.
25	Armavir–Baku; 873.0 miles.....	Single track, 566.8 miles; double track, 306.2 miles. Max. grade, 2.9%. Min. radius of curvature, 1,049 ft. Komsomlsk-na-Amure–Tbilisi: max. interval between passing tracks, 6.8 miles.	Double track Tbilisi–Baku. Electrified throughout. Automatic- and manual-block operations. Average train speeds, 20–25 m.p.h. (freight).	42 major bridges, 300–1,550 ft. long. 12 tunnels, 3,018–6,650 ft. long.

26	Leningrad–Lososna (Poland border); 540.0 miles.	Single track, 318.9 miles; double track, 221.1 miles. Known max. grades: Leningrad–Luga, 0.6%; Daugavpils–Pytalovo, 1.6%. Known min. radius of curvature: Leningrad–Luga, 971 ft. Max. interval between passing tracks, 7.5 miles.	Double track Leningrad–Siverskaya (42.2 miles), Dukshtas–Lososno (178.9 miles). Electrified Leningrad–Luga (85.1 miles). Automatic block Dukshtas–Lososna. Average train speeds, 20–30 m.p.h. (freight).	5 major bridges, 300–910 ft. long. 1 tunnel, 1,470 ft. long.
27	Kaliningrad–Bakhmach; 641.8 miles.	Single track, 216.2 miles; double track, 425.6 miles. Known max. grade, Zhlobin–Osipovichi Pervyye, 0.8%. Known min. radius of curvature, Zhlobin–Osipovichi Pervyye, 1,844 ft. Max. interval between passing tracks, 11.2 miles.	Single track Bobruysk–Bakhmach. Electrified Molodechna–Pukhovichi (86.9 miles). Automatic block Kaliningrad–Bobruysk. Average train speeds, excluding stops, 30 m.p.h. (freight).	6 major bridges, 530–1,130 ft. long. 1 tunnel, 3,940 ft. long.
28	Navtlugi Pervyye–Alyat; 591.5 miles.	All single track. Max. grade, 2.9%. Known min. radius of curvature: Dzhulfa–Alyat, 869 ft. Masis–Alyat: max. interval between passing tracks, 14.3 miles.	Electrified Navtlugi Pervyye–Norashen (309.4 miles). Manual block. Average train speeds, 17–20 m.p.h. (freight).	8 major bridges, 320–760 ft. long. 1 tunnel, 5,000 ft. long.
29	Sverdlovsk–Guryev; 970.6 miles..	Single track, 759.1 miles; double track, 211.5 miles. Known max. grades: Sverdlovsk–Orsk, 0.8%; Kondurovka–Guryev, 0.6%. Known min. radius of curvature: Sverdlovsk–Orsk, 1,394 ft. Orsk–Guryev: max. interval between passing tracks, 27.2 miles.	Double track, electrified, automatic block Chelyabinsk–Orsk (340.5 miles). Average train speeds, excluding stops, 20–30 m.p.h. (freight).	4 major bridges, 500–1,800 ft. long.
30	Krasnovodsk–Tashkent; 1,157.6 miles.	Single track, 1,037.7 miles; double track, 119.9 miles. Known max. grade: Ziadin–Khavast, 1.6%. Known min. radius of curvature: Ziadin–Khavast, 1,968 ft. Khavast–Krasnovodsk: max. interval between passing tracks, 13.6 miles.	Double track Samarkand–Dzhizak (70.2 miles), Khavast–Tashkent (94.4 miles). Electrified Syr-Darinskaya–Tashkent. Manual block. Average speeds, excluding stops, 20–25 m.p.h. (freight).	4 major bridges, 410–5,300 ft. long.

na Data not available.
*Direction of maximum grades is unknown.

As of 1 January 1972 the locomotive inventory totaled about 30,100 units, mostly diesels and electrics. Steam locomotives, now used on low-density lines and as switchers, move only 3.5% of the rail-hauled freight. Although Soviet-produced locomotives are technically somewhat inferior, the inventory is generally adequate to handle traffic requirements. Production of electric locomotives is concentrated at plants in Novocherkassk and Tbilisi, which have an annual combined output of 300 units. Diesel production is concentrated at Kharkov, Voroshilovgrad, and Kolomna, with a combined annual production of about 1,500 units. Additional locomotives (mostly electric), are imported from France (Figure 3), East Germany, Hungary, Austria, and Czechoslovakia. At the beginning of 1972 the freight car inventory totaled about 1.2 million units. The quality of freight cars is somewhat inadequate, and the quantity does not meet present-day demands. Approximately 95% of the fleet consists of 4-axle (or more) cars; all cars have automatic couplers and airbrakes. Domestic production of freight cars amounts to about 64,000 units annually; builders are located throughout the country, but the larger plants are at Nizhniy Tagil, Altayskaya, Zhdanov (tank cars), and Kryukov.

Container shipping between Japan and Western Europe via the Trans-Siberian Railroad is increasing steadily and is expected to mushroom during the next few years. According to the Soviets, such traffic amounted to 5,000 containers during the first half of 1972, a figure which is expected to grow to between 15,000 and 20,000 units during 1973. Container transfer yards have been established in Moscow, Leningrad, Brest, and other areas. About 80% of all Soviet containers have capacities of 3 tons or less, but larger units are being used increasingly with development of modern facilities. Experimental flatcars are available to transport 10- and 20-ton containers.

Most of the passenger cars are built at Kaliningrad, Riga, and Leningrad. All-metal cars comprise most of the total fleet, which has 2-, 3-, and 4-axle cars. Most of the 2-axle equipment is in service on suburban lines, and the heavier equipment on long-distance routes. Electric (Figure 4) and diesel multiple-unit trains are used for local and commuter service within large metropolitan centers.

The Soviet railroads are divided into 26 regional systems functioning as independent units under the Ministry of Railways. The railroads had 2,337,000 employees in 1971, of whom 2,015,000 were classified as operating personnel. Considerable attention is given to research, education, and training. The Central Scientific Institute of Railroad Transportation, located just south of Moscow, is probably the largest and most advanced railroad institute in the country. About 14 institutes offer degrees in railroad engineering, and other railroad schools provide job training as well as basic educational courses.

The current Five Year Plan (1971-75) calls for further dieselization and electrification, double tracking the remaining single-track trunk routes, acquiring new motive power and rolling stock, installing modern signaling, and construction of some new lines.

The Tyumen-Surgut route, one of the most important construction projects underway in Western Siberia, will provide service from a major oil-producing region in the northern part of the Tyumen Oblast. Presently completed to a point north of

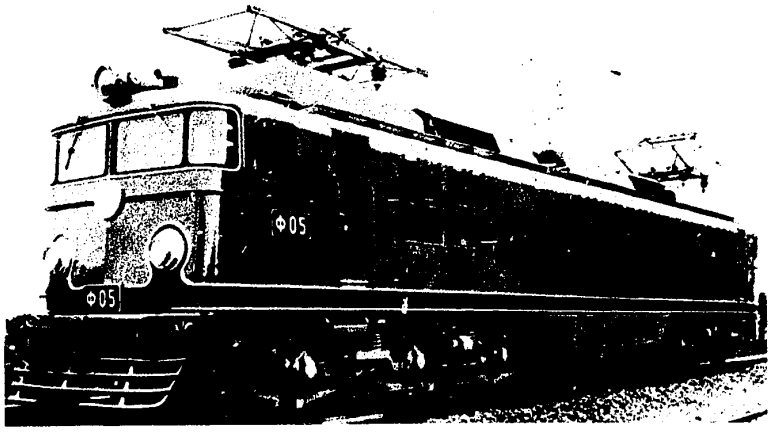


FIGURE 3. French-built electric locomotive, series F.05 (C)

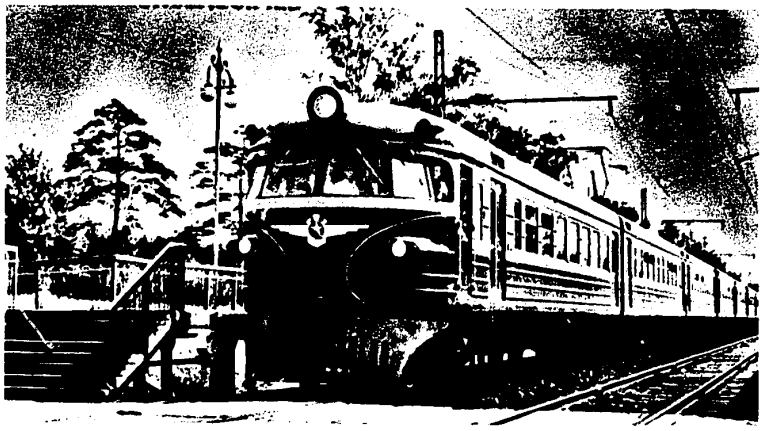


FIGURE 4. ER-1 electric train-set (U/OU)

Tobolsk, the line will eventually cross the Ob River at Surgut and run eastward along the Ob to terminate at Nizhnevartovskiy.

The Central Siberian and South Siberian railroads probably will be completed by 1975 and should provide considerable relief for the highly overworked Trans-Siberian line in this area. The Central Siberian line, originating north of Barnaul at the Talmenka junction, runs west through Karasuk, Kokchetov, Kustanay, and terminates at Dzhetygara. The South Siberian Railroad, originating on the Trans-Siberian line at Tayshet and running west through Abakan, Novokuznetsk, Tselinograd, and Kartaly to Magnitogorsk, is to be extended to Chishmy, on the Moscow-Kurgan trunk route.

After several years of delay, the Soviets have started work on the highly difficult task of bridging the Amur River between Komsomol'sk-na-Amure and Pivan in the Far East. The structure, when completed, not only will eliminate the need for train ferry operations across the Amur, but also will obviate the custom, in winter, of laying tracks across the frozen river.

D. Highways (S)

Highway transport is used primarily for short-haul movement of freight and passengers, and provides a feeder and distribution service to other modes of transport. Long distance international and domestic interurban trucking exist on several routes, but the amount of freight hauled in these operations is comparatively small. The average length of haul is slightly over 9 miles. In 1972 trucks carried 18.8 billion short tons of freight and produced 178 billion ton-miles.

Quantitatively, the road network is generally adequate to meet current economic requirements. In terms of quality, however, the network is deficient; over 84% of the total mileage comprises loose- or natural-surface roads.

The unevenly distributed national network ranges from a relatively dense net in European U.S.S.R. to a very sparse network in Asiatic U.S.S.R. Most paved or improved roads are located in the central and western parts of European U.S.S.R and along the southern border. The north-central and northeastern regions of the country have few roads. The Pacific coastal region and Sakhalin island are served by several improved roads. No continuous paved road crosses the entire country in an east-west direction. The U.S.S.R. road network makes connections with all bordering countries. The network density of slightly less than 0.1 mile of road per square mile of area is less than the densities in countries along the western border; about equal to neighboring Communist China, Mongolia, North Korea, and Turkey; and greater than that of Iran and Afghanistan. From the standpoint of quality, the countries along the western border have superior roads, while the countries along the southern border have equal or inferior roads. In 1971 the U.S.S.R. had 845,618 miles of roads. A breakdown of this mileage by surface type is as follows:

Surface	Miles	Percent of total
Paved (concrete; bituminous, including surface treatment; stone block; cobblestone)	128,340	*15.2*
Crushed stone, gravel	188,852	*22.3*
Earth (including tracks)	528,426	*62.5*

U.S.S.R. roads are classified administratively into four categories: all-union; republic; *oblast*, *kray*, or autonomous republic; and local. All-union roads are primarily long-distance main routes which connect large industrial and agricultural centers, serve

international traffic, and carry heavy freight or passenger traffic. Republic roads are main or secondary routes which connect the main administrative, political, and economic centers of autonomous republics, *krays*, and *oblasts* within a union republic. Roads of *oblast*, *kray*, or autonomous republic importance are short-distance routes which connect important areas within an *oblast*, *kray*, or autonomous republic. Local roads link *rayon* centers, rural settlements, villages, and state and collective farms.

Although the administrative classification of roads does not signify any particular type of road construction, the all-union roads are generally paved, these routes comprising less than 10% of the total network.

Most main routes in European U.S.S.R. have bituminous surfaces (Figure 5) 16 to 23 feet wide, with 3- to 10-foot earth or gravel shoulders.

Other main routes have surfaces 30 to 40 feet wide. Four-lane divided highways total about 500 miles, including the 68-mile Moscow circumferential highway, the Kaunas to Vilnyus highway, and approaches to some large urban areas.

In Asiatic U.S.S.R. most main routes are constructed of crushed stone or gravel and are 16 to 20 feet wide.

Bituminous surfaced roads 18 to 20 feet wide connect the more important cities in Soviet Central Asia. These roads generally have a surface thickness of less than 2 inches laid on a crushed stone, gravel, or sand base 10 to 20 inches thick, depending on the condition and type of subsoil. The surface of gravel roads in areas of stable soil and good drainage usually consists of 2 inches of gravel and sand; elsewhere the gravel or crushed stone roads range in thickness from 4 to 12 inches and have a base of large rocks, slag, or rubble. Improved earth roads are usually constructed by grading and rolling the natural surface. Earth shoulders are predominant throughout the roads network, but the better roads have gravel shoulders from 3 to 10 feet wide.

Because of the flat to rolling terrain in European U.S.S.R., roads there have gentle curves and grades, while in the Caucasus and the mountainous southern border areas many roads have steep grades and sharp curves.

Information is not available on the total number of road bridges in the U.S.S.R. Timber bridges, although common on secondary and local roads, are gradually being replaced by prefabricated, reinforced-concrete, deck-type structures. Steel bridges are used mainly in large urban areas and at wide-gap river crossings. In several of the cities there are doubled-deck combination rail-highway bridges. Load capacities of bridges vary considerably; recently constructed reinforced-concrete bridges have load capacities of about 66 short tons under controlled speeds and spacing of vehicles; however, low-capacity bridges (less than 10 short tons) still exist on many roads. Reinforced-concrete, steel, and masonry bridges are in fair to good condition; the timber bridges are generally in poor condition.

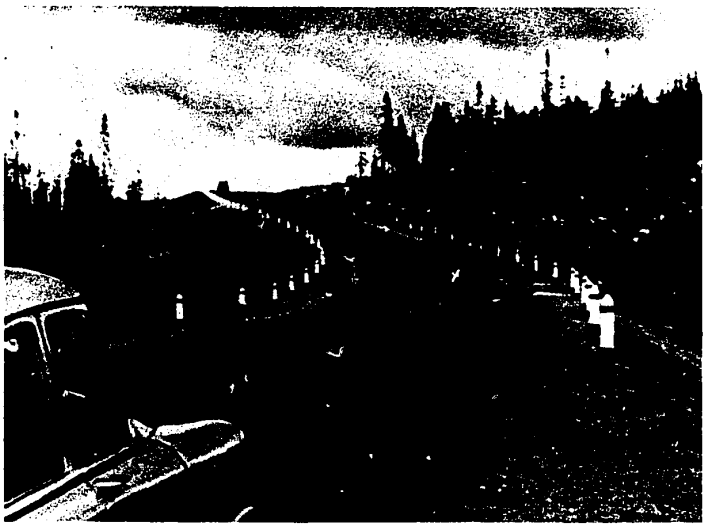
There are few road tunnels and galleries, and the small number of ferries and fords are usually limited to secondary road crossings. Known tunnels and galleries are of reinforced-concrete construction. Ferry craft vary from cable-operated barges with capacities of one or two vehicles to modern, diesel-powered craft each with a capacity of at least 25 vehicles.

Characteristics of selected principal highway routes are tabulated in Figure 6; the routes are shown on Figure 32.

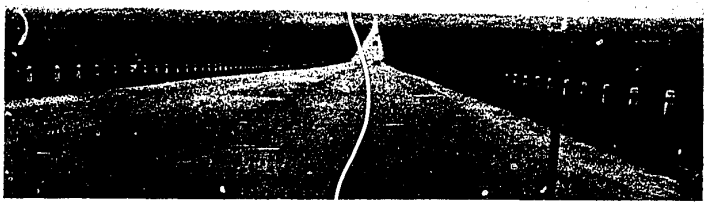
Road construction and maintenance activities are government controlled. The Main Administration for Highway Construction (*Glavdorstroy*), subordinate to the Ministry of Transport Construction, is responsible for the planning, design, and construction of all-union roads and any others of military significance. Planning and construction of the other roads, as well as road maintenance, is carried out by units of the Ministry of Motor Transport and Highways in each republic, with subordinate directorates at *kray* and *oblast* levels. In addition, some industries and enterprises build and maintain roads to serve their own needs.

Roads are constructed by highly mechanized groups assigned to specific road construction districts. Road maintenance and repair are performed by units (Road Repair Points) of 25 to 35 men, each unit being responsible for sectors 30 to 55 miles in length. Supplementary sources of labor include military personnel and members of collective and state farms, industrial enterprises, and other economic organizations. In general, roads are slowly and poorly constructed.

Many problems bar effective and efficient road construction and maintenance. There is a general shortage of appropriated funds, road construction materials, roadbuilding equipment, and skilled personnel. Moreover, mountainous terrain, unstable soils, and poor drainage hinder construction and maintenance in many areas. Road construction materials, in particular suitable gravel and crushed rock, are in short supply in some parts of the country and must be transported to construction sites—at times by rail over long distances. Bituminous materials are available in adequate amounts; portland cement, although sufficient in quantity, is used only in the construction of especially important roads.



Bituminous-surfaced stretch of Leningrad-Murmansk road. A lengthy part of this route has a gravel surface which is being replaced with bituminous surfacing. (U/OU)



Moscow-Minsk-Brest highway. This 668-mile route is the most important road connecting Moscow with Poland and routes leading to Western Europe. (S)

The U.S.S.R. has relatively few routes similar to the recently completed 59-mile Vilnyus-Kaunas highway shown here (U/OU)

FIGURE 5. Soviet highways

FIGURE 6. Selected principal highway routes (S)

ROUTE NO.	LOCATION AND LENGTH (SEE MAP, FIG. 32)	PHYSICAL CHARACTERISTICS	OPERATIONS	REMARKS
1	Poland border–Moscow; 668 miles.	Bituminous, concrete surface 30–42 ft. wide; 5–10-ft. earth shoulders. Gentle grades, moderate curves. 6 large bridges, 500–1,300 ft. long; 8 underpasses.	Most important road Moscow–western Europe. Provides best approach to Moscow from W., N. of extensive Pripet Marshes. All towns or urban areas of appreciable size skirted or bypassed thus facilitating rapid vehicular movement. About 17 fueling points, 7 repair shops along route.	Generally flat terrain. Usually in fair to good condition.
2	Finland border–Moscow via Leningrad; 560 miles.	Bituminous, concrete surface 24–30 ft. wide, short stretches of 4-lane divided highway lead N. from Moscow and Leningrad for 18 and 22 miles respectively; 3–15-ft. earth and gravel shoulders. Moderate grades and curves. 8 main bridges, 500–1,720 ft. long; 7 underpasses, 1 tunnel (at Moscow), 2 limited clearance bridges.	In addition to providing major highway connection with Finland, road connects 2 largest Soviet population and industrial centers, Moscow and Leningrad. Only few urban areas bypassed. About 12 fueling points, 6 repair shops along route.	Flat to undulating terrain. Usually in fair to good condition.
3	Poland border–Rostov via Kiyev, Kharkov; 967 miles.	Bituminous, concrete surface 20–25 ft. wide; 3–8-ft. earth and gravel shoulders. Gentle to moderate grades and curves. 12 large bridges, 500–5,000 ft. long; 8 underpasses.	Major highway connection with Poland. Route serves most important U.S.S.R. mining and basic metallurgical district and vast agricultural areas of Ukraine. Only few urban areas bypassed. About 18 fueling points, 12 repair shops along route.	Mostly flat to undulating terrain. In fair to good condition. Rovno–Kiyev being converted to 4-lane divided highway.
4	Poland border–Leningrad via Riga; 616 miles.	Bituminous, concrete surface 20–30 ft. wide; 3–8-ft. earth and gravel shoulders. Gentle to moderate grades and curves. 6 large bridges, 750–2,275 ft. long; 12 underpasses, 1 limited-clearance bridge.	Major highway connection with Poland. Route also connects with lateral routes extending from various ports and naval bases on Baltic Sea. Very few urban areas bypassed. Fuel and repair facilities located in large cities and some of large towns or villages.	Generally flat terrain. In fair to good condition.
5	Finland border–Leningrad via Murmansk, Petrozavodsk; 1,051 miles.	Finland border–about 30 miles N. of Kola: gravel surface 21–26 ft. wide; 0–3 ft. probably earth shoulders. 30 miles N. of Kola–vicinity of Loukhi; bituminous surface 20–24 ft. wide; 3–5 ft. gravel shoulders. Loukhi–vicinity of Medvezh'yegorsk: gravel surface 22–24 ft. wide. Medvezh'yegorsk–Petrozavodsk: bituminous surface 22–24 ft. wide; 5 ft. gravel shoulders. 7 large bridges, 500–2,000 ft. long. Bottlenecks include 2 limited-clearance bridges, 1 ferry.	Major highway connection with Finland; branch road links with Norway. Highway connects Leningrad, largest port, with Murmansk, only ice-free seaport on U.S.S.R. Arctic coast. Road supplements existing RR. to provide only 2 overland, N.–S. lines of communication in region.	Mostly flat to undulating terrain. Loukhi–Medvezh'yegorsk section being reconstructed; to be bituminous surfaced and probably in operation by 1974.
6	Czechoslovakia border–Rovno via L'vov; 303 miles.	Bituminous surface 17–20 ft. wide; 2–6-ft. earth and gravel shoulders. Moderate curves and grades. No large bridges or bottlenecks.	Principal connection with Czechoslovakia. Route serves L'vov, transportation and light-industries center, and petroleum fields of western Ukraine.	Hilly terrain. In fair to good condition.

7	Romania border–Zhitomir via Chernovtsy, and Vinnitsa: 286 miles.	Bituminous surface 16–26 ft. wide; 0–6-ft. earth shoulders. Moderate curves and grades. 5 large bridges, 550–984 ft. long; 1 underpass.	Principal connection with Romania.....	Undulating to hilly terrain. In good condition.
8	Romania border–Rostov via Kishinev, Odessa, Melitopol; 634 miles.	Bituminous, gravel surface 20–26 ft. wide; 2–6-ft. earth shoulders. Moderate curves and grades. 4 large bridges, 600–2,465 ft. long; 2 underpasses.	Principal connection with Romania. Route serves Black Sea port of Odessa and industrial, military, and transportation centers of Nikolayev, Kherson, Melitopol, and Zhdanov.	Flat to undulating terrain. In fair to good condition.
9	Odessa–Pskov via Kiyev, Vitebsk; 849 miles.	Bituminous, concrete surface 16–30 ft. wide; 3–12-ft. earth and gravel shoulders. Moderate curves and grades. 9 large bridges, 500–5,000 ft. long; 8 underpasses.	Route intersects all important E.–W. through routes in European U.S.S.R. and roughly parallels border of Communist Eastern Europe.	Mostly flat to undulating terrain. In fair to good condition.
10	Minsk–Sovetsk via Vilnyus; 281 miles.	Vilnyus–Kaunas: 4-lane divided highway. Concrete surface, each roadway 24.5 ft. wide, 3-ft. concrete shoulders. Remainder of route: Bituminous surface 20–26 ft. wide, 3–6-ft. shoulders. Moderate curves and grades along entire route. 1,150-ft. bridge at Kaunas, 2 underpasses.	Route connects 2 important E.–W. through routes in European U.S.S.R.	Flat to undulating terrain. In good condition.
11	Sevastopol–Moscow via Khar'kov; 920 miles.	Bituminous surface 18–40 ft. wide. 3–8-ft. gravel and earth shoulders. Sharp curves near Sevastopol; 8 large bridges, 500–1,560 ft. long; 17 underpasses.	Originating at Sevastopol, largest Black Sea naval base and major shipbuilding and industrial center, route serves heavy-industry complexes of Khar'kov and Dnepropetrovsk and Moscow industrial center. Road bypasses all major cities.	Mostly undulating terrain. Hilly near Sevastopel. In fair to good condition.
12	Junction 40 miles S. of Orel–Junction 56 miles N. of Kiyev; 226 miles.	Concrete surface 23 ft. wide, 10-ft. gravel shoulders, gentle grades; 1,300-ft. bridge over Seym at Baturin, 2 underpasses.	Route connects 2 important N.–S. through routes in European U.S.S.R. All large cities and villages bypassed.	Flat to undulating terrain. In good condition.
13	Shakhty–Kashira; 613 miles.....	Bituminous, concrete surface 26 ft. wide, 3–6-ft. earth, gravel shoulders. 18-mile stretch S. of Voronezh is 4-lane divided highway. Moderate grades and curves. 5 bridges, 720–1,600 ft. long; no bottlenecks.	Important N.–S. route connecting Rostov and Moscow areas.	*Do.*
14	Volgograd–Moscow; 627 miles...	Bituminous, gravel, earth surface 18–30 ft. wide, 0–2-ft. earth and gravel shoulders. Moderate grades and curves. 3 large bridges, 600–1,000 ft. long; 5 underpasses.	Important N.–S. route linking industrial and transportation center of Volgograd with Moscow.	Flat to undulating terrain; gravel and earth sections, in fair to poor condition, being rebuilt and surfaced with bituminous.
15	Moscow–Dzhusaly via Kuybyshev; 1,810 miles.	Moscow–Ryazan (109 miles): Bituminous, concrete surface, 4-lane divided highway. Remainder of route: Bituminous, crushed stone, gravel surface 15–25 ft. wide; 3–8-ft. earth, gravel shoulders. Moderate curves and grades. 12 large bridges, 500–2,340 ft. long. Road crosses Volga atop 15,400-ft. concrete dam. 8 underpasses, 2 limited-clearance bridges.	Route serves Moscow and important industrial centers of Kuybyshev, Orenburg, Orsk. Route also serves as overland connection between European U.S.S.R. and Soviet Central Asia.	Flat to undulating terrain. In fair to good condition.

FIGURE 6. Selected principal highway routes (S) (*Continued*)

ROUTE NO.	LOCATION AND LENGTH (SEE MAP, FIG. 32)	PHYSICAL CHARACTERISTICS	OPERATIONS	REMARKS
16	Moscow–Chelyabinsk via Gor'kiy, Kazan, Sverdlovsk; 1,265 miles.	Moscow–near Orekhovo-Zuyevo: (40 miles): Bituminous, concrete surface 4-lane divided highway. Also 4-lane divided highway for short distance W. approach to Gor'kiy. Remainder of route: Bituminous, gravel surfaced 20–30 ft. wide, 3–6-ft. earth shoulders. Moderate curves and grades; 3 large bridges, 700–2,810 ft. long; 9 underpasses. Ferries cross Volga, Vyatka, and Kama.	Major E.–W. route connecting industrial areas of Moscow, Gor'kiy, Kazan with petroleum-producing area around Perm and iron and steel producing areas around Sverdlovsk and Chelyabinsk. Ferries on route severely restrict sustained vehicular movement.	Flat to hilly terrain. In fair to good condition.
17	Moscow–Arkhangel'sk; 804 miles.	Bituminous, gravel, earth surface 15–25 ft. wide; 0–10-ft. earth, gravel shoulders. Gentle grades and curves. 3 large bridges, 1,300–3,430 ft. long; 6 underpasses, 3 ferries, 5 fords, 1 limited-clearance bridge.	Important N.–S. route serves Moscow, industrial city Yaroslavl, transportation center Vologda, and White sea port Arkhangel'sk. Route is alternate for RR. line into Arkhangel'sk. N. of Vologda numerous ferries and fords severely restrict and hamper sustained vehicular movement.	Mostly flat terrain. Some sections of earth surfaced roads in poor condition. Vologda–Arkhangel'sk being rebuilt; will be bituminous surfaced.
18	Rostov–Kazan via Volgograd; 959 miles.	Bituminous, concrete, gravel, improved earth surface 18–25 ft. wide; 2–5-ft. earth shoulders. Moderate grades and curves. 2 large bridges, 750 and 530 ft. long; 1 underpass; 2 ferries.	Important N.–S. route connects industrial and transportation centers of Rostov, Volgograd, Saratov, Kazan. 2 ferries across Volga restrict and hamper vehicular movement.	Mostly flat to undulating terrain. Some sections of loose-surface roads in poor condition.
19	Groznyy–Volgograd; 580 miles...	Bituminous, gravel, improved earth surface 20–29 ft. wide, 0–6-ft. earth shoulders. Gentle grades and curves. 3 large bridges 655–2,500 ft. long; 1 limited-clearance bridge.	Important N.–S. route connects European U.S.S.R. with Caucasus. Also serves industrial and transportation centers and inland waterway ports of Volgograd and Astrakhan.	Flat to undulating terrain. In fair to good condition.
20	Baku–Rostov via Ordzhonikidze; 921 miles.	Bituminous, concrete, crushed stone surface 12–40 ft. wide; 0–6-ft. earth shoulders. Steep grades and sharp curves. 4 large bridges, 492–2,000 ft. long; 5 underpasses, 3 tunnels, 2 galleries.	Major N.–S. trunk route in Caucasus. Connects industrial and transportation center of Rostov, industrial center of Tbilisi, petroleum producing and refining area of Baku. Ordzhonikidze–Tbilisi (Georgian Military Highway) subject to washouts, landslides, snow blockage. Traffic restricting tunnels and galleries are on this section.	Hilly to mountainous terrain. Some sections in fair to poor condition. Ordzhonikidze–Baku requires frequent maintenance.
21	Baku–Ordzhonikidze; 435 miles..	Bituminous, stone block surface 18–30 ft. wide; 2–6-ft. earth shoulders. Moderate grades and curves. 3 large bridges, 690–1,000 ft. long; no bottlenecks.	Major N.–S. trunk route in Caucasus. Alternate approach route to Baku.	Some mountainous terrain. In fair condition.
22	Turkey border–Junction Route 20; 664 miles.	Bituminous, concrete, gravel, improved earth surface 15–30 ft. wide; 0–6-ft. earth, gravel shoulders. Numerous steep grades and sharp curves. 17 large bridges, 525–2,310 ft. long; 4 underpasses, 1 limited-clearance bridge.	Principal connection with Turkey. Major N.–S. trunk route in Caucasus. Steep grades and sharp curves severely hamper vehicular movement.	Mountainous terrain. Some sections (loose surface) in poor condition.

22A	Samtredia–junction 19 miles N. of Tbilisi; 147 miles.	Bituminous surface 18–25 ft. wide; 3–6-ft. earth, gravel shoulders. Some steep grades. 1 large bridge, 530 ft. long.	Important E.–W. route connects 2 N.–S. trunk routes.	Some mountainous terrain.
22B	Turkey border–Tbilisi; 137 miles..	Bituminous, crushed stone surface 18–25 ft. wide, 0–6-ft. shoulders. Sharp curves, steep grades. No large bridges or bottlenecks.	Principal connection with Turkey. Road subject to closure by snow mid-Dec. to end of Mar.	Some mountainous terrain. In fair condition.
22C	Iran border–Kazakh; 232 miles..	Bituminous surface 20–25 ft. wide; 3-ft. shoulders. Sharp curves, steep grades. 2 large bridges, 505 and 1,260 ft. long; 1 limited-clearance bridge	Principal connection with Iran. Route subject to closure by snow mid-Dec. to end of Mar.	Mountainous terrain. 4-lane divided highway under construction Yerevan–Sevan vicinity, 7-mile stretch Sevan N. completed. 8,000-ft. tunnel under construction between Sevan and Dilizhan.
22D	Iran border–Baku; 108 miles....	Bituminous surface 18–25 ft. wide; 6–7-ft. earth shoulders; moderate curves and grades. 1 large bridge, 1,020 ft. long; no bottlenecks.	Principal connection with Iran. Route subject to flooding after heavy rains in marshy areas. In places road runs on embankment thus impeding off-road dispersal.	Flat terrain. Some sections in poor condition.
23	Chelyabinsk–Irkutsk via Novosibirsk; 2,155 miles.	Predominantly gravel surfaced, some bituminous and unimproved earth 18–25 ft. wide. Moderate curves and grades. 14 large bridges, 550–3,305 ft. long. Bottlenecks include 2 limited-clearance bridges, ferry crossing Yaya about 56 miles E. of Tomsk.	Important E.–W. highway connects 5 major industrial urban areas: Chelyabinsk, Omsk, Novosibirsk, Krasnoyarsk, Irkutsk.	Mostly flat to undulating terrain. Some sections in poor condition.
23A	Mongolia border–Novosibirsk; 613 miles.	Concrete, bituminous, crushed stone surface 15–25 ft. wide; 0–3-ft. earth shoulders. Steep grades, sharp curves. 5 large bridges, 500–1,525 ft. long; bottlenecks include 3 underpasses.	Principal connection with Mongolia. Route serves coal-and-iron-ore mining Kuznetsk Basin and heavy-industry centers of Biysk, Barnaul, Novosibirsk.	Mountainous terrain.
23B	Mongolia border–Achinsk; 690 miles.	Mostly crushed stone, some bituminous, unimproved earth surface 20–25 ft. wide. Steep grades, sharp curves. 6 large bridges, 580–1,625 ft. long; 2 limited-clearance bridges.	Principal connection with Mongolia. Route serves Kyzyl, transportation center, and coal-mining and industrial centers of Minusinsk, Abakan.	Hilly to mountainous terrain.
24	Chimkent–Chelyabinsk; 1,061 miles.	Mostly gravel, some bituminous surface 15–20 ft. wide. Gentle curves, grades. One large bridge, 485 ft. long; no bottlenecks.	Principal N.–S. route connecting Soviet Central Asia with Chelyabinsk and rich industrial Urals region. Sections subject to drifting sand in desert areas.	Flat to undulating terrain.
25	Iran border–Barnaul via Tashkent, Alma-Ata; 2,557 miles.	Short stretches of 4-lane divided highway near Tashkent, Alma-Ata. Remainder of route bituminous, gravel surface 15–30 ft. wide; 0–10-ft. gravel, earth shoulders 0–10 ft. wide; moderate grades, curves. 5 large bridges, 500–2,600 ft. long; bottlenecks include 10 underpasses, 2 limited-clearance bridges.	Southernmost E.–W. route parallels Iran, Afghanistan, China border regions. Principal connection with Iran.	Some mountainous terrain. In fair to good condition.
25A	Afghanistan border–Khavast; 293 miles.	Bituminous, cobblestone surface 15–26 ft. wide, 0–10-ft. gravel shoulders. 4-lane divided highway 13 miles N. from Dushanbe. Numerous sharp curves, steep grades. One large bridge, 980 ft. long; one underpass; ferry crossing at Afghanistan-U.S.S.R. border.	Principal connection with Afghanistan. Subject to snow blockage during winter. 3 mountain passes facilitate interdiction.	Hilly to mountainous terrain. In fair condition.

FIGURE 6. Selected principal highway routes (S) *(Continued)*

ROUTE NO.	LOCATION AND LENGTH (SEE MAP, FIG. 32)	PHYSICAL CHARACTERISTICS	OPERATIONS	REMARKS
25B	China border–junction 38 miles W. of Frunze; 513 miles.	Bituminous, improved earth surface 15–22 ft. wide; 0–3-ft. earth shoulders. Numerous steep grades, sharp curves. One large bridge, 800 ft. long; 2 tunnels, 5,340 and 8,830 ft. long.	Principal connection with China. Road subject to snow blockage in winter, early spring.	Mountainous terrain. Probably in fair condition.
25C	China border–Sary-Ozek; 142 miles.	Bituminous surface 20 ft. wide; gentle grades, curves. No large bridges, bottlenecks.	Principal connection with China.....	Fla' terrain. Probably in fair condition.
25D	China border–Ayaguz; 196 miles..	Bituminous, gravel surface 20–25 ft. wide. Moderate grades, curves. No large bridges, bottlenecks.	....*do*.....	Flat to undulating terrain. Probably in fair condition.
26	Irkutsk–China border; 996 miles..	Mainly gravel, crushed stone surface, some bituminous stretches, 18–25 ft. wide. Steep grades, sharp curves. 5 large bridges, 500–2,500 ft. long; 2 limited-clearance bridges.	Principal connection with China. Route connects 3 major transportation, industrial, military centers of Irkutsk, Ulan-Ude, Chita.	Some hilly to mountainous terrain. In fair to good condition.
26A	Mongolia border–Ulan-Ude; 147 miles.	Bituminous surface 18–20 ft. wide. Some sharp curves. 2 large bridges, 1,100 and 1,195 ft. long; 2 limited-clearance bridges.	Most important road connection with Mongolia. Extension of road into Mongolia connects its capital, Ulaanbaatar, with the industrial, commercial, and transportation center of Ulan-Ude and the Trans-Siberian Railroad.	Hilly terrain. Usually in good condition.
26B	Mongolia border–junction 40 miles S. of Chita; 191 miles.	Bituminous surface 20 ft. wide. Some sharp curves. 2 large bridges, 855 and 2,040 ft. long; 2 limited-clearance bridges.	Principal connection with Mongolia.....	Hilly to mountainous terrain. Probably in fair condition.
27	Never–Magadan; 1,908 miles.....	Mainly gravel, crushed stone, some bituminous surface 9–20 ft. wide. Several sharp curves, steep grades. 7 large bridges, 550–900 ft. long; 1 limited-clearance bridge, 3 ferries.	Provides only overland mode of transport through base area of E. Siberia. Serves rail facilities at Never, river port of Yakutsk, Okhotsk seaport of Magadan. Road also serves widespread areas of important resources including iron ore, gold, coal.	Some hilly to mountainous terrain. Road crosses several swampy areas; usually in fair to good condition.
28	Svobodnyy–Khabarovsk; 538 miles.	Mostly gravel, some bituminous surface 18 and 25 ft. wide, 3–5-ft. shoulders. Moderate grades, curves. No large bridges, bottlenecks.	Road serves river port of Blagoveshchensk, major transportation, industrial, oil-distribution urban area of Khabarovsk.	Flat to undulating terrain. In good condition.
29	North Korea border–Khabarovsk; 530 miles.	Bituminous, gravel surface 20–25 ft. wide; 0.5–2-ft. shoulders. Moderate grades, curves. 16 large bridges, 500–2,700 ft. long; 1 limited-clearance bridge, 2 underpasses.	Principal connection with North Korea. Most important trunk route serves most highly industrialized area of U.S.S.R. E. of Lake Baykal. Short lateral road links important naval base and RR. center of Vladivostok and seaport of Nakhodka, largest commercial port on U.S.S.R. Pacific coast.	Flat to undulating terrain. In fair to good condition.
30	Khabarovsk–Sovetskaya Gavan; 460 miles.	Bituminous, gravel, unimproved earth surface 15–25 ft. wide. Moderate curves, grades. No large bridges; 9 fords Pivan–Sovetskaya Gavan.	Route serves important river port and industrial center of Komsomol'sk-na-Amure and important naval base of Sovetskaya Gavan.	Flat terrain. In fair to good condition. Combination road-RR. bridge under construction at Komsomol'sk-na-Amure.

Motor transport operations are performed by union republic organizations which provide bus, truck, and taxi services for the general public, and by truck fleets operated by the socialized industries and state and collective farms for their own needs. Each of the 15 union republics has a Ministry of Motor Vehicle Transport, or similarly named organization, which controls and regulates motor transport activities including the hauling of passengers and various kinds of freight for state and public and cooperative organizations. Bus lines connect most populated centers. Several motor transport organizations are engaged in international haulage under the trade name *Sovtransavto*. Truck lines connect the U.S.S.R. with the Mongolian People's Republic, Afghanistan, Iran, Turkey, Finland, the Eastern European Warsaw Pact Countries, and France, Italy, Austria, Switzerland, and the Netherlands.

Although rapid industrial growth, improvement of the road network, and increased motor vehicle production have caused a considerable increase of traffic volume, the overall amount is less than that of Western Europe. The largest part of road traffic is short-haul trucking operations concentrated around densely populated centers, large industrial or construction sites, and collective farms. Motor transport is the principal mode of transportation only in areas of central Asia and eastern Siberia, in districts without railroads or waterways. Overall, traffic consists mainly of trucks; animal-drawn vehicles continue to be significant outside the major cities and especially in the northern rural areas of the country.

The principal types of freight hauled by motor transport consist of manufactured goods, agricultural products, construction materials, and fuel.

Automotive repair and fueling facilities are generally inadequate. There are shortages of garages, gasoline or diesel-fuel stations, spare parts, and skilled technical personnel. Garages equipped for major repair work are few and mainly in large cities. The government has been engaged in extensive construction of gasoline stations and technical repair stations. Most of these facilities are located in large cities. Elsewhere, gasoline stations and garages are few and far between.

The U.S.S.R. is self-sufficient in motor fuels. Gasoline with octane ratings up to 96, diesel fuel, and lubricants are available in adequate amounts.

Road transport operations are greatly hampered by climatic conditions. Most traffic interruptions occur during periods of prolonged rain, especially in spring and autumn, when many secondary roads become muddy and virtually impassable. During dry periods dust conditions prevail on earth, gravel, and crushed-stone roads. In winter, freezing temperatures, ice conditions, and snowdrifts obstruct vehicle movement on most roads. In the northern regions permafrost damages bridges, roads, and culverts. Roads in mountainous areas have numerous sharp curves, steep grades, and narrow and low-capacity bridges and are subject to snow blockage and spring washouts.

As of January 1972, the U.S.S.R motor vehicles inventory was estimated at 7,240,000 units comprising 4,900,000 trucks, 2,050,000 passenger cars and 290,000 buses. Many of the vehicles are of recent manufacture and in fair to good condition. The U.S.S.R. produces its own vehicles but imports a small number of special-purpose vehicles, buses, and motorcycles from Communist Eastern Europe. In 1971, the U.S.S.R produced 613,700 trucks and buses and 529,000 passenger cars. The Soviet Union has been modernizing and greatly expanding its motor vehicle industry. During the past few years, several vehicle assembly plants have been established, and others are being built or planned. The Italian Fiat Motor Company is equipping a passenger-car plant at Tolyatti. The planned output is to be 600,000 units per year when full production is reached, probably in 1974. Moreover, a large heavy truck plant is currently under construction at Naberezhnyye Chelny on the Kama River: upon completion it will be the world's largest truck plant with a planned production capacity of 150,000 three-axle, diesel-powered trucks a year.

The U.S.S.R.'s road development program is primarily concerned with the reconstruction and improvement of the existing network and secondly with the building of new, long-distance intercity and short-distance feeder roads. Under the current Five Year Plan about 68,000 miles of paved roads are programmed to be constructed.

Significant new roads under construction include the following: Tambov to Volgograd, Leningrad to Murmansk, Arkhangel'sk to Vologda, and Kuybyshev to Ufa. Large bridges are under construction at Komsomol'sk-na-Amure, Astrakhan' and Riga. In many large cities bypasses or circumferential roads are under construction in order to expedite through traffic.

E. Inland waterways (S)

The extensive and well developed Soviet inland waterway system is used primarily in providing mining and other basic processing industries a dependable low-cost means in long-haul transportation of strategically and economically important bulk commodities. The system also plays a significant role

in sc scheduled interurban passenger service combined river-maritime operations in foreign trade, and the internal intersea transfers of small naval vessels. Undergoing extensive improvements, the inland waterways are playing an increasingly important part in the national transportation pattern and are most instrumental in supporting the Soviet's efforts to increase industrial output and foreign commerce and to expand mining and agricultural production. The system is utilized far below capacity and is more than adequate for current traffic requirements. Port facilities, craft, and shipping channels on most major routes are well developed and maintained. There are high operating efficiency standards, and the work force is generally ample in numbers and is well trained and efficient. Major weaknesses in the system include a lack of lengthy east-west interconnected routes necessitating in many instances costly and time-consuming transshipment operations, the closure of many routes from 2 to 9 months each year because of fast ice conditions, and the need of modern and more efficient managerial techniques and procedures.

Excluding the Caspian Sea, there are 89,850 route miles of navigable inland waterways in the U.S.S.R., comprising the largest inland waterway system in the world. The system serves most of the Soviet Union's major centers of population, production, and transportation, including the largest maritime ports and major railheads. They are oriented mainly in a north-south directional pattern with few lateral (east-west) interconnections. The European U.S.S.R. waterways provide strategically important internal transport links between the Baltic, White, Black, and Caspian Seas and international connections—some indirectly—with adjacent countries. The unevenly distributed system is dense and fairly well integrated in the heavily populated and highly productive areas with numerous interconnections made by a high degree of canalization and many dam/lock installations. They provide by far the most important waterway routes in terms of volume of traffic, types of cargo hauled, and significance of areas served. Except for the Amur system, the waterways in Asiatic U.S.S.R. form lengthy north-south routes, are widely separated and unconnected, and must rely on maritime/river or rail/river transshipment for through east-west, north-south cargo movements. In vast areas north of the Trans-Siberian railroad, where increasing industrial development requires north-south freight movement, the Asiatic waterways are the primary means of surface transport.

The most significant inland waterways are grouped in seven large systems as follows: the Greater Volga and Dnepr systems in European U.S.S.R. and the Aral Sea-Amudar'ya, Ob-Irtysh, Yenisey, Lena and Amur systems in Asiatic U.S.S.R. International connections are made with inland waterways of Poland, Romania, Finland, Iran, Afghanistan, Mongolia, and the People's Republic of China. Connections to Poland are made via the Pripyat' waterway and the Soviet-Polish controlled parts of the Frisches Haff on the Baltic. Soviet access to Central Europe from the Black Sea is available on the Communist-controlled international Danube, of which its uppermost delta channel forms part of the common boundary between the U.S.S.R. and Romania. Joint Soviet-Finnish control is exercised over the Saymenskiy Canal, a route crossing the international border northwest of Leningrad. Other significant connections include: the upper Amudar'ya, forming part of the common boundary between the U.S.S.R. and Afghanistan, the jointly shared Soviet-Iranian Caspian Sea, and the jointly shared sections of the Amur and the Ussuri with the People's Republic of China. Minor approaches to the latter are made via the Argun, Sungacha, Khanka Lake, Ili and the upper Irtysh, and to Mongolia via the Selenge Gol.

The Greater Volga and Dnepr systems in European U.S.S.R. are the most highly developed and active waterways in the country, characterized by numerous dam/lock installations, extensive canal links between major rivers and waterways, and long sections of large man-made reservoirs and natural lakes. Accounting for more than half of the total inland waterway freight, the Greater Volga provides heavily trafficked access to, exit from, and transit between the most industrially advanced and urbanized areas west of the Ural Mountains, including such major centers of Soviet waterway activity as Moscow, Rybinsk, Yaroslavl', Kazan', Saratov, Gor'kiy, Kuybyshev, Volgograd, and Perm.

The Volga river and eight other connecting waterways, comprising the Greater Volga system, provide a unified deep-water inland transport network. It currently accommodates the internal passage of 2,000- and 2,700-ton river/seagoing vessels between the Baltic, White, Black and Caspian Seas and 5,000- and 6,000-ton craft between the Baltic, Black and Caspian Seas. During low-water periods, reduced loads are required for all river/seagoing vessels on the lower Don exit to the Black Sea and on a short section of the mid-Volga near Chevoksary for 5,000- and 6000-ton craft where cargo is temporarily

transloaded to an accompanying barge. Small naval craft movements, including newly constructed submarines from Gor'kiy and Leningrad, are made to fitting-out facilities on the White Sea. Only upon completion of a dam under construction at Chevoksary, the cascading of the lower Don, and the expansion of the Belomorsk lock on the White Sea Canal, will the deep water system permit the unimpeded passage of fully loaded river/seagoing vessels of all types between the four seas. The Dnepr system is the most important waterway system west of the Volga. It provides important transportation within the Dnepr basin, particularly from the iron and coal regions to important industrial complexes such as Kherson, Zaporozh'ye, Dnepropetrovsk, Kiyev, and Gomel'. The system allows access to the Black Sea and makes an international connection with the Polish waterway system in the vicinity of Brest, where through movement is impeded by lockless dams and/or weirs near the border.

The major Asiatic systems, comprising mostly natural free-flowing rivers with relatively little regulation, are becoming increasingly active and are playing a major role in the exploration and industrial development of the vast regions east of the Ural Mountains including the current exploitation of petroleum and natural gas resources in western Siberia. Except for the self-contained Aral Sea-Amudar'ya waterway, the individual Asiatic systems provide rapidly growing industrial, mining, and agricultural centers of the interior access to important maritime/river ports in their northern or eastern extremities and make vital connections in the south to key rail/river transshipment points along the Trans-Siberian railroad. River shipping is closely allied with the movement of cargo in maritime or river/seagoing vessels and is closely coordinated with the east-west movement of freight on the Trans-Siberian railroad. From a strategic standpoint, the Amur and its tributaries comprise one of the more important systems, occupying a key position in the industrial, agrarian, military, and political activity of the Soviet Far East. The system serves major port areas with shipbuilding, aircraft-production, steel-production, petroleum-refining, and machine-tooling capabilities. Komsomol'sk-na-Amure and Khabarovsk, two important ports, rank as two of the most important industrial complexes, and the former has the only naval shipbuilding activity in the Soviet Far East capable of building nuclear-powered submarines. Along with rail, the system plays a vital role in the movement of large amounts of raw materials and semifinished and finished products, most of which are channeled into an expanding industrial base. The Amur accommodates fully loaded 2,000-ton river/seagoing vessels from the Tatar Strait upstream to Blagoveshchensk, a route that forms a part of extensive river/seagoing routes extending into the Sea of Okhotsk, the Sea of Japan, the Kuril Islands, and the eastern coast of the Kamchatka Peninsula.

The primary traffic interruption factor is fast ice which normally suspends operations on waterways in European U.S.S.R. from 2 to 7 months annually, excluding the ice free southern half of the Caspian Sea. In Asiatic U.S.S.R. the waterways are icebound from 5 to 9 months annually, except certain sections of the Aral Sea-Amudar'ya system in the extreme south, which are icebound only for a period of 1 to 2 months. Operations are also hampered by short periods of drift ice preceding the freeze and following the spring thaw. On some major waterways icebreakers are used to extend the navigation season during both drift-ice periods. Intensive research and experimentation since 1970 is producing new potential methods for combating ice formations. Operations on unregulated waterways in both European and Asiatic U.S.S.R. are hindered by seasonal reductions in water level, extreme flooding, excessive shoals and silting, and shifting navigation channels. Generally, the middle and lower sections of the larger rivers are broad and have meandering courses, multiple channels, and shoals. Seasonal variations have been greatly reduced on those rivers regulated by dams. On open lakes and reservoirs, navigation is occasionally suspended because of strong winds and heavy wave action.

Soviet inland waterway facilities include locks, dams, weirs, safety gates, levees and groins, pumping stations, bridges, navigational aids, and ports.

The heavily cascaded and canalized inland waterway system has about 1,000 regulatory structures for the control of water flow on the 11,600 miles of artificial waterways. The major waterways have slightly more than 30 dams in operation, most of which are large multipurpose dams, eight more in various stages of construction, and several more planned. The significant concentration is in European U.S.S.R. where dams have canalized lengthy sections of the Dnepr and Greater Volga systems, creating stable reservoirs suitable for deep-draft navigation. Many of the dams are earthfill structures. All are bypassed by locks, and several support rail and highway crossings.

The major waterways of the system have over 90 major locking installations (Figure 7), more than 95% of which are located in European U.S.S.R. The well-constructed and efficiently operated locks are mostly

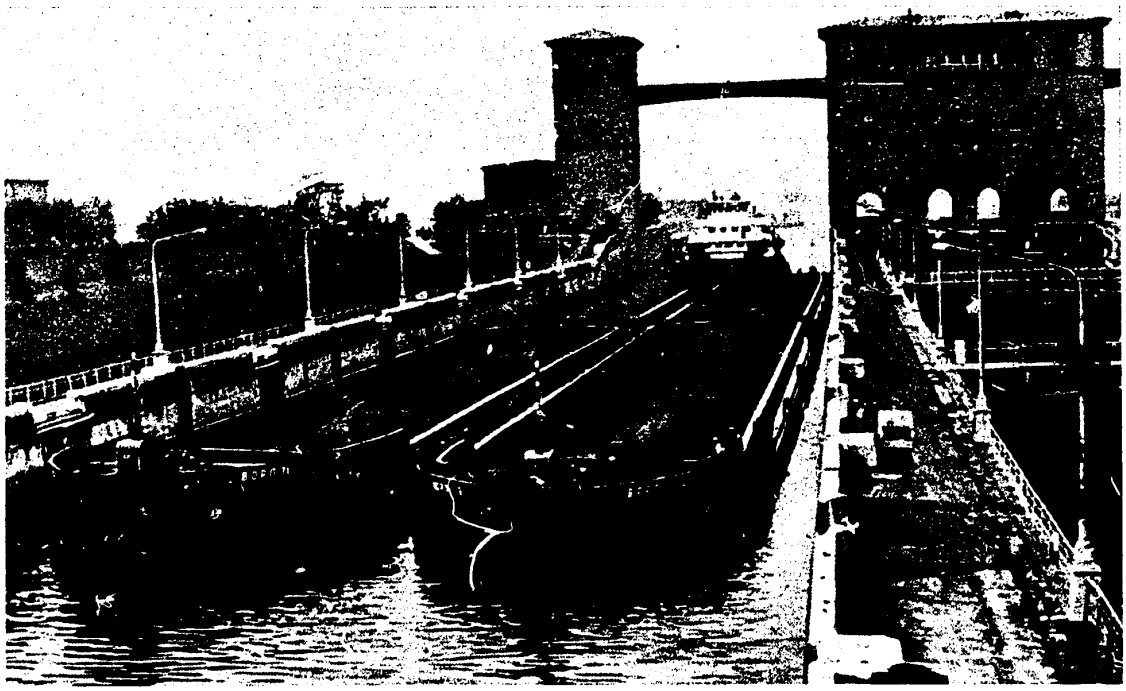


FIGURE 7. Large 15,000-ton pusher barge train entering one or the two chambers at Rybinsk lock on the Volga river (U/OU)

of concrete construction, varying in arrangement from those with single chambers to one installation comprising two parallel rows each with six tandem chambers. The locks vary in size throughout the country but are generally of uniform dimensions on the individual waterways. The gates are of steel, mostly of the miter or lift type. Most locks are also fitted with repair and emergency gates. Lifts range from less than 10 to more than 100 feet, and locking cycles vary from 10 to 15 minutes at single chamber locks to 40 to 50 minutes at multichambered installations. Locking operations are semiautomatic. Most locks are lighted for night operations and provide for one-way lock traffic. Of the major waterways, only the locks on the Volga and Kama rivers of the Greater Volga system allow for two-way traffic with parallel chamber arrangements.

The majority of bridges spanning the waterways are of the fixed span type, but a few have movable spans. Most are of steel or reinforced-concrete construction. None of the bridges impose any major restrictions on normal vessel operations.

Shipping channels on major waterways are marked with an extensive, modern, and well maintained system of floating and shorebased navigational aids for both day and night shipping. Visual navigational aids in use include range lights, beacons, buoys, and lighthouses. The use of radar, ship-to-shore radio and radio-telephone and other audio devices is continually expanding.

Ports serving the waterway system include inland ports and those with a joint maritime/river function. Excluding the maritime/river ports, the system is serviced by 54 major inland ports—36 in European U.S.S.R. and 18 in Asiatic U.S.S.R. Each major port usually consists of a complex of two or more extensively developed facilities, most having at least 1,000 feet of berthing, and each transfers over a million tons annually. All are focal points of industry and transportation, and some are major transshipment centers for maritime, rail, highway, and inland waterway cargo. The majority are adequately equipped with quayage, open and covered storage facilities, mechanical handling equipment, and rail and/or highway clearance facilities. Significant features of most ports include a high degree of mechanization and standardization in cargo handling facilities, the extensive use of floating cranes and specialized bulk transloading devices, the division of berthing facilities into sections for handling specific

cargoes, and the use of floodlights for night operations. Occasional bottlenecks occur at some ports during peak traffic periods due to a shortage of freight cars, inefficient allocation of manpower and equipment, poor planning and supervision in operating techniques and procedures, and insufficient quantities of high-speed cargo handling equipment. Year-round port activity is increasing primarily due to prolonged port operations during the winter period by more intensive use of icebreakers, the establishment of higher labor productivity standards, the expansion of containerized cargo operations, the provision for better coordinated river/rail operations, and the utilization of river craft for winter storage purposes as well as loading craft for the coming navigation season. Ongoing port development includes construction of new ports, enlargement of existing facilities, the installations of heavy-duty cargo-handling equipment, and the introduction of containerized cargo operations. Major new port construction is underway at Balakovo, Novocheboksarsk, Tol'yatti on the Volga, Medvezhyegorsk on Lake Onega, Kambarka on the Kama, Tomsk on the Tom, Surgut on the Ob', Tobol'sk on the Irtysh, and Osetrovo on the Lena. Leading centers of combined maritime/river operations are Kherson, Leningrad, Arkhangel'sk, Kaliningrad, Reni, and Izmail in European U.S.S.R.; and Dudinka, Igarka, and Nikolayevsk-na-Amure in Asiatic U.S.S.R. In terms of location, complexity of the transport function, cargo turnover, and extent of facilities, key inland ports in European U.S.S.R. are Zaporozh'ye, Dnepropetrovsk and Kiyev on the Dnepr; Astrakhan', Volgograd, Saratov, Kuybyshev, Tol'yatti, Ul'yanovsk, Kazan', Gor'kiy, Kineshma, Yaroslavl' and Rybinsk on the Volga; Cherepovets on the Rybinsk reservoir of the Volga-Baltic Waterway; Baku, Krasnovodsk, and Makhachkala on the Caspian Sea; Rostov, Ust'-Donetskiy, and Volgodonsk on the Don, Perm' on the Kama; and the Moscow complex served by the ports of Yuzhnyy, Zapadnyy, and Severnyy. In Asiatic U.S.S.R., key inland ports are Omsk and Tobol'sk on the Irtysh; Surgut, Kolpashevo, and Novosibirsk on the Ob'; Krasnoyarsk (Figure 8) on the Yenisey; Ust'-Kut/Osetrovo and Yakutsk on the Lena; and Komsomolsk-na-Amure, Khabarovsk and Blagoveshchensk on the Amur.

In 1972, Soviet waterway shipping carried 435.4 million short tons of cargo and generated a ton-mile performance of 123.3 billion. The average length of haul was about 300 miles. Passengers carried and passenger-miles in 1971 were 146.5 million and 3.5 billion, respectively. The average journey was 25 miles. Sand, gravel, and other construction materials constitute about 50% of the total freight traffic, rafted and shipped timber and lumber about 25%, and crude oil and petroleum products about 9%. Coal and ores, grain and other foodstuffs, and general cargo comprise the remaining 16%. The traffic patterns of the several systems vary to some degree but are mainly long-haul north-south freight movements. With the exception of rafted timber, dependence on inland shipping is inversely related to the accessibility of other carriers, and the shippers choice of transport services is dictated by urgency rather than economic advantages. In some parts of Asiatic U.S.S.R., however, inland waterway transport is the only medium of bulk haulage available, although, in many cases, other modes are relied upon for through east-west movement. Despite the significant role of the Asiatic waterways, the waterways in European U.S.S.R. handle at least 90% of all waterway traffic, exclusive of the Caspian Sea.

With few exceptions traffic moves continuously day and night on the major waterways, especially in European U.S.S.R. Vessel movement and traffic-flow patterns are subject to controls and prearranged schedules, the strict adherence to which is considered essential. Operations are aided by a regional vessel-cargo dispatcher system and a well developed system of visual and audio navigational aids. Of the 81,600 route-miles equipped with navigational aids, slightly more than 60% also have lighting facilities for night navigation. Cargo vessel types in operation are generally large high-capacity units and include self-propelled barges, barge trains towed astern, pusher trains, and passenger-cargo craft. Self-propelled dry and liquid cargo craft mainly in the 600- to 2,000-ton classes are hauling an increasing proportion of the total waterway cargo traffic. Barge train formations vary according to waterway. On the Greater Volga, pusher barge tows are commonly fleeted two in line in both upstream and downstream operations. Barges towed astern normally comprise 1 to 4 units with a total capacity ranging from 4,000 to 6,000 tons while large pusher trains range from 1 to 4 units of 3,000-tons each with a maximum capacity of 12,000 tons. A notable trend in recent years is the increased utilization of push-towing and self-propelled barge operations, including the increasing use of 2,000-, 2,700-, 3,000-, 5,000-, and 6,000-ton vessels capable of both river and maritime navigation. River/seagoing vessels operate on all major systems except the Aral Sea-Amudar'ya and are providing direct and continuous long-haul movements of cargo from key inland ports deep in the interior to maritime ports in Eastern and Western Europe, and to the Middle and Far East. In addition, they are used to a limited degree

FIGURE 8. Section of Krasnoyarsk port complex on the Yenisey. The complex is the largest in Siberia, and extensive transshipment facilities typify major river junctions with the Trans-Siberian railroad. (U/OU)

in inter-system transfers of cargo, and to achieve maximum utilization some river/seagoing classes are deployed to ice-free maritime routes in the Mediterranean and Black Seas during the winter.

In European U.S.S.R., river/maritime routes originate primarily from interior inland ports of the Greater Volga system northward to maritime ports on the White, Barents, Baltic, and North Seas and southward to maritime ports on the Mediterranean and Black Seas, including river/maritime ports along the Danube River. River/seagoing vessels also regularly operate between ports of the Greater Volga and Dnepr systems. In the Soviet Far East, river/maritime operations stem from Amur river ports across the Sea of Okhotsk to Magadan, the Kuril Islands, and Kamchatka Peninsula as well as south through the Sea of Japan to North Korean and Japanese ports. The northern Siberian waterways operate solely on domestic routes between inland river ports astride the Trans-Siberian Railroad and mining and gas and oil exploitation sites as well as with maritime ports on the Kara, Laptev, and East Siberian Seas.

One of the largest in the world, the inland waterway fleet comprises an estimated 17,200 craft, of which about 14,000 units are in commercial cargo operations, 1,200 in passenger service, and 2,000 in construction and maintenance. About two-thirds of the commercial fleet operates in European U.S.S.R. and the remainder on the Asiatic waterways. Undergoing extensive modernization in recent years, the fleet is fairly well developed and maintained and is generally adequate in numbers and capacity for present traffic demands. The fleet is being standardized and is largely dieselized. There is about a 2:1 ratio between self-propelled and dumb barges. The relatively high-speed, high-capacity passenger fleet includes large numbers of modern hydrofoils

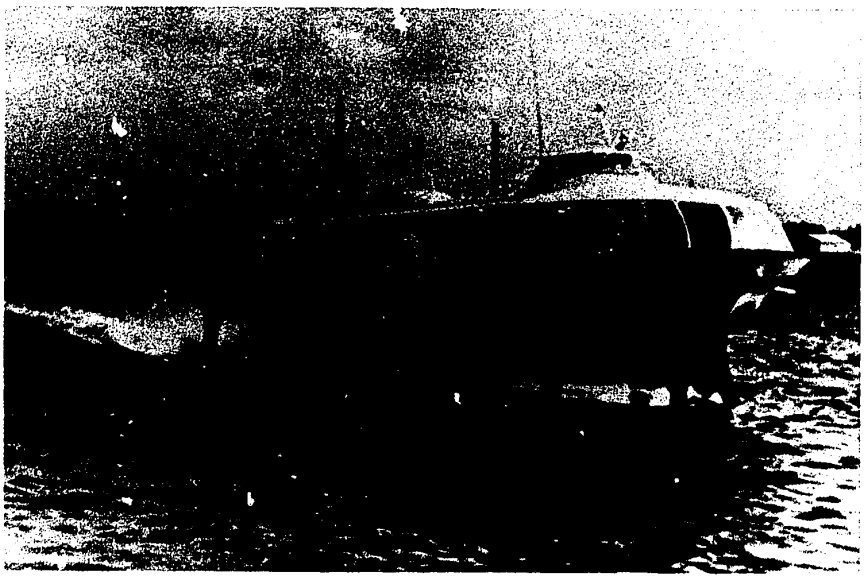


FIGURE 9. Meteor-class 150-passenger-capacity hydrofoil used mostly in short-to-medium-distance interurban passenger service (U/OU)

(Figure 9), capacities of which number 30 passengers or more. About 75% of the total fleet inventory is under the control of the Ministry of the River Fleet, R.S.F.S.R. (Russian Soviet Federated Socialist Republics); the remaining 25% is under the Autonomous Union Republics.

The commercial fleet composition by numbers, capacity, and horsepower is not available. The aggregate carrying capacity of the barge fleet is in excess of 12 million tons. Of the total R.S.F.S.R. fleet in 1968, which is probably representative of the fleet as a whole, the self-propelled dry cargo vessels accounted for 29.5% of the carrying capacity, the self-propelled tankers 24.2%, and the dry- and liquid-cargo dumb barges 46.3%. The average capacities of the larger self-propelled classes were 1,060 tons for dry-cargo craft and 1,530 tons for tankers. The larger dry-cargo and tanker dumb barges averaged 1,000 and 2,630 tons, respectively. Towboats and tugs averaged 363 h.p. for the larger classes, and 250 h.p. for the smaller units. Although 2,000- and 4,000-h.p. diesel towboats (pusher type) are being serially produced, small steam driven units represented 29% of the R.S.F.S.R. towing fleet in 1968.

The Soviet inland waterway fleet is undergoing gradual change in composition, capacity, and operating efficiency. Continuous progress is being achieved on complete dieselization, expanded use of pusher-type towboats (Figure 10), standardization of vessels to a restricted 57 basic classes, introduction of light-weight craft constructed of aluminum or special alloy materials, equipping of craft with modern and sophisticated navigational gear, and the increased acquisition of larger type craft, including those with a limited maritime capability. Introduced in the early 1960's, the river/seagoing fleet operated by the Ministry of the River Fleet of the R.S.F.S.R. now number an estimated 300 to 400 units, most of which comprise six basic classes—the dry cargo carriers, Baltiskiy (2,000-ton) (Figure 11), Sormovskiy (2,300-ton), Morskoy (1,850-ton), and Volga-Balt (2,700-ton); the 2,700-ton mixed dry- and liquid-cargo carrier Nefterudovoz; and the 5,000/6,000-ton tanker Volgoneft. These modern, shallow draft inland-merchant ships are normally loaded to a draft ranging from 10.8 to 11.5 feet. They meet international maritime regulations and are equipped with modern navigational instruments—including radar, ship-to-shore radio and radiotelephone, radar direction finders, remote main-engine and auxiliary machine controls, and echo sounding gear. All are powered by twin diesel engines with ratings from 1,000 to 2,000 h.p. and are constructed with double bottoms and sides, with hulls reinforced for navigation in ice floes. Operating speeds achieved under various river, reservoir, and sea conditions range from 9 to 11 knots. Most units were built in the U.S.S.R.; other suppliers include Czechoslovakia, Hungary, Bulgaria, Romania, and Finland.

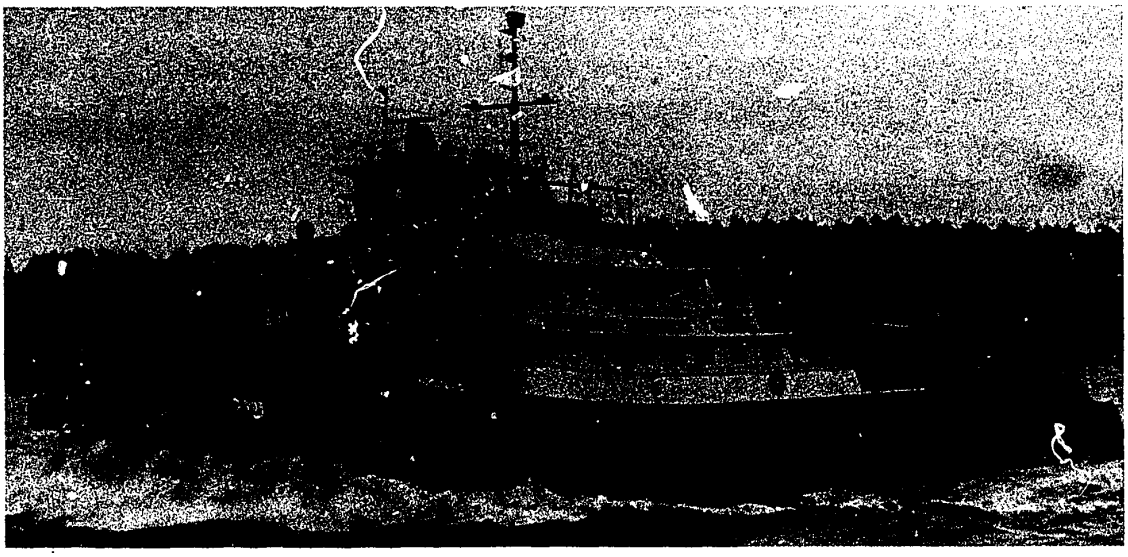


FIGURE 10. Soviet 4,000-horsepower towboat designed for push-towing operations. Pusher units of this class are the newest and largest in use on the inland waterways. (U/OU)

The administrative and operational control of inland waterway transportation is exercised by the Ministry of the River Fleet, R.S.F.S.R., the directorates of river shipping in the Council of Ministers of other union republics, and the Ministry of Maritime Fleet, all of which are directly subordinate to the U.S.S.R. Council of Ministers. The Ministry of River Fleet exercises effective control of 84% of all navigable waterways; 20 of the 28 major inland waterway shipping companies subordinate to this ministry account for 87% of the annual waterway tonnage and 94% of the total cargo turnover. Three companies, operating on the Caspian Sea, the Danube River, and the Aral Sea-Amudar'ya, are subordinate to the Ministry of the Maritime Fleet, and five companies to the directorates of river shipping in the Council of Ministers of the various Union Republics. All companies are organized on river or river basin lines. On the integrated waterway system the vessels of one company also operate within the established territorial jurisdiction of other companies, except for the towing craft. In addition to the transport function,

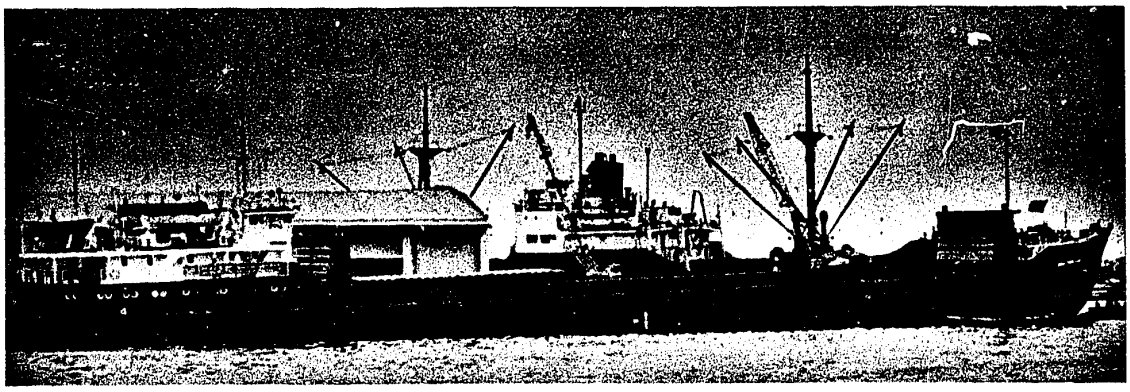


FIGURE 11. Baltiskiy class (Series 781) 2,000-ton dry-cargo river/seagoing vessel, the predominant class in Soviet river/maritime operations. (C)

FIGURE 12. Selected principal inland waterways (S)

ROUTE NO.	LOCATION AND LENGTH (SEE FIG. 33)	PHYSICAL CHARACTERISTICS	OPERATIONS	REMARKS
1	Kherson–Kiyev; 577 route miles via lower Dnepr river.	Mostly regulated stream; channel width 230–650 ft.; safe draft 7–12 ft.; multichanneled with shoaling below 6 reservoirs; low water in Mar., Apr.; high water end of May to early June, rising by 16–18 ft.; tide negligible; current velocity 0.6–2.0 m.p.h. from mouth to mile 60, insig. beyond to Kiyev. Waves to 10.5 ft. on reservoirs; 4 single, one 3-chambered-in-tandem locks; controlling dimensions: 396-ft. length, 58-ft. width, 12-ft. depth over sill; 6 RR. bridges.	Navigation season 8 months; fast ice mid-Dec.–early Mar.; supports self-propelled craft to 2,000 tons and 1,800-ton dumb push barges, which, coupled together, comprise principal tow; heavy traffic density, with up to 20 million tons moved annually; principal cargoes: mineral construction materials, coal, ore, POL.	Most important inland waterway for Ukraine; RR. and maritime transshipping connection with international trade at Kherson, important maritime/river port 17 miles upstream from Black Sea; recently constructed Kanev dam, 1 of 5 on route, now creating reservoir about 490 miles upstream from mouth, will allow passage of 5,000-ton river/sea craft to Kiyev; major inland river ports handling 5–7 million tons annually: Kiyev, Zaporozh'ye, Dnepropetrovsk.
2	Kiyev–Brest; 499 route miles via middle Dnepr river and Pripyat' waterway, consisting of Pripyat' river, Pina river, Dnepr-Bug canal, Mukhovets river.	Composite summit-level route mostly improved stream; channel width at least 60 ft.; safe draft 5 ft. at low water; min. radius of curvature 650 ft.; normal current velocity low, not exceeding 1.3 m.p.h.; Pripyat' river portion generally tortuous with many horseshoe bends; 14 bridges (9 highway, 5 RR.); 2 pipeline crossings; 12 single-chambered locks with controlling dimensions of 260-ft. length, 36-ft. width, 5-ft. depth over sill.	Navigation season 7 months; fast ice mid-Nov.–mid-Mar.; shallows and curves may require 1-way operations on sections Pinsk–Mozyr' on Pripyat' river; accommodates 600–800-ton craft; barge tows usually comprise 1–2 barges; traffic density moderately heavy; principal cargoes: iron ores to Brest for transshipment to Poland via RR. and Polish coal to U.S.S.R.; other cargoes: mineral construction materials, timber.	Waterway important for import/export trade with Poland; shipbuilding and repair facilities at Pinsk; Kiyev is major port; other significant ports: Brest, Mozyr'.
3	Leningrad–Voznesen'ye; 267 route miles via Neva river, Lake Ladoga, Svir river.	Composite waterway consisting of natural stream, lake, regulated stream; safe draft 11–13 ft.; channel width 1,300–4,300 ft.; normal current velocity to 3.5 m.p.h. on Neva river; water level fluctuations 2–10 ft.; structures: 2 single-chambered locks; dimensions: 659-ft. length, 70-ft. width, 19.6-ft. depth over sill; at least 11 bridges, 1 under construction; controlling underbridge vertical and horizontal clearances est. min. 50 ft. and 120 ft. respectively.	Navigation season 7 months; fast ice late Nov.–early May; route supports self-propelled craft up to 6,000-tons; used extensively by river/seagoing vessels in foreign commerce and small naval craft in intersea transfers; strong winds forming seiches to 3 ft. affect operations for short periods; traffic normally heavy; principal cargoes: mineral construction materials, timber, coal, POL, ores; Lake Ladoga bypass canal, 102 route miles long, used by small craft unsuited for lake navigation.	Most important waterway segment for import/export trade; vital link in Greater Volga unified waterway system linking Baltic, White, Black, Caspian Seas; RR. and maritime transshipping connections with international trade at Leningrad, most important maritime/fluvial port on Baltic Sea, handling about 12 million short tons of river cargo annually.
4	Belomorsk–Voznesen'ye; 288 route miles via White Sea canal, Lake Onega.	Composite summer level route consisting of canalized stream, lakes, reservoirs, regulated streams; channel width 118 ft.; safe draft 11 ft.; current velocity insig.; wind waves up to 3 ft. on Lake Onega; 19 locks with controlling dimensions of 470-ft. length, 56-ft. width, 11.5-ft. depth over sill; at least 5 bridges, 15 dams.	Navigation season 6 months; fast ice early Nov.–mid-May; supports 3,000-ton craft including river/seagoing, small naval and coastal vessels; traffic normally heavy; principal cargoes: timber, mineral construction materials, coal, ores.	Important as transient route connecting northern seas with Baltic and central economic regions; Petrozavodsk is major port; other ports of some significance: Medvezh'yegorsk, Belomorsk, a maritime/river facility. Locks to be reconstructed, enlarged to accommodate up to 5,000-ton craft.

FIGURE 12. Selected principal inland waterways (S) *(Continued)*

ROUTE NO.	LOCATION AND LENGTH (SEE FIG. 33)	PHYSICAL CHARACTERISTICS	OPERATIONS	REMARKS
5	Voznesen'ye–Rybinsk; 334 route miles via Lake Onega, Volga-Baltic canal, Rybinsk Reservoir, Volga river.	Mostly natural lake and/or reservoir; canalized stream; channel width 130–133 ft.; safe draft 11–13 ft.; minimum radius of curvature 3,300 ft.; current velocity insig.; continuous dredging necessary on some sections to maintain channel characteristics; 8 locking installations (7 single-chambered, 1 parallel single-chambered locks); controlling dimensions: 660-ft. length, 70-ft. width, 15-ft. depth over sill; at least 4 bridges; controlling underbridge vertical and horizontal clearances est. min. 50 ft. and 70 ft. respectively.	Navigation season 6 months; route accommodates up to 6,000-ton self-propelled barges; storms, high waves interrupt navigation for short periods on lakes and reservoirs; Onega bypass canal, 42 route miles long, available for small craft; traffic density heavy; principal southbound cargoes: timber, mineral construction materials, ore, chemicals; principal northbound cargoes: coal, POL, salt, grain.	Important mainly as transient route connecting central regions with Baltic, White Seas; major ports: Cherepovets, Rybinsk; 1 lock in common with Route 6.
6	Moscow–Rybinsk; 237 route miles via Moscow canal, upper Volga river, Rybinsk reservoir, Volga river.	Composite waterway consisting of land-cut canal, canalized stream, reservoir; channel width 150 ft.; safe draft 12–16 ft.; no significant current velocity; min. radius of curvature 9,800 ft.; 11 locking installations (7 single-chambered, 3 double-chambered in tandem, 1 parallel single-chambered locks); controlling dimensions: 980-ft. length, 98-ft. width, 18-ft. depth over sill; at least 8 bridges; controlling underbridge vertical and horizontal clearances est. at least 50 ft. and 98 ft., respectively.	Navigation season 6.5 months; fast ice mid-Nov.–late April; icebreakers used; route accomodates up to 6,000-ton craft; traffic density heavy; principal cargoes: mineral construction materials, POL, grain, timber, salt; speed restriction of 7.5 m.p.h. on Moscow canal.	Most important waterway connecting Moscow and nearby centers to other major segments of Greater Volga system; major ports: Moscow, Rybinsk; former handles over 12 million tons annually and is country's largest port complex, consisting of Yuzhnyy (S.) Port, Zapadnyy (W.) Port, and Severnyy (N.) Port; 1 lock in common with Route 5; route mileage derived from confluence of Moskva river with Moscow canal.
7	Rybinsk–Kamskoye Ust'ye; 601 route miles via middle, upper Volga river.	Partially improved stream, reservoir; channel width 330 ft.; safe draft 8–13 ft.; normal channel velocity 0.7–1.2 m.p.h.; min. radius of curvature 13,000 ft.; dredging of channel required Gor'kiy–Cheboksary because of shoals, bars, low water levels; 2 parallel single-chambered locks—over sill; at least 4 bridges; controlling underbridge vertical and horizontal clearances at least 75 ft. and 330 ft. respectively.	Navigation season 6.5 months; fast ice mid-Nov.–late April; route capable of supporting self-propelled craft up to 2,700 tons; 5,000- and 6,000-ton self-propelled craft must partially offload to lighters on short section near Cheboksary because of restrictive depths; most densely trafficked waterway segment in U.S.S.R.; principal cargoes: mineral construction materials, timber, ore, chemicals, coal, POL.	Important for serving central economic regions and through connections to other regions; completion of dam at Cheboksary will improve navigation conditions mainly by reducing sailing distance and increasing channel depths; major ports: Rybinsk, Yaroslavl', Kineshma, Gor'kiy, Kazan.

8	Perm–Kamskoye Ust'ye; 562 route miles via middle, lower Kama, middle Volga rivers.	Canalized stream; channel width 260 ft.; safe draft 11–13 ft.; normal current velocity 0.6–1.3 m.p.h.; low water levels mid-Oct., early Nov.; high water early May–mid- or late-July; wide, multichanneled waterway route with occasional shoaling, controllable through dredging; large dams form long consecutive reservoirs; 1 parallel single-chambered lock—1,085 ft. long, 98-ft. wide, est. 12–15-ft. depth over sill; at least 4 bridges; controlling underbridge vertical and horizontal clearances at least 60 ft. and 100 ft. respectively.	Navigation season 6.5 months; ice late Nov.–late Apr.; accommodates self-propelled river/sea vessels up to 2,700 tons and towed or pushed 3,000-ton dumb barges; high waves, storms on reservoirs may cause suspension of traffic for short periods; traffic density heavy; downstream movements far exceeds upstream shipments; principal cargoes, amounting to over 45 million tons annually: timber, POL, mineral construction materials, chemical fertilizers, industrial goods—much of which moves in transit traffic between European U.S.S.R. and Siberia in coordination with RR. transport.	Route provides access to region noted for forestry, extractive, metallurgical industries and along with RR. forms important arterial connection for trans-Ural freight; the Kama, largest tributary of Volga, makes important connections with Belaya and Vyatka rivers; lower Kama dam under construction at Naberezhnyye Chelny, about 165 miles upstream from confluence of Kama with Volga; major port: Perm; other significant ports: Chaykovskiy, Kambarka.
9	Kamskoye Ust'ye–Volgograd; 744 route miles via lower Volga river.	Canalized stream; channel width 330 ft.; safe draft 12–13 ft.; normal current velocity up to 1.2 m.p.h.; broad, multichanneled river interspersed with reservoirs; some dredging below dams necessary to correct channel shifting; 4 locking installations, 1 parallel double-chambered in tandem, 3 parallel single-chambered locks—980-ft. length, 98-ft. width, 18-ft. depth over sill; at least 4 bridges; controlling underbridge vertical and horizontal clearance at least 75 ft. and 650 ft. respectively.	Navigation season 7.5 months; ice early Dec.–mid-Apr.; supports 2,000–6,000-ton self-propelled craft and composite barge trains up to 15,000 tons; high waves, storms on reservoirs may cause suspension of traffic for short periods; traffic density heavy; principal cargoes: timber, mineral construction materials, POL, salt, coal, grain.	Important as high-capacity deep-water transient waterway connecting central regions with Caspian and Black Sea basins; major ports: Ul'yanovsk, Tol'yatti, Kuybyshev, Saratov, Volgograd.
10	Volgograd–Astrakhan; 301 route miles via lower Volga river.	Partially improved stream; channel width 330 ft.; safe draft 11–13 ft.; normal current velocity 0.6–1.2 m.p.h.; extensive mud and sand shoals below Volgograd controlled through dredging; no locks; 1 movable span bridge.	Navigation season 8.5 months; ice mid-Dec.–early Mar.; supports up to 6,500-ton self-propelled craft; principal cargoes: POL, timber, salt.	Transient waterway for Caspian Sea freight to central regions of country and Azov–Black Sea basins; the principal shipping route through low, marshy delta approach from Caspian Sea via Bakhtemir channel with 13–14-ft. draft; water diversion dam with navigation lock under construction N. of Astrakhan; major ports: Astrakhan, Volgograd.

FIGURE 12. Selected principal inland waterways (S) (*Continued*)

ROUTE NO.	LOCATION AND LENGTH (SEE FIG. 33)	PHYSICAL CHARACTERISTICS	OPERATIONS	REMARKS
11	Caspian Sea; about 162,000 sq. miles between lower European and central Asian U.S.S.R.	Natural lake; safe draft at least 23 ft.; continuous falling water levels requires dredging at approaches to Bakhtemir channel and most major ports.	Navigation season 8 months; ice late Nov.–Apr.; S. Caspian generally ice free and open year round; supports up to 9,500-ton self-propelled units and 5,000-ton dumb barges; most larger units of fleet self-contained to Caspian Sea operate because of restricted depths through Volga delta channel, necessitating costly and time-consuming offshore lightering and/or transloading operations; strong winds, high seas interrupt vessel movements and port operations for short periods; principal cargoes: POL, agricultural products, industrial equipment; sizeable amount of passenger traffic; important RR./passenger ferry service Krasnovodsk–Baku, providing E.–W. RR. link.	Largest lake in world serves oil-rich Caspian Basin and provides important link in Soviet transport system by extending important Volga into Caucasus and central Asia including major connection with Iran; major ports: Baku, Krasnovodsk, Makhachkala, Shevchenko; RR. ferry terminal at Shevchenko nearing completion.
12	Volgograd–Rostov; 370 route miles via Volga-Don canal, lower Don river.	Dredged stream, land-cut canal interspersed by large reservoirs; channel width 120–200 ft.; safe draft 8–12 ft.; normal current velocity *insig.*; dredging of shipping channel necessary on shallow Tsimlyansk reservoir and sections of Don, particularly during low water periods; many islands and course meandering on lower Don; 16 single-chambered locks; controlling dimensions 490-ft. length, 59-ft. width, 14.5-ft. depth over sill; at least 9 bridges; controlling underbridge vertical clearance 53 ft.	Navigation season 8 months; ice early Dec.–early Mar.; supports self-propelled craft to 2,000-ton capacity fully loaded and 5,000-ton self-propelled craft partially loaded as low as 54% of capacity; reduced loads of latter necessary because of critical shallows on lower Don; heaviest traffic volume Kalach-na-Donu–Rostov, amounting to 7 million tons annually; principal cargoes: coal, timber, grain, mineral construction materials.	Forms part of militarily and economically significant transport artery interconnecting Black and Azov Seas with other important waterways of Greater Volga system; plays significant role in moving products to and from strategic Donets Basin industrial complex; major ports: Volgograd, Volgodonsk, Ust'-Donetskiy, Rostov, the latter 37 miles upstream from mouth of Don.
13	Novyy Port–Khanty-Mansiysk; 771 route miles via lower Ob' river.	Natural stream, some partially improved stream; channel width at least 260 ft.; safe draft 7–30 ft.; normal curent velocity 1.0–4.2 m.p.h.; river surface width 3,800 ft. to 2.5 mi.; many anabranches, multichanneled, many islands, shifting channels, sand shoals; low water Apr., Sept., Oct.; high water late May–Aug.; no structures; lower Ob' approached from bay by 2 deltaic channels about 100 miles long, northernmost of which is principal shipping lane.	Navigation season 4–5 months; fast ice period late Oct.–mid-June in bay, mid-Oct.–late June on river; normally supports navigation for self-propelled craft up to 2,000-ton capacity and dumb barges to 3,000 tons; violent northerly winds occasionally halt operations; traffic moderate; principal cargoes: timber, foodstuffs, POL, general cargo, mineral construction materials; shipping closely geared to maritime operations in N. and requirements of gas and oil field activity along Taz, Pur, Nyda, Nadym rivers.	Primary transport route where there is almost complete absence of RR., highway facilities; important section of Ob' provides access to sea and maritime shipping lanes of Northern Sea routes; ports of any significance: Khanty-Mansiysk, important river transloading point, Novyy Port, which is minor maritime/fluvial transloading port on Northern Sea route.

14	Khanty-Mansiysk–Novosibirsk; 1,054 route miles via middle Ob'.	Partially improved stream; channel width 130–260 ft.; safe draft 7–10 ft.; min. radius of curvature 650–2,600 ft.; normal current velocity 2.5–3 m.p.h.; river surface width 1,700–4,500 ft.; multichanneled, island studded, shifting sand shoals and channels; numerous sandbars; low water Apr., Sept., Oct.; high water May–Aug.; water levels Novosibirsk—downstream for about 165 miles controlled by Novosibirsk dam: no locks; 3 bridges (2 RR., 1 highway); controlling underbridge vertical and horizontal clearances 40 ft. and 385 ft. respectively.	Navigation season 6 months; fast ice early Nov.–mid-May; year-round navigation made possible Novosibirsk dam downstream for 75–100 miles by increased water temperature and turbulence from released water of dam, 10 miles S. of Novosibirsk; normally supports navigation for self-propelled craft to 2,000-ton capacity and dumb barges to 3,000 tons; 600–1,000-ton self-propelled craft and 2,000-h.p. pusher tug with barge tows to 12,000-tons predominant; traffic normally heavy; volume of freight traffic at least 15 million tons annually; principal cargoes: POL, grain, mineral construction materials, timber, coal, general cargoes.	Novosibirsk, largest port on Ob', major river-RR. transshipment point, site of major shipbuilding, repair yard; Surgut, new large highly mechanized facility supporting oil, gas exploitation, principal recipient of Ob' and Irtysh freight traffic; Kolpashevo, rapidly expanding major port primarily for oil and timber exploitation, is only long-haul mode of transportation available.
15	Khanty-Mansiysk–Omsk; 439 route miles via lower Irtysh.	Mostly natural stream, some partially improved sections; channel width at least 100 ft.; river surface width 1,000–3,000 ft.; safe draft 8–10 ft.; normal current velocity 1–3 m.p.h.; meandering, braided, multichanneled, shifting channels, sand and gravel shoals; dredging required annually; low water Apr., Sept., Oct.; high water June–Aug.; no locks; 4 bridges (3 RR., 1 highway); controlling underbridge vertical and horizontal clearances 50 ft. and 370 ft. respectively.	Navigation season 6 months; fast ice late Oct.–early May; normally supports navigation for 2,000-ton self-propelled craft, 3,000-ton dumb barges; predominant are 600–1,000-ton self-propelled craft and 2,000 h.p. pusher tugs with up to four 3,000-ton barges; traffic very heavy with downstream haulage predominant; estimated annual freight tonnage over 17,000,000 tons; principal cargoes: timber, mineral construction materials, grain, POL, manufactured goods, general cargo.	Most important and heavily trafficked section of Ob'-Irtysh inland waterway system; Omsk, largest port and most important river-RR. transshipment point on Irtysh; site of major shipbuilding and repair yard; Tobolsk, large new river/rail transshipment port primarily developed to supply gas and oil exploitation in Soviet north.

FIGURE 12. Selected principal inland waterways (S) *(Continued)*

ROUTE NO.	LOCATION AND LENGTH (SEE FIG. 33)	PHYSICAL CHARACTERISTICS	OPERATIONS	REMARKS
16	Dudinka–Krasnoyarsk; 1,261 route miles via lower, middle Yenisey.	Mostly natural stream; some partially improved sections; channel width at least 100 ft.; safe draft 7.8–12.5 ft.; normal current velocity 0.6–3.0 m.p.h.; rapids on several stretches of middle Yenisey; river surface width generally 0.6–2.0 miles but narrows to less than 1,600 ft. at rapids; shifting sandbars, shoals; low water Aug.–Oct.; high water May–early Aug.; no locks, 2 bridges (1 RR., 1 highway); controlling underbridge vertical and horizontal clearances are 32 ft. and 450 ft. respectively.	Navigation season 3–7 months; fast ice mid-Oct.–early June; normally supports self-propelled craft up to 10,000 tons on maritime/fluvial section of lower Yenisey (Dudinka–Igarka), 2,000-ton self-propelled barges and 3,000-ton dumb barges on fluvial section (Igarka–Krasnoyarsk); typical barge tow is 2,000-h.p. pusher tug and four 3,000-ton barges; partially loaded 5,000-ton river/seagoing craft operate to Krasnoyarsk; upstream tow assistance and 1-way operations near mile 995 and mile 1,319 of middle Yenisey due to rapids and narrows; traffic normally heavy in both directions and closely geared to maritime operations to N. and Trans-Siberian RR. to S.; 20-ton container route Krasnoyarsk–Dudinka; principal cargoes: POL, timber, manufactured and agricultural goods, ores, construction materials, general cargo.	Only adequate N.–S. long-haul surface transport route in region undergoing extensive mining and industrial development, including Norilsk mining and industrial complex; important maritime/fluvial ports: Dudinka, Igarka, 261 and 423 route miles upstream from mouth of Yenisey at entrance to Kara Sea; Krasnoyarsk, major inland waterway port astride Trans-Siberian RR., is site of large shipbuilding and repair facilities; Igarka is important timber transshipment port.
17	Tiksi–Ust'-Kut/Osetrovo; 2,100 route miles via Lena delta, Lena river.	Mostly natural stream, some improved stream; channel width 100–265 ft.; safe draft 6.5–10.5 ft.; current velocity 0.5–6.0 m.p.h.; river surface width 600–2,500 ft.; multichanneled; shifting channels and shoals, sandbars, numerous islands; low water late Oct.; high water late May–late July; no structures.	Navigation season 3–6 months; fast ice mid-Sept.–mid-June; normally supports navigation for self-propelled craft up to 2,150-ton capacity and dumb barges up to 3,000-ton capacity; vessel movements occasionally interrupted for short periods by dense fog, strong winds, rough water; traffic heaviest Yakutsk–Ust'-Kut with downstream shipments predominant; through E.–W. shipments dependent on transshipment/transloading to and from maritime craft in N. and branch line of Trans-Siberian RR. in S.; principal cargoes: POL, timber, coal, agricultural and industrial products, containerized materials.	Most important N.–S. transport route in E. Siberia; major port, shipbuilding/repair facilities available at Yakutsk, Ust'-Kut/Osetrovo; Tiksi, maritime port on Northern Sea Route, is important maritime/river transshipment site; Lena Steamship Co. is responsible for port facilities on Yana, Indigirka, Kolyma rivers including diamond and gold mining activities along these rivers; river/sea craft of Lena transload to shallow draft vessels at points near river mouths.

18	Nikolayevsk–Khabarovsk; 577 route miles via lower Amur.	Partially improved stream; channel width 360 ft.; safe draft 12–17 ft.; normal current velocity 1.9 m.p.h.; river surface width 0.4–3 miles; multichanneled; shifting channels, many islands, extensive gravel and sand shoals; low water Apr., Oct.; high water July, Aug. frequently accompanied by intensive flooding; no locks; 1 bridge; vertical and horizontal underbridge clearances 50 ft. and 400 ft. respectively; combined RR.-highway bridge under construction at Komsomol'sk.	Navigation season 6 months; fast ice early Nov.–mid-May; pilotage compulsory; normally supports navigation for self-propelled craft to 2,000-ton capacity and dumb barges to 3,000 tons; operations occasionally impeded by summer fog, monsoonal flooding for short durations; traffic density heavy; principal cargoes: POL, coal, grain, timber, fish, salt, bulk construction materials, general cargo.	Most important section of Amur system; shipping associated closely with RR., maritime transshipment operations; Nikolayevsk is principal upriver terminus of maritime navigation; important river-RR. pipeline transshipment effected at major river ports of Komsomol'sk and Khabarovsk and river/maritime transshipment at Nikolayevsk; Komsomol'sk site of major naval shipbuilding yard; Khabarovsk, the largest port, is principal upstream river/sea terminal.
19	Khabarovsk–Blagoveshchensk; 587 route miles via middle Amur.	Partially improved stream; channel width 260–980 ft.; safe draft 10.5–21.5 ft.; normal current velocity 3.7 m.p.h.; river surface width 1,500–5,000 ft.; low water mid-Feb. through March; high water Aug., Sept.; critical shoals near Soyuznoye, Konstantinovskoye; lower and upper sections: multichanneled, many islands, sloping sandy clay banks; midsection: relatively narrow river bed, few islands, steep banks; no structures.	Navigation season 6 months; fast ice 15 Nov.–5 May; normally supports navigation for self-propelled craft to 2,000-ton capacity and dumb barges to 3,000-tons; operations occasionally impeded by shifting channels, extensive shoals; traffic normally heavy; principal cargoes: coal, grain, bulk construction materials, general cargo.	Shipping associated closely with RR. transshipment operations; Blagoveshchensk, major port, RR./river transshipment point and upstream river/sea navigation terminus; site of major river shipbuilding yard; route forms part of Sino-Soviet border.
20	Iman–Khabarovsk; 233 route miles via Ussuri, Iman rivers.	Partially improved stream; channel width at least 100 ft.; safe draft 3–6.5 ft.; normal current velocity 2.4 m.p.h.; river surface width 1,600–3,300 ft.; braided, multichanneled; many islands; shifting shoals; low water June, Aug.; high water May, July, Sept.; no structures.	Navigation season 7 months; fast ice mid-Nov.–mid-April; normally supports navigation for self-propelled craft to 500–600-tons; operations interrupted for short periods by intense flooding after monsoon rains; traffic currently light due to Sino-Soviet dispute; principal cargoes: coal, general cargo.	Route forms Sino-Soviet border; Iman is small river/RR. transshipment port.

each company is responsible in its area for operating most shipbuilding and repair yards, port facilities, personnel training schools, and the fleet. There are 17 basin/canal administrations, under the control of the Ministry of River Fleet, R.S.F.S.R. and the Union Republics, which maintain all waterway routes and associated structures such as locks and dams.

Earlier development plans for the waterways are gradually being realized with the completion of new dams, river dredging, the development of new ports and repair facilities, the enlargement of existing facilities, and the increasing use of push towing and large river/sea craft. In port operations the emphasis is on mechanization and containerization along with port construction and rehabilitation.

The completion of long-range programs in European U.S.S.R. will provide deep-draft navigation for river/seagoing vessels up to 6,000-ton capacity between the Black, Caspian, White, and Baltic Seas. Dams with bypass locks are under construction at Kanev on the Dnepr, Cheboksary and Volzhskoye on the Volga, Nikolayevskaya on the lower Don, Naberezhnyye Chelny on the Kama, and at Takhia-Tash and near Pitnyak on the Amudar'ya. Locks are being reconstructed and enlarged at Zaporozh'ye on the Dnepr, Svir'stroy on the Svir and Sheksna on the Volga-Baltic Canal, and locks on the White Sea Canal. Plans also call for the reconstruction of the two locks at Gorodets on the Volga.

The Siberian rivers are to an increasing extent supplementing the Northern Sea Route in support of establishments above the Arctic Circle. Work on the Krasnoyarsk shiplift on the Yenisey was scheduled for completion in 1973. The 2,000-ton-capacity inclined shiplift is to be the largest in the world. However, technical problems and testing will delay the opening until 1974 at the earliest. Dams are under construction at Zeya on the Amur system, Shushenskoye on the Yenisey, and near Ust'-Ilimsk on the Angara. Extension of the Karakum Canal on the Aral Sea-Amudar'ya system beyond Ashkhabad to the Caspian Sea is continuing. To arrest the rapidly falling water level of the Caspian Sea, several plans are in the investigative stage involving diversion of the Pechora and/or the Sukhona river flows from north to south by means of a series of dams and canals which will increase the water flow via the Kama and Volga rivers southward to the Caspian Sea.

Characteristics of selected principal inland waterways providing 11,857 route miles of primary navigation are tabulated in Figure 12, the routes are shown on Figure 33. Although representing only 13% of total Soviet navigability, the selected waterways account for over 90% of the yearly waterway tonnage. They include most of the important high-capacity through routes between major production and/or strategic areas and all high-capacity routes that make significant international connections.

F. Pipelines (S)

The development of pipeline systems in the Soviet Union has been one of the most important issues associated with the continued expansion of petroleum and natural gas industries. Most consumers now have a far greater preference for liquid and gaseous fuels in place of coal, and petroleum production has been accelerated to satisfy the increased domestic demand and to earn foreign exchange credits. The difficulty of transporting petroleum and natural gas over the vast distances and difficult terrain encountered in the U.S.S.R has not been completely solved. The Soviets lack the technology and modern oilfield and pipeline equipment needed to fully exploit their extensive reserves of petroleum and natural gas and are trying to bridge this gap by procuring assistance from Western sources.

As of January 1973, the U.S.S.R. had about 74,800 miles of pipelines: 23,000 miles for crude oil; 5,800 miles for refined products; and 46,000 miles for natural gas.

Plans call for the construction of an additional 2,300 miles of crude oil pipelines by the end of 1973. The major Soviet oil pipelines can be grouped into seven systems, five large and two secondary. A primary effort is being made to complete the large-diameter CEMA (Friendship) pipeline system which transports crude oil from the Urals-Volga oilfields to refineries in western U.S.S.R, Poland, East Germany, Hungary, and Czechoslovakia. The first line of this 2,700-mile pipeline system became operational in 1956, but growing oil requirements in Eastern Europe called for the doubling of the system. This work, scheduled for completion in 1973, will more than double the carrying capacity of the CEMA system. A major crude oil pipeline system over 1,600 miles in length was recently completed to bring oil from fields near the Ob' river to refineries at Omsk, Tomsk, and Angarsk. Another pipeline from the Ob' river fields is under construction to Al'met'yevsk and Kuybyshev. Construction of a crude oil pipeline between Irkutsk and Nakhodka in the Soviet Far East has been planned and is likely to be built, but its construction seems dependent upon the acquisition of equipment and technical assistance from Japan.

FIGURE 13. Selected major petroleum pipeline systems (C)

TERMINALS		LENGTH	DIAMETER	PRODUCTS TRANSPORTED	CAPACITY	REMARKS
From	To					
		Miles	*Inches*		*Bbl./day*	
CEMA (Friendship) system:						
Kuybyshev	Unecha	823	40	Crude	800,000	Main CEMA trunk line.
Do.	*....do*	823	48	*....do*	*1,200,000	Parallel line.
Unecha	Mozyr	183	32	*....do*	540,000	
Do.	*....do*	183	*na*	*....do*	*na*	Parallel line, under construction; expected completion 1973.
Mozyr	Brest	297	24	*....do*	240,000	
Do.	*....do*	297	*na*	*....do*	*na*	Parallel line; reported completed 1972.
Do.	Uzhgorod	453	21	*....do*	160,000	
Do.	*....do*	453	28	*....do*	*320,000	Parallel line.
Unecha	Polotsk	279	28	*....do*	360,000	
Do.	*....do*	279	*na*	*....do*	*na*	Parallel line, under construction; expected completion 1973.
Polotsk	Ventspils	341	25	*....do*	240,000	
Almetyevsk	Kuybyshev	170	32	*....do*	340,000	Feeds crude oil into CEMA system.
Do.	*....do*	170	*na*	*....do*	*na*	Parallel line.
Do.	*....do*	170	*na*	*....do*	*na*	*Do.*
Uzen	*....do*	926	40	*....do*	600,000	Feeds crude into CEMA system. Pipeline heaters located every 50 miles because of high-viscosity oil being transported.
Kuybyshev	Rovno (via Bryansk)	1,120	21	Products	*165,000	Extension planned to Poland or Czechoslovakia border.
Unecha	Ventspils	621	24	*....do*	240,000	Transports diesel fuel, crude oil.
Tuymazy	Kuybyshev	220	14	Crude	83,000	
Do.	*....do*	220	32	*....do*	340,000	Parallel line.
Trans-Siberian system:						
Almetyevsk	Tuymazy	62	21	*....do*	151,000	
Do.	*....do*	62	28	*....do*	340,000	*Do.*
Tuymazy	Omsk	827	21	*....do*	120,000	
Do.	*....do*	827	28	*....do*	300,000	*Do.*
Do.	*....do*	827	32	*....do*	380,000	*Do.*
Ufa	*....do*	740	15	Products	114,000	Parallels Tuymazy–Omsk line.
Do.	*....do*	740	20	*....do*	190,000	Parallel line.
Omsk	Irkutsk	1,500	28	Crude	340,000	
Anzhero-Sudzhensk	*....do*	*900	40/48	*....do*	*na*	Under construction; expected completion 1973. Parallels previous line.
Omsk	Novosibirsk	432	20	Products	190,000	
Novosibirsk	Chita	1,575	*na*	*....do*	*na*	Planned.
Irkutsk	Nakhodka	2,188	48	Crude	*na*	Planned; construction dependent upon Japanese aid.

Footnotes at end of table.

FIGURE 13. Selected major petroleum pipeline systems (C) (*Continued*)

TERMINALS				PRODUCTS		
From	To	LENGTH	DIAMETER	TRANSPORTED	CAPACITY	REMARKS
		Miles	*Inches*		*Bbl./day*	
Tyumen system:						
Ust-Balyk	Omsk	816	40	Crude	900,000	
Aleksandrovskoye	Ust-Balyk	156	28	*do*	*na*	
Do	Anzhero-Sudzhensk	621	48	*do*	1,500,000	
Do	Almetyevsk (via Kurgan)	1,140	48	*do*	*na*	Under construction; expected completion 1973.
Do	Kuybyshev	*1,430	56	*do*	*na*	Planned; expected completion 1976.
Shaim	Tyumen	267	21	*do*	140,000	
Central Asian system:						
Omsk	Pavlodar	250	32	*do*	151,000	
Pavlodar	Chimkent	*1,000	24	*do*	*na*	Under construction; dual 24-in. pipelines; expected completion 1975.
Nebit-Dag	Chardzhou	600	*na*	*do*	*na*	Planned.
Chimkent	*do*	450	*na*	*do*	*na*	*Do.*
Northwestern system:						
Almetyevsk	Gorkiy	360	21	*do*	160,000	
Do	*do*	360	32	*do*	480,000	Parallel line.
Do	*do*	360	32	*do*	*480,000	*Do.*
Do	*do*	360	*na*	*do*	*na*	*Do.*
Gorkiy	Yaroslavl	245	28	*do*	340,000	
Do	*do*	245	*na*	*do*	*na*	*Do.*
Yaroslavl	Kirishi	*320	*na*	*do*	*na*	
Kirishi	Leningrad	*60	*na*	Products	*na*	
Gorkiy	Ryazan	260	28	Crude	340,000	
Do	*do*	260	*na*	*do*	*na*	*Do.*
Ryazan	Moscow	125	24	*do*	240,000	
Do	*do*	125	16	Products	85,000	
Do	*do*	125	*na*	*do*	*na*	
Voy-Vozh	Ukhta	100	*na*	Crude	*na*	
Ukhta	Yaroslavl	600	*na*	*do*	*na*	Under construction; expected completion 1973.
Caucasus system:						
Baku	Batumi	546	10	*do*	34,000	
Do	*do*	515	28	*do*	*na*	
Do	*do*	552	*na*	Products	*na*	
Groznyy	Dnepropetrovsk	700	*na*	*do*	*114,000	
Far Eastern system:						
Okha	Komsomolsk-na-Amure	390	12	*do*	63,000	
Do	*do*	390	17	*do*	*na*	Parallel line.
Komsomolsk	Khabarovsk	181	*na*	*do*	*na*	

na Data not available.

FIGURE 14. Selected major natural gas pipeline systems (U/OU)

TERMINALS		LENGTH	DIAMETER	CAPACITY	REMARKS
From	To	*Miles*	*Inches*	*Cu. m./day*	
Northern system:					
Nadym	Ukhta	*650	56	*na*	Under construction; expected completion 1976.
Novyy Port	Salekhard	*635	*na*	*na*	Planned.
Vuktyl	Ukhta	119	40	*na*	
Ukhta	Torzhok	857	48	41,000,000	Main trunk line of "Northern Lights" system.
Do	*....do*	857	48	*na*	Parallel line.
Do	*....do*	857	56	*na*	Parallel line; reported under construction; completion *na*.
Do	*....do*	857	56	*na*	Parallel line; planned.
Kotlas	Arkhangelsk	*300	*na*	*na*	Under construction; completion *na*.
Nadym	Punga	435	48/56	*na*	
Do	*....do*	435	*na*	*na*	Parallel line; under construction; expected completion 1974.
Punga	Serov	*270	32	17,800,000	
Do	*....do*	270	*na*	*na*	Parallel line.
Serov	Nizhniy Tagil	143	40	*na*	
Nizhnyaya Tura	Perm	186	40	25,000,000	
Messoyakhskaya	Norilsk	183	28	*na*	World's northernmost pipeline.
Do	*....do*	183	*na*	*na*	Parallel line; reported under construction; completion *na*.
Central Asian system:					
Bukhara area gasfields	Nizhniy Tagil (via Chelyabinsk)	1,558	40	29,000,000	"Bukhara-Urals" pipeline.
Do	Chelyabinsk	1,238	40	29,000,000	Parallel line.
Do	Alma-Ata (via Chimkent)	1,150	20/28	*na*	
Do	*....do*	1,150	40	*na*	*Do.*
Do	*....do*	1,150	*na*	*na*	Parallel line; reported under construction; completion *na*.
Do	Moscow	2,000	40	*29,000,000	"Central Asia-Center" pipeline.
Do	*....do*	2,000	40	*29,000,000	Parallel line.
Koturdepe	Moscow (via Beyneu, Ostrogozhsk)	1,558	40/48	*65,000,000	Third "Central Asia-Center" pipeline: under construction; expected completion late 1973.
Shatlyk gasfield	Moscow (via Khiva and Ostrogozhsk).	2,250	56	*82,000,000	Fourth "Central Asia-Center" pipeline; under construction; expected completion late 1973.
Kelif	Bukhara	*250	*na*	*na*	Brings natural gas from Shibarghan, Afghanistan.
Do	Dushanbe	190	32	*na*	Under construction; expected completion 1973.
Ashkhabad	Mary	230	*na*	2,000,000	

Footnotes at end of table.

FIGURE 14. Selected major natural gas pipeline systems (U/OU) (*Continued*)

TERMINALS		LENGTH	DIAMETER	CAPACITY	REMARKS
From	To				
		Miles	*Inches*	*Cu. m./day*	
Western system:					
Dashava area gasfields	Soviet-[illegible]	63	12	*na*	
Do	*....do*	63	28	12,500,000	
Do	Soviet-Czech border	115	32	*na*	
Do	*....do*	115	*na*	*na*	Parallel line; under construction; expected completion 1973.
Do	Kiev	321	20	12,500,000	
Do	Serpukhov	760	20	12,500,000	
Ivatsevichi	Riga	324	28	*na*	
Torzhok	Minsk	*350	*na*	*na*	
Moscow	Leningrad (via Torzhok)	*400	28	12,500,000	
Do	*....do*	*400	40	*na*	
Leningrad	Tallin	*215	*na*	*na*	
Do	*....do*	*215	*na*	*na*	
Novgorod	Riga	*300	*na*	*6,850,000	
Leningrad	Soviet-Finland border	95	*na*	*na*	Planned; expected completion 1973.
Southern system:					
Shebelinka	Bryansk (via Orel)	338	28	12,500,000	
Do	Nikolayev	310	28	11,000,000	Double pipeline to Dnepropetrovsk.
Do	Ostrogozhsk	150	40	29,000,000	
Do	Voroshilovgrad	160	40	29,000,000	
Nikolayev	Kishinev	170	*na*	*na*	
Stavropol area gasfields	Moscow	813	28	12,500,000	
Do	*....do*	813	28/32	17,800,000	Parallel line.
Leningradskaya area gasfields	Serpukhov (via Rostov)	650	40	29,000,000	
Do	Rostov	63	32	17,800,000	
Do	*....do*	63	32	17,800,000	*Do.*
Baku	Mozdok	480	20/28	*na*	
Stavropol	Groznyy	360	20/28	12,500,000	
Far Eastern system:					
Khampa	Tas-Tumus	125	21	4,700,000	
Tas-Tumus	Yakutsk	250	21	4,700,000	
Okha	Korsakov	620	26	*na*	Planned.
Yakutsk	Nakhodka	*1,500	*na*	*na*	*Do.*

na Data not available.
*Estimated.

The widespread use of large-diameter pipe has substantially aided the exploitation of gasfields, but the long distances between gas-producing areas and the primary consuming centers have put a severe strain on Soviet pipe manufacturers. Nevertheless, long-distance large-diameter trunk pipelines are being built. The third and fourth strings of the Central Asia-Moscow gas pipeline system use 48-inch and 56-inch pipe, and the third and fourth strings of the "Northern Lights" gas line, which will bring natural gas from northwest Siberia to Moscow, is to be of 56-inch pipe.

Tabulated details of selected crude oil, refined products, and natural gas pipelines are given in Figures 13 and 14; the pipeline systems are shown on Figure 34.

G. Ports (S)

The U.S.S.R. has 62 major ports, 122 minor ports of some significance, and numerous other ports too small to be of more than local importance. The major and minor ports are distributed among the following four coastal maritime areas as follows:

	Major	Minor
Black Sea coast	17	23
Baltic coast	12	24
Pacific coast	15	55
Arctic coast	18	20

Each maritime area has its own merchant and naval fleets and operates its own port system. The Baltic and Black Sea areas have the greatest concentrations of ports and port activity, and most U.S.S.R. maritime trade is carried on from there; the ports in these areas serve heavily industrialized and populated regions and have the best rail, road, inland waterway, and cross-country pipeline clearance facilities.

With the exception of Leningrad, the larger Soviet commercial ports do not compare in size or extent of facilities with the major ports of other leading maritime nations. Inadequacies such as the lack of deep-water berths and approaches, lack of oil bunkering and storage terminals, and lack of railroad cars have at times hampered port operations and caused delays. However, the U.S.S.R is striving to improve the situation to better meet the needs of their growing merchant marine. They recently inaugurated container service in a few ports—the method for speeding up cargo-handling operations using internationally standardized van-sized boxes.

Maritime shipping and the ports occupy a key place in the Soviet transportation system. In many instances the Soviets have found it more economical to move their freight by sea rather than overland, even though the sea distance might be twice as long via other means.

Soviet ports still rely heavily [illegible] cargo transfer between railroad cars an[illegible] interruption to the rail service adv[illegible] operations. Most cargo is handled a[illegible] he wharves, and little lightering is ca[illegible] nchorages or moorings. Rapid-handling [illegible] anes are used extensively; ship's gear is seldom employed. Many Soviet ports, and particularly those of a naval character or those where sensitive military activities are performed, are not open to non-Communist shipping.

U.S.S.R. ports are affected more by weather and climate than those of any other large maritime power—ice constituting the most serious obstacle. Almost half the coastal waters are unnavigable for part of the year, and many ports are closed during winter. The most favorable climatic conditions exist in the Black Sea, where the ports are usually operational year round. Most ports are predominantly commercial in nature, only a few being exclusively naval; many commercial ports, however, provide some degree of support to the naval forces as operating bases or shipbuilding/ship-repair centers.

The Black Sea area, site of major European U.S.S.R. transport facilities, handles about 50% of the total seaborne trade. Most post-World War I port development in the U.S.S.R. has taken place in this area. Several ports have been considerably improved with new and deeper wharves, new storage terminals, ship-repair facilities, and handling equipment. Il'ichevsk, a fairly large [illegible] is newly built. Novorossiysk, Odessa (Figure 15), and Il'ichevsk are the most significant Black Sea c[illegible]nercial ports, together handling about 40 million tons of cargo annually. One of the largest supertanker terminals in Eurasia is located at Novorossiysk. N[illegible]layev is the largest, most important shipbuilding [illegible]enter in the area, followed by Kerch and Kherson. The best commercial ship-repair facilities are at Odessa and Il'ichevsk. Sevastopol/Balaklava has the finest natural harbor in the Black Sea and is the area's principal naval base, headquarters of the Soviet Black Sea Fleet, and the most important naval ship-repair and supply port; several other ports have small logistical support bases or minor naval facilities. Black Sea naval ports provide logistic support for maintaining Soviet naval presence in the Mediterranean Sea. Zhdanov is a principal exporter of coal, and Novorossiysk, Batumi, Feodosiya, and Tuapse are primarily oil-shipping

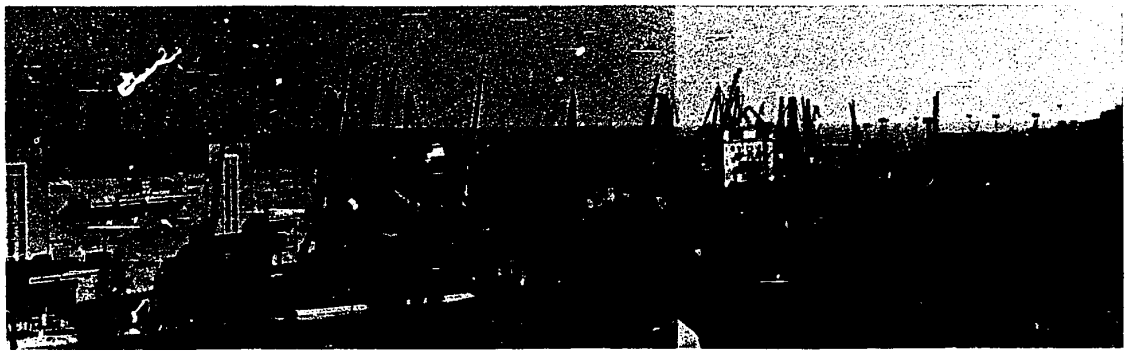


FIGURE 15. Odessa is an important commercial port and significant industrial center on the Black Sea and also a secondary naval operations base. (C)

ports. Kerch and Poti are mainly ore-shipping ports, while Yalta, Sochi, and the minor port of Sukhumi are noted health resorts. Reni and Izmail, in addition to Kherson, are important exchange ports for the transshipment of cargoes between oceangoing and river vessels. Ports open to non-Communist shipping are Batumi, Novorossiysk, Zhdanov, Odessa, Il'ichevsk, Tuapse, Poti and the minor port of Sukhumi. Most military and commercial cargoes destined for Cuba, North Vietnam, or Egypt and other Arab countries originate from Black Sea ports.

The Baltic Sea plays an extremely important role in the Soviet Union's maritime shipments. It occupies second place among the seas of the U.S.S.R. in total volume of freight turnover. Especially significant is its role in foreign trade. Baltic seaports handle up to 20% of export cargo and over 30% of import cargo passing through seaports of the Soviet Union. In this regard the Baltic Sea surpasses all other seas in the U.S.S.R. Petroleum and petroleum products, timber, coal, coke, metals, machinery and equipment, and grain predominate in shipments over the Baltic Sea. Leningradskaya Oblast is the Soviet Union's most highly developed region in an economic sense and the most important on the Baltic Sea. Of distinction in the oblast's industry are shipbuilding, machine building, and the aluminum, chemical, oil-refining and cellulose-paper industries. Leading to Leningrad, second in freight turnover and the most complex transportation center in the U.S.S.R., are 12 railroad trunk lines, 10 major highways, and some sea and river routes, pipelines, and air routes. Ventspils, the largest Baltic port in respect to freight turnover, is a specialized petroleum port (about 90% of its freight turnover is petroleum and petroleum products). Klaypeda, an important industrial center, is the locale of shipbuilding and ship-repair plants, cellulose-paper and fish processing combines, and other industrial enterprises. Additionally, Klaypeda occupies second place in the Baltic after Ventspils in the export of petroleum and petroleum products. Riga is a major seaport with year-round navigation. Coal, petroleum and petroleum products, various ores, grain, sugar, and cotton predominate in the port's freight turnover. Tallin is a large industrial center. Electrical engineering, radio engineering, instrument making, shipbuilding and ship-repairing, cellulose-paper, and light and food industries have been developed in the city. Kaliningrad is the largest city in Kaliningradskaya Oblast. There are machine building, fish processing, and other enterprises in the city. An oceangoing fishing and refrigerator fleet and a whaling fleet are based there. Kaliningrad is a naval headquarters, and Baltiysk is the principal naval operating base for the Baltic Fleet. The Kronshtadt naval base guards the approaches to Leningrad. Riga, Liepaya and Tallin are important naval bases. Vyborg and Pal'diski are small naval bases. Ports open to non-Communist shipping are Leningrad, Klaypeda, Ventspils, Riga, Tallin and Vyborg.

In the Pacific area over 90% of the port facilities are located in southeast Siberia, in a maritime zone extending from the Amur river south to the North Korean border. This area is served by the Trans-Siberian railroad and the Amur river system, and several of its ports can be kept open year round. Vladivostok and nearby Nakhodka (Figure 16) lie close to Japan, Communist China, and North Korea, and they dominate in carrying on foreign trade in the area: these ports are also supply points for Soviet Far East coastal bases and garrisons; reception points for coal, ores, minerals, petroleum, timber, and furs; and

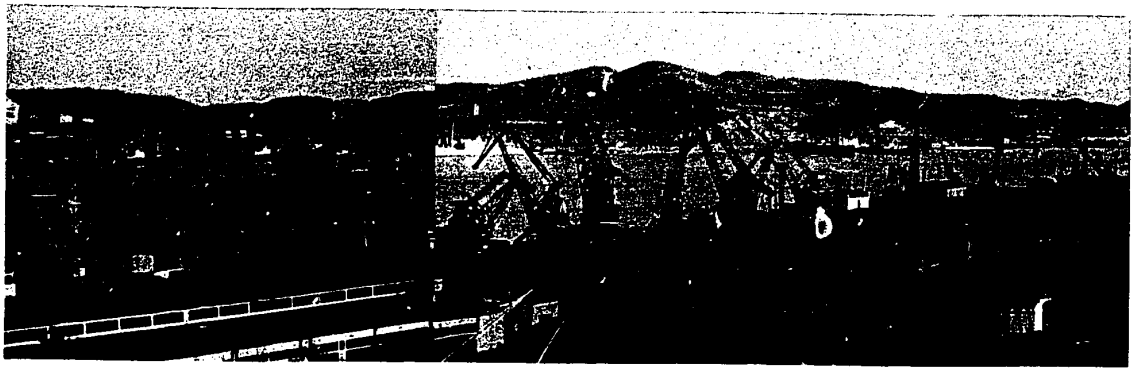


FIGURE 16. Nakhodka, the largest commercial port in the Soviet Far East, is open to non-Communist shipping and is served by the Trans-Siberian railroad. (C)

large fish-processing centers. Nakhodka, built since World War II, is now the largest commercial port in the Soviet Far East. Vladivostok—the largest port, naval base, and ship-repair center—is also an important commercial port and headquarters of the Soviet Pacific Fleet. Other ports of significance are Petrovka, the Zaliv Strelok complex, and Sovetskaya Gavan', all of naval importance—the latter also the site of commercially important Vanino; Nikolayevsk-na-Amure, gateway to the Amur river; and Mago and Lazarev, timber exporting ports. On Sakhalin the largest port is Korsakov; Kholmsk and Nevel'sk are fishing and coal-shipping ports, and Moskal'vo is a crude-oil shipping terminal. Northeast Siberia has three significant ports; Petropavlovsk-Kamchatskiy, an important naval base and operating center for missile-range instrumentation ships; Magdan, serving an important mining region; and Provideniya, the eastern terminus of the North Sea Route. Petropavlovsk-Kamchatskiy is open year round, but the other ports in northeast Siberia are closed for several months of the year. Nakhodka is the only major Soviet Pacific port open to non-Communist shipping; however, Japanese ships occasionally call at Kholmsk, Mago, Lazarev, and several minor ports.

Except for Murmansk, Severodvinsk, Severomorsk and Arkhangel'sk, the Arctic major ports are minor in size compared to the other Soviet maior ports, but because of their extreme strategic nature, several of these Arctic ports are covered as major ports.

Soviet Arctic ports lie in three distinct zones, based on ice conditions and geographic factors. The first zone, between the Norwegian border and the White Sea, is warmed by a branch of the Gulf Stream and is comparatively ice free, thus leaving the ports generally open year round. Within this zone is Murmansk, which is one of the two largest Arctic commercial ports, the western terminus of the North Sea Route, the largest fishing base in the U.S.S.R., and an important naval ship-repair center as well. Murmansk ships equipment and supplies to polar stations, ports, mining centers, and air bases on the Northern Sea Route and in the Far East and receives minerals and timber from other Northern Sea Route ports. Naval ports include Severomorsk and Polyarnyy which are in the same inlet with Murmansk; and Pechenga, Iokanga, and a number of recently constructed ports in bays along the coast. Severomorsk is the site of headquarters for the Soviet Northern Fleet. The second zone, the White Sea, is closed by ice for as much as 6 months annually. Within this zone are Arkhangel'sk, equaling Murmansk in commercial importance, a river-sea transshipping point and a supply and repair base for North Sea Route traffic; nearby Severodvinsk, largest shipbuilding center in the Arctic; Belomorsk, a lumber-shipping port and terminus of the White Sea-Baltic Canal; and Kandalaksha, serving the aluminum and sawmilling industries. The third zone, between the White Sea and Bering Strait, lies along the Northern Sea Route, which is navigable only a few months each year. Ports along the route serve primarily as outlets for natural resources of the regions, provision and bunkering points for vessels traversing the route, and as bases for Soviet Arctic research groups. The most important are Dikson, Tiksi, Zelenyy Mys, and Pevek along the coast, and Dudinka and Igarka inland on the Yenisey river. Ports of the Arctic area listed as open to non-Communist shipping are Murmansk, Arkhangel'sk, Kandalaksha, Dudinka, Pevek, Tiksi, Zelenyy Mys, and Dikson.

FIGURE 17. Major ports (S)

NAME; LOCATION; ESTIMATED MILITARY PORT CAPACITY*	ACTIVITIES	HARBOR	BERTHS
Baltic Coast Area:			
Baltiysk 54°38′N., 19°54′E. 22,000	Principal naval operating base for Baltic Fleet; outport for Kaliningrad. A naval shipyard for minor repairs, 3 minor commercial shipyards; largest floating drydock has 1,500-long-ton lifting capacity. Land being reclaimed at Petroleum and Works harbors; much shoreline being quayed with concrete block construction.	Artificial harbor of 8 divisions, most breakwater protected; general depths 18–34 ft.; fairway leading to Basins I, II, III of Naval Harbor has 30-ft. controlling depth.	Alongside—3 large, 28 medium, 88 small naval vessels; 7 standard coaster-type cargo vessels, 12 lighters. Anchorage—Only small craft can anchor in harbor.
Kaliningrad 54°42′N., 20°29′E. 26,000	Significant commercial port, headquarters Soviet Baltic Fleet. One of largest fishing ports; important shipbuilding/repair center. Other principal industries: woodworking and production of lumber, paper, cellulose, industrial alcohol, RR. cars. Principal cargoes handled: fish and fish products, coal, logs, lumber, wood products, metals, ores, chemicals, fertilizers, grain, machinery, petroleum, cement, sugar, general cargoes. Naval training and research facilities. 1 large, 1 medium, 2 small shipyards; largest floating drydock has 10,000-ton lifting capacity. Several shipbuilding ways under construction at State 820 shipyard. Additional cold storage facilities planned for fishing port.	Improved natural river port has inner and outer divisions; general depths of 22–28 ft.; fair protection from low surrounding terrain.	Alongside—30 standard, 18 small ocean-type cargo vessels; 8 standard, 18 small coaster-type cargo vessels; 12 lighters; 3 standard coaster-type tankers, 1 sound-and-river-type tank barge.
Klaypeda 55°43′N., 21°07′E. 16,500	Transshipment point for E. German, Scandinavian imports. Major crude oil and coal shipping terminal. Important shipbuilding and fishing industry center; also textile, electric battery, cellulose, paper, fertilizer industries. 3 major, 1 minor shipyards; largest drydocking facility is floating drydock with 27,000-ton lifting capacity. Small naval patrol-craft support activity. Major ship-repair yard under development; partly operational. Petroleum pipeline connecting port with CEMA pipeline system planned.	Breakwater-protected natural harbor consists of narrow part of lagoon, short lower reach of stream; general depths 10–24 ft.	Alongside—10 standard, 20 small ocean-type cargo vessels; 8 standard, 44 small coaster-type cargo vessels; 63 lighters; 3 small ocean-type tankers, 1 sound-and-river-type tank barge; 15 small naval vessels.
Kronshtadt 59°59′N., 29°46′E. 15,700	Important naval operating base; chief logistic support base for Baltic Fleet; plays important part in guarding seaward approach to Leningrad; base has landing, ship-repair, ordnance, supply, communications, training, miscellaneous medical facilities. 1 major naval shipyard; largest graving dock has 1,160-ft. length on floor.	Large, well-protected harbor has 3 breakwater-enclosed basins, 2 smaller basins, 3 canals; general depths 21–36 ft. Dredged approach has 32½-ft. controlling depth.	Alongside—4 large, 3 medium, 99 small naval vessels. Fixed mooring—29 large, 39 medium, 46 small naval vessels at Mediterranean-moorings as alternative to 1 large, 1 medium, 29 small vessels alongside. Anchorage—Large number of coasters or small naval vessels.

Leningrad..... 59°55′N., 30°15′E. 54,500	Largest U.S.S.R. port, center of shipbuilding industry, leading naval training center, Soviet Baltic area's most significant transportation and industrial center. Principal receipts: general cargo, coal, petroleum products, foodstuffs, sugar, cotton, metals, machinery, chemicals. Shipments: lumber, fish, dry bulk chemicals, foodstuffs, manufactured goods. 4 major, 5 medium, 5 minor shipyards; largest drydocking facility is floating drydock with 6,000-ton lifting capacity. Projects underway: building several wharves, adding handling and storage facilities. Plans include adding container-handling facility, granary, very large storage building, tunnel connecting Ostrov Kanonerskiy with mainland.	Partly artificial, partly natural well-protected harbor at head of Gulf of Finland; has 3 main divisions; 7–33½-ft. general depths.	Alongside—6 large, 39 standard, 44 small ocean-type cargo vessels; 13 standard, 99 small coaster-type cargo vessels; 201 lighters; 1 small ocean-type tanker, 1 standard coaster-type tanker, 1 sound-and-river-type tank barge; alternative to 9 coasters, 1 lighter are 12 small naval vessels. Fixed mooring—1 ocean-type cargo vessel, several coasters; double-ended mooring berths for large naval vessels occasionally set in Neva. Anchorage—Large numbers for all sizes in exposed Gulf of Finland.
Liepaya..... 56°31′N., 21°01′E. 19,400	Important naval base; military center; several army installations in area; strategic air-defense center; commercial port. Naval base provides logistic support and repairs to submarines and surface vessels to cruiser size. Principal receipts: general military supplies, general cargoes, fish, sugar, coal, refined petroleum products. Principal shipments: grain, animal meal, butter, lumber, oil cakes. 1 large naval shipyard; largest graving dock 750 ft. long.	Mostly artificial breakwater-protected harbor consisting of Outer Harbor, Commercial Harbor, Naval Harbor; 3–32-ft. general depths. 29-ft. controlling depth through Naval Harbor Canal, 24-ft. through Commercial Harbor; passage through E. end of canal limited by 10-ft. underbridge clearances.	Alongside—29 small ocean-type cargo vessels; 3 standard, 15 small coaster-type cargo vessels; 4 lighters; 1 standard coaster-type tanker; 1 large, 16 medium, 49 small naval vessels. Anchorage—5 ocean-type cargo vessels or light cruisers, 23 coasters or small naval vessels.
Lomonosov..... 59°55′N., 29°46′E. 4,200	Port complements and serves as auxiliary supply depot for nearby Kronshtadt naval base. Handles naval supplies and limited amounts of lumber, dry bulk cargoes. Minor shipyard has floating drydock with 1,000-ton lifting capacity.	Breakwater-protected artificial harbor; 7–20-ft. general depths.	Alongside—1 small ocean-type cargo vessel; 3 standard, 5 coaster-type cargo vessels; 79 lighters; 18 small naval vessels. Mooring—28 Mediterranean mooring berths for small naval vessels as alternative to 10 alongside berths for small naval vessels.
Pal'diski..... 59°20′N., 24°06′E. 4,825	Small naval operating base supporting submarines, torpedo boats. Logistic supply base for military installations on nearby islands. Small fishing industry. Minor shipyard with drydocking repair capability limited to small naval vessels by lifting capacity of floating crane. New basin under construction for naval use.	2 breakwater-protected artificial basins; 7–26-ft. general depths.	Alongside—1 large, 6 medium, 16 small naval vessels. Anchorage—Large numbers for all sizes in well-sheltered bay.

Footnote at end of table.

FIGURE 17. Major ports (S) (*Continued*)

NAME; LOCATION; ESTIMATED MILITARY PORT CAPACITY*	ACTIVITIES	HARBOR	BERTHS
Baltic Coast Area (*Continued*):			
Riga..... 56°57′N., 24°06′E. 28,000	Largest commercial port of Latvian S.S.R. Important industrial center engaged in shipbuilding; ship repairing; building and repairing RR. cars and locomotives; producing electrical and radio equipment, paint and varnish, chemicals, superphosphate, lumber and plywood. Principal receipts: ore, cotton, hides, cellulose, and coal. Principal shipments: flax, hemp, tallow, turpentine, timber, dairy products, liquefied gas, machinery. Naval operating and supply base provides logistic support for submarines and surface vessels to frigate size. 1 large, 2 medium, 4 small shipyards; largest floating drydock has 27,000-ton lifting capacity. Naval vessel repair facilities. New container facility under construction. Channel dredging increasing depths.	Large improved river harbor with 3 segments—upper, middle, lower harbors; protected by 2 jetties, inner breakwaters. 12–39-ft. general depths. 26–27-ft. controlling depths in harbor fairways.	Alongside—25 standard, 21 small ocean-type cargo vessels; 9 standard, 13 small coaster-type cargo vessels; 58 lighters; 1 small ocean-type tanker, 2 standard coaster-type tankers; 7 large, 5 medium, 25 small naval vessels. Anchorage—Large numbers for all sizes outside harbor in unprotected roadstead; 8 coasters or small naval vessels in harbor.
Tallin..... 59°27′N., 24°45′E. 39,000	Important operating base of Baltic Fleet; provides logistic support to naval vessels to cruiser size. Capital of Estonian S.S.R.; administrative, industrial, cultural center. Commercial activities: expanding ship repairing, fishing and whaling industries. Receipts: coal, timber, cotton, chemical fertilizers, sugar, coffee, machinery. Shipments: fish products, oils, meat, cement products, chemicals, light industry products, vehicles, agricultural equipment. 3 major, 4 minor shipyards; largest floating drydock has 9,500-ton lifting capacity. Extensive port works continue along both sides of New Fishing Harbor where additional ship repairing, fish processing, cold storage, landing, mechanical handling facilities are being installed.	Well-protected improved natural harbor; 7–33-ft. general depths. Entrance channel for Admiralty Basin has 60-ft. controlling width.	Alongside—5 large, 11 standard, 4 small ocean-type cargo vessels; 6 standard, 24 small coaster-type vessels; 24 lighters; 1 large, 12 medium, 68 small naval vessels. Anchorage—Large numbers for all sizes.
Ventspils..... 57°24′N., 21°34′E. 18,000	Most significant petroleum-shipping port in Baltic area. Other principal shipments: potash, timber, coal, agricultural products. Principal receipts: fruits, frozen meat, vegetables, metals, sugar, cotton fibers, and agricultural machinery. Naval operational support base for small fleet of submarines, minesweepers, patrol craft. Minor shipyard with marine railway of 60-ton hauling capacity. Petroleum exporting pier and fishing port facilities under development.	Breakwater-protected artificial Outer Harbor and natural stretch of stream; 13–37-ft. general depths.	Alongside—7 standard, 14 small ocean-type cargo vessels; 1 standard, 8 small coaster-type cargo vessels; 3 lighters; 4 standard, 4 small ocean-type tankers; 1 standard coaster-type tanker; 1 medium, 31 small naval vessels. Anchorage—Numerous berths for all sizes in roadstead; very limited and temporary berths within Outer Harbor.

Vyborg 60°43′N., 28°44′E. 6,500	Shipbuilding; production of paper, matches, lumber. Small naval patrol-craft base with training component. Principal receipts: coal, coke, iron ore, steel plates, wheat, petroleum products. Principal shipments: paper, matches, lumber, chrome ore. Major shipyard with 450-ft.-long launching basin which can be used as repair basin.	Improved natural harbor; 6½-23-ft. general depths. 20-ft. controlling depth in approach; 400-ft. controlling vessel length.	Alongside—12 small ocean-type cargo vessels; 1 standard, 6 small coaster-type cargo vessels; 2 lighters; 1 standard coaster-type tanker; 4 small naval vessels. Anchorage—Only for small craft in harbor.
Black Sea Coast Area:			
Batumi 41°38′N., 41°38′E. 4,100	Primarily petroleum-shipping port. Other principal shipments: citrus fruits, vegetables, tea, timber, linseed oil, wire, manganese ore. Receipts: metals, machinery, grain, iron ore, coal. Minor naval logistic support base. 1 minor shipyard with marine railways; accommodates 100-ft. craft.	Breakwater-protected improved natural harbor; general depths to 32 ft.	Alongside—5 ocean-type cargo vessels, 1 coaster, 3 lighters, 6 ocean-type tankers (1 at offshore pipeline), 1 small naval vessel. Mooring—At least 8 for small naval vessels or coasters. Anchorage—9 ocean-type cargo vessels and numerous berths for small naval vessels and coasters.
Feodosiya 45°02′N., 35°24′E. 10,400	Primarily petroleum-shipping and naval port. Secondary naval operating and repair base and naval torpedo stations. Receipts: petroleum products, coal, general machinery, foodstuffs. Shipments: military cargoes, petroleum products. 2 minor shipyards, 1 boatyard with marine railways accommodating craft to 100 ft. long. New-type floating petroleum handling pier planned.	3 breakwater-protected artificial harbors and roadstead; 18–30-ft. central depths.	Alongside—7 ocean-type cargo vessels; 3 coasters; 4 medium, 22 small naval vessels; 14 lighters. Anchorage—Limited number for ocean-type and coasters abreast S. Naval Harbor; numerous ocean-type and coaster berths in roadstead abreast Commercial Harbor.
Il'chevsk 46°19′N., 30°40′E. 23,500	Considerable commercial importance; established as outport of Odessa. Probably fastest-growing commercial port in U.S.S.R. First international container handling port in Black Sea. Shipments: vegetable oils, molasses, machinery, vehicles, coal. Receipts: crude rubber, tea, jute, cork, cocoanut oil, cotton. Major ship-repair yard; largest floating drydock has 60,000-ton lifting capacity. Shipyard and new port area serves whaling and fishing fleet.	Well-protected natural harbor with 2 main divisions; 18–49-ft. central depths in Main Harbor, 18–45 ft. in Inner Harbor.	Alongside—33 ocean-type cargo vessels, 1 coaster, 40 lighters. Anchorage—Few ocean-type cargo vessels or light cruisers and coasters or small naval vessels in Main Harbor; large numbers for all sizes in unprotected roadstead outside harbor entrance.
Izmail 45°20′N., 28°50′E. 6,500	Important transshipment point for Danube river craft and oceangoing ships. Fishing center. Operating base for Soviet Danube river units of Black Sea Fleet. Receipts and shipments of bulk cargoes such as ores, metals, coal. Other receipts: building materials, foodstuffs, tobacco, metal products, chemicals, machinery. Other shipments: metal products, building materials, chemicals, grain, lumber, timber products, foodstuffs. 2 major shipyards; largest drydocking facility is floating drydock with 1,500-ton lifting capacity.	Improved natural river harbor; 26–104-ft. central depths; controlling depth in 2 approach fairways are: 24 ft. over bar at Sulina via Bratul Sulina (middle delta arm of Danube); about 3 ft. over entrance bar via Kiliyskoye Girlo (N. delta arm).	Alongside—7 ocean-type cargo vessels, 4 coasters, 13 lighters, 4 small naval vessels. Mooring—Reportedly vessels sometime moor to pontoon wharves while awaiting berths.

Footnote at end of table.

FIGURE 17. Major ports (S) (*Continued*)

NAME; LOCATION; ESTIMATED MILITARY PORT CAPACITY*	ACTIVITIES	HARBOR	BERTHS
Black Sea Coast Area (*Continued*):			
Kerch 45°22′N., 36°29′E. 19,800	Controls approach to Sea of Azov and major inland-waterway system. Produces iron agglomerates for steel mills. Other principal activities: shipbuilding, fish processing. Shipments: iron agglomerates, iron ore, limestone, machinery and metal products, food products, fish, chemicals, construction materials. Receipts: fish, coal, refined petroleum products. Primarily engaged in coastal trade and transshipment of cargo between Black Sea and Sea of Azov ports. 3 major, 1 minor shipyards; largest drydocking facility is floating drydock with 5,500-ton lifting capacity. Small naval patrol-boat base. Reclamation project underway at S. end of Kamysh-Burun Shipyard where graving dock is being constructed.	Improved natural harbor; general depths 7–23 ft. in Kerchenskaya Bukhta, 13–18 ft. in Bukhta Kamysh-Burunskaya and Ferry Basin: 24-ft. controlling depth in approach channel; 4 channels lead to port facilities; controlling depth to main harbor 21 ft., to pier at Kolonka 15 ft., to Boatyard Basin 6 ft., to Bukhta Kamysh-Burunskaya 18 ft.	Alongside—16 ocean-type cargo vessels, 13 coasters, 74 lighters, 12 small naval vessels. Mooring—Naval quay provides Mediterranean moorings for 42 small naval vessels. Anchorage—No standard berths in port area, berths limited to small craft; nearest anchorage for larger ships 9 miles from port.
Kherson 46°38′N., 32°37′E. 7,100	Only maritime port on Dnepr. Significant shipbuilding and grain-shipping activity. Principal receipts: food products, cotton, metals, ores, crude oil, refined petroleum products, cement, construction and shipyard materials. Principal shipments: grain, timber, coal, iron and steel products, sulphates. 1 major, 2 minor shipyards; controlled-level launching basin can be used as graving dock, has 600-ft. length on floor. Shipyard facilities being expanded.	Well-protected natural river harbor. 23-ft. approach fairway controlling depth.	Alongside—13 ocean-type cargo vessels, 26 coasters, 61 lighters, 2 coaster-type tankers. Anchorage—Temporary anchorage for several coasters or small naval vessels.
Nikolayev 46°58′N., 32°00′E. 18,500	Shipbuilding center for commercial ships, naval ships of Black Sea Fleet. Principal receipts: general cargo, foodstuffs, refined petroleum products, machinery. Principal shipments: coal, iron ore, agricultural machinery, industrial equipment, sheet metal. Minor naval operating base. 2 major, 1 minor shipyards; largest floating drydock has 8,000-ton lifting capacity.	Natural river port; 27-ft. controlling depth in approach channel; 18–34-ft. general depths in Yuzhnyy Bug section; 27-ft. central depth in Ingul section.	Alongside—30 ocean-type cargo vessels, 19 coasters, 39 lighters, 1 coaster-type tanker. Anchorage—Temporary anchorage area available for numerous coasters or small naval vessels, but anchorage prohibited by port regulation.
Novorossiysk 44°43′N., 37°47′E. 28,000	Important commercial port; a principal cement-producing center. Largest Soviet petroleum-exporting port. Other industries: RR. car repair shop, sawmill, machine-building plant, shipyard. Principal receipts: machinery, machine tools, rolled steel, steel pipes, ores. Principal shipments: lumber, cement, crude oil, refined petroleum products, grain. Small naval base provides operational support to small number of naval vessels based at port. 1 major, 3 minor shipyards; largest floating drydock has 30,000-ton lifting capacity.	Breakwater-protected improved natural harbor; 47–50-ft. central depths at Petroleum Harbor, 36–43 ft. elsewhere.	Alongside—44 ocean-type cargo vessels, 25 coasters, 52 lighters, 11 ocean-type tankers, 1 tank barge. Anchorage—3 ocean-type cargo vessels or light cruisers in harbor; large number of all sizes in bay outside harbor.

Ochakov 46°37′N., 31°33′E. 2,000	Naval security station controlling and protecting access to significant part of major Soviet inland waterway system. Provides operational support to naval patrol craft and other light units of Black Sea Fleet. Naval training. Commercial activities: fish and food-product processing and canning, brick making. Principal shipments: fish products, corn, salt, canned goods. Principal receipts: coal, naval materiel.	Open roadstead and 3 artificial basins; 7–19½-ft. general depth. Controlling depth at Naval Harbor 17 ft., at Ochakovskaya Gavan' 16½ ft., at Fishing Basin at least 7 ft.	Alongside—1 coaster, 8 lighters, 17 small naval vessels. Anchorage—Numerous ocean-type or light cruisers in roadstead; numerous coasters or small naval vessels inside entrance to Dneprovskiy Liman.
Odessa 46°29′N., 30°45′E. 38,500	Important commercial port; significant industrial center. Principal receipts: jute, jute products, grain, metals, tin, rubber, cotton, crude oil, refined petroleum products, fruit. Principal shipments: crude oil, refined petroleum products, grain, raw sugar, machinery, building materials, textiles. Secondary naval operating base for destroyer escorts, submarines, minesweepers, patrol craft. 1 major, 2 minor shipyards; largest floating drydock has 15,000-ton lifting capacity.	Breakwater-protected harbor; 8–42-ft. general depths. Controlling depths in entrance fairways at E. entrance 32 ft., central entrance 40 ft., W. entrance 21 ft.	Alongside—36 ocean-type cargo vessels, 30 coasters, 25 lighters, 5 ocean-type tankers, 3 coaster-type tankers (1 at offshore pipeline), 25 small naval vessels. Mooring—3 for small naval vessels. Anchorage—Extensive for all sizes in roadstead outside harbor.
Poti 42°09′N., 41°40′E. 14,000	Important as shipping point for manganese ore and as site of naval operating base for submarines and surface units. Principal receipts: coal, grain, sugar, rice, chemicals, machinery, metallurgical equipment. Principal shipments: manganese ore, chrome ore, cotton, light industrial products. Naval base provides operational and logistic support for units of Black Sea Fleet. Minor shipyard; floating drydock has 8,000-ton lifting capacity. One harbor basin being enlarged.	Breakwater-protected artificial harbor. Turning room limited in all harbor divisions; 18–36-ft. central depths.	Alongside—12 ocean-type cargo vessels, 6 coasters, 3 lighters, 31 small naval vessels. Fixed mooring—33 Mediterranean-mooring berths for small naval vessels. Anchorage—Extensive anchorage in open roadstead.
Reni 45°26′N., 28°17′E. 5,800	Transshipping port for Danube oceangoing/river traffic. Principal products handled: iron ore, coal, petroleum, general cargoes.	Improved natural river harbor; 10–50-ft. general depths. Controlling depths in 3 approaches: 24 ft. over bar via Bratul Sulina, 5–6 ft. over entrance bar via Bratul Sfintu Gheorghe, 3 ft. over entrance bar via Kiliyskoye Girlo.	Alongside—8 ocean-type cargo vessels, 1 coaster, 16 lighters, 1 tank barge. Anchorage—No standard free-swinging berths, but undetermined number of ocean-type vessels can anchor in stream.

Footnote at end of table.

FIGURE 17. Major ports (S) (*Continued*)

NAME; LOCATION; ESTIMATED MILITARY PORT CAPACITY*	ACTIVITIES	HARBOR	BERTHS
Black Sea Coast Area (*Continued*):			
Sevastopol'/Balaklava..... 44°37′N., 33°32′E./ 44°30′N., 33°36′E. 30,000	Principal operating, repair, training, supply base for Black Sea Fleet; Hq. Commander Black Sea Fleet; also has Office of Commander of Fleet, Chief of Staff, other administration sections. Site of naval academy. 2 major, 3 minor naval shipyards; largest graving dock has 955-ft. length.	Natural harbor with 3 divisions, all well protected except for group of small bays. At entrance to Balaklavskaya Bukhta length of vessels limited to about 400 ft.; other areas length not limiting. Central depths—Bukhta Severnaya 18–52 ft.; Balaklavskaya Bukhta 15 to over 100 ft.; other bays 10–72 ft.	Alongside—6 large, 13 medium, 133 small naval vessels; 3 ocean-type cargo vessels; 1 coaster; 26 lighters; 2 coaster-type tankers; 3 tank barges. Mooring—Double-buoy moorings for 9 large, 2 medium naval vessels. Anchorage—9 ocean-type cargo vessels or light cruisers, 9 coasters or small naval vessels. Additional temporary anchorage in exposed roadstead.
Sochi..... 43°35′N., 39°43′E. 4,200	Port serving health and summer resort. Mostly passenger traffic and general cargoes handled. Small naval patrol craft operating base. Minor shipyard with marine railways capable of hauling out only small craft and hydrofoils for repairs.	Breakwater-protected artificial harbor; 13–24-ft. general depths.	Alongside—3 ocean-type cargo vessels, 7 coasters, 6 lighters, 1 small naval vessel. Mooring—14 ocean-type cargo vessels, 10 coasters, 4 small naval vessels at Mediterranean-mooring berths. Anchorage—Several berths for all sizes in roadstead W. of harbor.
Tuapse..... 44°05′N., 39°04′E. 11,000	Important as shipping point for petroleum products, naval petroleum supply depot, ship-repair center; also resort town. Principal receipts: machinery, consumer goods, solid fuels, sugar, grain. Principal shipments: petroleum products, iron and steel products, iron and lead ores, timber, machine tools. 2 major shipyards; largest drydocking facility is floating drydock with over 10,000-ton lifting capacity.	Breakwater-protected harbor; 20–38-ft. central depths.	Alongside—10 ocean-type cargo vessels; 5 coasters; 14 lighters; 5 ocean-type, 1 coaster-type tankers; 2 small naval vessels. Fixed mooring—15 ocean-type cargo vessels at Mediterranean-mooring berths. Anchorage—5 coasters or small naval vessels. Several berths for all sizes in open roadstead SW. of port.
Yalta..... 44°30′N., 34°10′E. 3,900	Largest health resort in Crimea. Primarily passenger port. Handles limited amounts of general cargoes, timber, coal, dry bulk construction materials. Minor boatyard effects drydocking repairs to craft small enough to be lifted onto wharf apron by crane. New commercial port facilities under construction NE. of harbor.	Breakwater-protected artificial harbor; 10–40-ft. general depths.	Alongside—5 ocean-type cargo, 1 coaster, 10 lighters. Mooring—Small vessels sometimes Mediterranean-moor to S. side of outer segment of small breakwater. Anchorage—None in harbor. Limited number for all sizes short distance SE. of main breakwater.
Zhdanov..... 47°04′N., 37°31′E. 17,500	Principal Black Sea coal-shipping port. Significant steel-producing center. Principal receipts: manganese ore, iron ore, scrap iron. Principal shipments: coal, iron and steel products. 1 major, 1 minor shipyard; largest floating drydock has 12,500-ton lifting capacity. Development of coal processing, sorting and loading complex nearing completion.	Almost completely artificial port with 3 separate harbors. Central depths—Port Azovstali 16–24 ft., Port Zinteva Balka 12–26 ft., Port Leytenanta Schmitda 7–9 ft. Controlling depths in fairways: W. channel 27 ft., middle channel 15 ft., E. channel 18 ft.	Alongside—22 ocean-type cargo vessels, 12 coasters, 27 lighters. Anchorage—3 coasters or small naval vessels.

Pacific Coast Area:			
Kholmsk 47°03′N., 142°03′E. 6,900	Second most important port on Sakhalin. Principal fishing base on W. coast of Sakhalin. Principal shipments: paper and pulp products, fish products, coal. Principal receipts: salt, timber, fruit, vegetables, cement, minerals, chemicals, general cargoes, military supplies. Small naval school. Minor shipyard has 600-ft.-long marine railway serving 335-ft.-long launching ways which can be used for repairs; hauling capacity 300 tons. Construction of large base for fishing fleet in N. part of Kholmsk. Kholmsk–Vanino RR. ferry nearing completion.	2 breakwater-protected artificial basins, roadstead; 9–33-ft. general depths: basins, roadstead 32–110 ft. About 20-ft. controlling depth to N. harbor, 33-ft. to main harbor.	Alongside—2 ocean-type cargo, 11 coasters, 20 lighters. Anchorage—3 for large passenger ships or aircraft carriers, 2 for ocean-type cargo vessels or light cruisers, 5 for coasters or small naval vessels.
Korsakov 46°38′N., 142°46′E. 11,200	Leading port on Sakhalin serving as commercial and military port for capital, Yuzhno-Sakhalinsk. Principal receipts: petroleum products, military supplies, industrial and mining equipment, machinery, automotive vehicles, RR. rolling stock. Shipments: wood products, fish products, paper, camphor, coal. Coastal defense and patrol-craft operating base for Soviet Pacific Fleet. 3 minor shipyards with marine railways capable of drydocking boats to 60 tons. Site of small naval air station; secondary naval base.	4 breakwater-protected artificial basins, roadstead; 6–28-ft. general basin depths, roadstead 18–90 ft.	Alongside—10 ocean-type cargo vessels, 3 coasters, 32 lighters, 2 small ocean-type tankers. Anchorage—Extensive for all sizes in roadstead.
Lazarev 52°13′N., 141°32′E. 2,000	Important as log-shipping port, minor base for patrol boats of Maritime Border Guard. Small fish-processing industry. Principal receipts: petroleum products, general cargo. Shipments: logs.	Breakwater-protected artificial harbor; 14–24-ft. general depths. Controlling depth 23 ft. after periodic dredging; as little as 18 ft. in nondredged years.	Alongside—3 ocean-type cargo vessels, 1 coaster, 8 lighters, 1 coaster-type tanker. Anchorage—Extensive for coasters, small naval vessels.
Magadan 59°34′N., 150°48′E. 4,500	Supply, distribution center for significant mining region. Minor summer naval operating base. Principal shipments: fish, furs, ores. Principal receipts: petroleum products, construction materials, machinery and parts, explosives, foodstuffs, coal. Shipyard builds small fishing craft, barges; above water repairs to diesel submarines and small craft; small craft hauled up on beach for repairs; shipyard being expanded.	Well-protected natural harbor; 25–120-ft. general depths.	Alongside—5 ocean-type cargo vessels, 1 lighter, 1 ocean-type tanker, 1 medium naval vessel. Anchorage—Extensive for all sizes.
Mago 53°15′N., 140°11′E. 3,250	Timber-exporting port, mostly in trade with Japan. Fishing industry. Winter harbor for Amur River craft. Receipts: salt, coal, petroleum products, general cargo. Shipments: timber, fish. Minor shipyard.	Natural river harbor; 10–16½-ft. general depths.	Alongside—19 coasters, 6 lighters, 1 coaster-type tanker. Anchorage—Several berths for coasters or small naval vessels.

Footnote at end of table.

FIGURE 17. Major ports (S) (*Continued*)

NAME; LOCATION; ESTIMATED MILITARY PORT CAPACITY*	ACTIVITIES	HARBOR	BERTHS
Pacific Coast Area (*Continued*):			
Moskal'vo 53°32′N., 142°31′E. ?,000	Primarily crude-oil shipping port. Distribution point for foodstuffs, other supplies. Fish cannery. Possibly further development of off-shore pipeline berth.	Natural harbor; 20–50-ft. general depths 22–23-ft. controlling depth in approach channel; under favorable conditions 25-ft.-draft vessels can reach wharves.	Alongside—4 ocean-type cargo vessels, 1 coaster-type tanker. Anchorage—18 berths for ocean-type cargo vessels or light cruisers. Offshore tanker loading berth, depth at least 35 ft.; underwater pipelines. Vessels moor or anchor.
Nakhodka 42°48′N., 132°52′E. 37,000	Only principal port open to foreign shipping; largest Soviet commercial port in Pacific. Principal receipts: construction materials petroleum, grain. Principal shipments: fluorite, canned fish, vehicles, cement, crude oil, coal, lumber, potassium salts. 2 major commercial shipyards; largest floating drydock has 25,000-ton lifting capacity; another with 27,000-ton lifting capacity reportedly to be assigned to port. Naval activity provides limited logistic and operational support to patrol craft of Border Guard assigned to port; submarine training school for enlisted personnel. Large crude-oil shipping terminal with berthing facilities for large tankers nearing completion; specialized port area for exporting lumber and potassium also under construction. Construction beginning on new port at Bukhta Vrangelya; 3 port areas: container, coal, woodchips. Numerous buildings, quays under construction. Container service between port and Hong Kong, Tokyo.	Natural harbor consisting of large bay, Zaliv Amerika, and 4 smaller, well-protected adjoining bays. 18–120-ft. general depths; 35-ft. controlling depth in approach.	Alongside—47 ocean-type cargo vessels, 33 coasters, 16 lighters, 5 ocean-type tankers, 1 sound-and-river-type barge, 3 small naval vessels. Mooring—Some wharves sometimes used for Mediterranean-mooring. Anchorage—Large numbers for all sizes.
Nevel'sk 46°40′N., 141°51′E. 7,700	Fishing port, fish-processing facilities. Principal shipments: fish, fish products, timber. Principal receipts: general cargoes, foodstuffs, rice, coal, mineral oil. 1 major, 3 minor shipyards. Graving dock with 300-ft. length on floor for drydocking repairs. Major repair base for Sakhalin fishing fleet. Possible wharf expansion. Site of large quarry; several maritime training schools in area.	Improved natural harbor protected by reefs, breakwaters; 3–24-ft. general depths. 36–48-ft. depths in roadstead.	Alongside—3 ocean-type cargo vessels, 63 lighters. Mooring—1 ocean-type tanker, 25 lighters; alternate Mediterranean-mooring berths. Anchorage—12 berths for large passenger ships or aircraft carriers.

Nikolayevsk 53°08′N., 140°43′E. 4,200	Important for strategic location at Amur mouth; controls river access to inland industrial areas. Minor naval base for Amur River patrols. Transshipment port for transfer of cargoes between shallow-draft river barges, deeper-draft coasters. Principal receipts: coal, petroleum products, timber, foodstuffs, fish. Principal shipments: sand, gravel, timber, provisions. 2 major shipyards; largest drydocking facility is graving dock with 400-ft. length on floor. New basin under construction.	Outer natural harbor, inner artificial basin; 22–66-ft. general depths in river stretch, 40–20 ft. at inner harbor. Small adjoining Shipyard Basin has depth of at least 13 ft. Controlling depths in downriver approach 20 ft. (MHHW) in N. fairway, 11 ft. (MHHW) in S. fairway.	Alongside—4 ocean-type cargo vessels, 8 coasters, 23 lighters, 1 coaster-type tanker, 2 small naval vessels. Anchorage—Numerous berths for coasters or small naval vessels, at least 3 ocean-type cargo/light cruiser berths.
Petropavlovsk-Kamchatskiy 53°01′N., 158°39′E. 25,700	Largest port in N.E. Siberia; submarine and patrol-craft operating base. Hq. of Kamchatka Flotilla. Port of call for ships traversing Northern Sea Route. Missile-tracking station and operating center for several missile-range instrumentation ships. Important ship-repair center with 3 medium, 4 minor shipyards; largest of 6 floating drydocks has lifting capacity of about 14,000 tons. Fishing and fish-processing industry.	Well-protected natural harbor; 36–90-ft. general depths.	Alongside—25 ocean-type cargo vessels; 24 coasters; 18 lighters; 9 coaster-type tankers; 2 sound-and-river-type tank barges; 3 large, 38 medium, 25 small naval vessels. Anchorage—Extensive for all sizes.
Petrovka 43°07′N., 132°20′E. 7,300	Nuclear submarine naval support facility. Major naval shipyard for repair and fitting out; drydocking facility includes transverser-marine railways facility with 4,000-ton hauling capacity capable of handling vessels 450 ft. long, 55 ft. wide. Filling and quaying operations continuing at various locations along shore line. At least 3 transporter docks operating in and out of port.	Breakwater-protected improved natural harbor; central depth at least 28 ft.	Alongside—13 medium, 22 small naval vessels. Anchorage—Few berths in harbor for coasters or small naval vessels. About 35 berths for ocean-type cargo vessels or light cruisers and numerous berths for coasters and small naval vessels in adjoining bays outside the harbor.
Provideniya 64°26′N., 173°13′W. 1,500	Only deepwater port in extreme N.E. Siberia. Supply port for military airfield, supporting installations. Base for fishing, sealing operations. A main port on Northern Sea Route. Minor summer operating base for submarines, small naval units. Principal receipts: coal, petroleum products, provisions, supplies, industrial and consumer goods, army materiel, construction materials. Principal shipments: coal, furs, supplies to arctic ports. Minor shipyard.	Well-protected natural harbor; 18–84-ft. central depths.	Alongside—3 ocean-type cargo vessels, 1 lighter, 1 coaster-type tanker. Mooring—Probably 2 free-swinging mooring buoys, berth-type undetermined. Anchorage—1 large passenger ship or aircraft carrier, 5 ocean-type cargo vessels or light cruisers, 25 coasters or small naval vessels in harbor. 1 additional large passenger ship or aircraft carrier berth at nearby Reyd Plover.

Footnote at end of table.

FIGURE 17. Major ports (S) (*Continued*)

NAME; LOCATION; ESTIMATED MILITARY PORT CAPACITY*	ACTIVITIES	HARBOR	BERTHS
Pacific Coast Area (*Continued*):			
Sovetskaya Gavan'..... 49°02′N., 140°20′E. 15,700	One of most important naval bases in Far East. Site of significant commercial port, Vanino. E. terminal of branch line of Trans-Siberian RR. Principal receipts: grain, other foodstuffs, petroleum products, coal. Principal shipments: timber, furs, wood chips, canned fish, machinery, construction materials. 3 major shipyards. Largest drydocking facility has 27,000-ton lifting capacity. Development projects underway RR. ferry terminal to connect mainland with Sakhalin RR. at Kholmsk; reconstruction of RR. line to Komsomol'sk; additional petroleum-bunkering facility; additional wharfage and handling facilities.	Natural coastal harbor consisting of Sovetskaya Gavan' and 4 arms with 5–105-ft. general depths and Bukhta Vanina with 18–50-ft. central depths.	Alongside—23 ocean-type cargo vessels; 9 coasters; 16 lighters; 3 coaster-type tankers; 6 medium, 49 small naval vessels. Mooring—5 ocean-type cargo vessels; 1 ocean-type tanker; 45 medium, 4 small naval-vessel Mediterranean-mooring berths. Anchorage—3 large passenger ships or aircraft carriers, 7 ocean-type cargo vessels or light cruisers, 13 coasters or small naval vessels.
Vladivostok..... 43°06′N., 131°52′E. 37,000	Most important naval base and largest port in Far East; ranks 2d to Nakhodka as commercial port. Hq. of Soviet Pacific Fleet. Principal receipts: fish and fish products, lumber, furs, paper, grain, sand and gravel, coal, petroleum. Principal shipments: refined petroleum products, coal, grain, foodstuffs, machinery, military equipment. 3 naval, 2 commercial shipyards; largest drydocking facility is graving dock 745 ft. long; largest floating drydock has 10,000-ton lifting capacity. Port development projects underway: expansion of fishing port, development of S. side of inner half of Bukhta Zolotoy Rog, extension of several wharves, construction of several shipyard buildings.	Improved natural harbor consisting of 3 divisions: Bukhta Zolotoy Rog, Proliv Bosfor Vostochnyy, and Bukhta Novik. General depths 18–160 ft.	Alongside—52 ocean-type cargo vessels; 13 coasters; 14 lighters; 1 ocean-type tanker; 3 coaster-type tankers; 2 tank barges; 21 medium, 64 small naval vessels. Mooring—7 medium, 20 small naval vessels; 2 standard ocean-type tankers; 1 sound- and river-type tank barge; Mediterranean-mooring berths. Anchorage—7 large passenger ships or aircraft carriers, 28 ocean-type cargo vessels or light cruisers, 29 coasters or small naval vessels.
Zaliv Strelok..... 42°52′N., 132°31′E. 9,560	Naval operating base for Pacific Fleet submarines, surface ships. Naval supply and storage center for missiles, munitions, torpedoes, mines, general stores. Major naval shipyard with floating drydock capable of lifting 8,000 long tons. Expansion of several landing facilities underway.	Natural harbor; 18–144-ft. central depths.	Alongside—2 medium, 67 small naval vessels. Mooring—2 large, 2 medium, 55 small naval vessels at Mediterranean-mooring berths. Anchorage—Extensive for all sizes.
Arctic Coast Area:			
Arkhangel'sk..... 64°34′N., 40°32′E. 65,000	Largest sawmilling center and lumber port in U.S.S.R.; significant transshipping port for river/ocean traffic; important supply, repair base for shipping on Northern Sea Route. Wood-processing, fish-processing, canning industries also important. Principal shipments: lumber, wood products, tars, turpentine, furs, supplies and equipment for polar stations. Principal	Well-protected natural harbor consisting of part of river and sections of 4 channels. Ships entering limited by depth over bar of 26 ft. ($30^1/_2$ ft. MHWN).	Alongside—113 ocean-type cargo vessels, 48 coasters, 26 lighters, 6 coaster-type tankers, 1 tank barge, 2 small naval vessels. Anchorage—Numerous ocean-type cargo vessels or light cruisers, numerous coasters or small naval vessels in roadstead; 15 ocean-type cargo vessels or light cruisers,

	receipts: coal, salt, fish, hardware, machinery, tea, coffee. Small naval operating base for light units of Northern Fleet, particularly patrol craft, minesweepers; seaplane station. 2 major, 5 minor commercial shipyards; largest drydocking facilities are floating drydock with 5,000-ton lifting capacity and 360- and 445-ft.-long graving docks.		about 15 coasters or small naval vessels in harbor.
Belomorsk..... 64°32′N., 34°46′E. 3,300	Serves lumber industry, fish cannery. Minor shipyard and boatyard have small floating drydock, lifting capacity about 350 tons. Transit stop for submarines and other naval vessels brought through waterway system on transporter docks.	Breakwater-protected artificial harbor; 15–20-ft. general depths. Channels to curved pier and Timber Export Wharf have 20-ft. controlling depth.	Alongside—1 ocean-type cargo vessel, 7 coasters, 15 lighters, 1 coaster-type tanker. Mooring—2 coasters. Anchorage—Numerous berths for ocean-type cargo vessels or light cruisers, coasters or small naval vessels.
Dikson..... 73°30′N., 80°24′E. 1,100	Administrative and polar station. Important provisioning base for Northern Sea Route. Transshipping port for Yenisey river traffic and oceangoing traffic. Icebreaker depot. Fish-processing industry. Small naval patrol-craft operating base. Minor shipyard.	Natural river harbor; 18–100-ft. general depths.	Alongside—2 ocean-type cargo vessels, 4 coasters, 2 coaster-type tankers, and 2 small naval vessels. Anchorage—4 ocean-type cargo vessels or light cruisers, 20 coasters or small naval vessels at Inner Road; large numbers of all sizes at Outer Road.
Dudinka..... 60°24′N., 80°10′E. 6,000	Largest port in Arctic E. of Arkhangel'sk. Serves Noril'sk, one of most important mining centers in Soviet Arctic. Principal receipts: logs, machinery, explosives, petroleum products, construction materials, foodstuffs. Principal shipments: furs, coal, lumber; copper, nickel, cobalt, platinum, other ores. Port has fishing, timber-processing industries. Serves as transshipment point for transfer of cargoes between Yenisey river craft and oceangoing vessels.	Natural river harbor; 22–125-ft. general depths.	Alongside—4 ocean-type cargo vessels, 36 lighters, 1 tank barge. Anchorage—For numerous ocean-type cargo vessels or light cruisers on W. side of Yenisey.
Guba Sayda..... 69°15′N., 33°20′E. 4,700	Serves long-range diesel- and nuclear-powered missile submarines and naval auxiliaries; has storage areas apart from main port for nuclear warheads, naval missiles.	Natural harbor, well protected by configuration of land, surrounding terrain, islands only short distance from wharves; 38–130-ft. general depths.	Alongside—17 medium, 7 small naval vessels. Mooring (fixed)—1 large naval vessel. Anchorage—Only for small craft near port.
Guba Ura..... 69°20′N., 32°15′E. 1,200	Logistic support and operating base for conventional torpedo-attack submarines; has storage facilities for materiel, petroleum, munitions; has numerous barracks. Transporter dock possibly used for limited floating repairs.	Natural harbor, well protected by inland location and high surrounding terrain; 48–200-ft. general depths.	Alongside—20 small naval vessels. Anchorage—Only for small craft near port.
Guba Zapadnaya Litsa..... 69°26′N., 32°25′E. 250	Provides logistic and maintenance support to conventional and nuclear guided-missile submarines; some minor above-water repairs to conventional and nuclear submarines.	Natural harbor, well protected by high surrounding terrain; 28–180-ft. general depths.	Alongside—26 medium, 14 small naval vessels. Anchorage—Only for small craft near port.

Footnote at end of table.

FIGURE 17. Major ports (S) *(Continued)*

NAME; LOCATION; ESTIMATED MILITARY PORT CAPACITY*	ACTIVITIES	HARBOR	BERTHS
Arctic Coast Area *(Continued)*:			
Igarka..... 67°28′N., 86°35′E. 4,400	Primarily used for transshipping lumber between Yenisey river craft and oceangoing vessels. Minor boat repair yard with marine railways capable of hauling out only small river craft.	Natural river harbor in passage formed between right bank and offshore island; 38–60-ft. general depths; bars in downriver approach have controlling depth about 23 ft.	Alongside—7 ocean-type cargo vessels, 4 coasters, 1 coaster-type tanker. Mooring—12 ocean-type. Mediterranean-mooring berths on W. bank of Yenisey.
Iokanga..... 68°04′N., 39°41′E. 3,200	Nuclear submarine, torpedo boat base. Naval anchorage; advance patrol, repairing base. Major naval shipyard has graving dock with 50-ft. overall length.	Natural harbor in passage between mainland and offshore islands; 21–90-ft. general depths.	Alongside—12 medium, 10 small naval vessels; 1 coaster-type tanker. Anchorage—Large numbers for all sizes.
Kandalaksha..... 67°08′N., 32°26′E. 2,600	Site of large aluminum plant; also produces chemical byproducts, aircraft parts, motor-vehicle and tractor parts, lumber supplies, fish products. Principal receipts: foodstuffs, manufactured goods, coal, other industrial products. Principal shipments: lumber, apatite, canned fish, iron castings, aluminum, other metal products. No shipyards, but engineering works can effect limited floating repairs.	Natural well-sheltered harbor; 40–225-ft. general depths. Controlling depth outside harbor entrance 31 ft.	Alongside—2 ocean-type cargo vessels, 3 coasters. Anchorage—10 ocean-type cargo vessels or light cruisers, 7 coasters or small naval vessels.
Murmansk..... 68°58′N., 33°03′E. 38,000	Important as largest U.S.S.R. fishing-fleet base, W. terminus of Northern Sea Route, principal supply depot and major ship-repair base of Northern Fleet. Largest graving dock has 740-ft. length; largest floating drydock has 27,000-ton lifting capacity. City is administrative and commercial center of Kola Peninsula. Principal shipments: apatite concentrate, raw apatite, flax, timber, fish and fish products. Principal receipts: timber, raw sugar, cotton, steel products, coal, salt, wire, building materials.	Natural harbor, well protected by inland location and surrounding mountainous terrain; 33–198-ft. general depths.	Alongside—55 ocean-type cargo vessels; 23 coasters; 20 lighters; 4 coaster-type tankers; 5 medium, 12 small naval vessels; 1 gasoline tanker. Anchorage—5 large passenger ships or aircraft carriers, 4 ocean-type cargo vessels or light cruisers, numerous coasters or small naval vessels.
Pechenga..... 69°39′N., 31°22′E. 2,200	Fishing and fish-processing port. Naval operating base provides logistic support for submarines, small surface vessels of Northern Fleet. Minor shipyard has marine railway for drydocking repairs to small craft.	Natural harbor at inlet off Barents Sea; 65–340-ft. general depths.	Alongside—1 coaster; 1 tank barge; 3 medium, 16 small naval vessels. Mooring—2 mooring berths, type and size undetermined. Anchorage—1 large passenger ship or aircraft carrier, 3 ocean-type cargo vessels or light cruisers, 2 coasters or small naval vessels.
Pevek..... 69°42′N., 170°16′E. 2,100	Northern Sea Route port. Serves as ore-shipping port for large mining region. Principal receipts: mine machinery and equipment, lumber, logs, explosives, grain, coal. Minor shipyard.	Natural harbor, protected by 2 islands and mainland; 30–100-ft. general depths.	Alongside—3 ocean-type cargo vessels, 1 coaster, 1 coaster-type tanker, 1 ocean-type tanker at offshore pipeline berth. Anchorage—Large numbers for all sizes.

Polyarnyy 69°12′N., 33°28′E. 7,100	Important operating base for submarines, other light units of Northern Fleet; facilities at Polyarnyy and nearby inlets. Hq. of Coastal Defense Forces. Commercial quarrying enterprise in area. Major naval shipyard has floating drydocks with lifting capacities to 28,000 tons. Port controls entrance to Kol'skiy Zaliv and access to Murmansk and Severomorsk.	Natural harbor consisting of reach of Kol'skiy Zaliv, several adjoining bays; 30–300-ft. general depths; entrance to Guba Pala limited by controlling depth of 32 ft. at MHWN.	Alongside—16 medium, 55 small naval vessels; 2 coaster-type tankers. Mooring—3 medium, 3 small naval vessels. Anchorage—Great depths and limited swinging-room restrict anchorage; at least 4 berths for small naval vessels in Guba Tyuva.
Severodvinsk 64°35′N., 39°47′E. 16,700	Most important naval shipbuilding yard in Soviet Arctic. Builds nuclear submarines. Naval base, nuclear-submarine support facility. Principal industries: shipbuilding, lumbering, munitions. 2 major shipyards. 1 nuclear submarine special-support facility; launching basin with 1,200-ft. length can be used for drydocking repairs; floating drydock with about 8,000-ton lifting capacity.	Improved natural river harbor, 20–30-ft. general depths (possibly deeper in places).	Alongside—22 lighters; 29 medium, 4 small naval vessels. Mooring—Berths undetermined. Vessels occasionally moor along unimproved shoreline. Anchorage—6 coasters or small naval vessels.
Severomorsk 69°05′N., 33°27′E. 11,000	Principal operating and logistic base for all units of Northern Fleet except submarines. Site of Naval Headquarters Northern Fleet and Naval Headquarters, Submarine, Northern Fleet. Extensive missile and ordnance storage and handling facilities. Major shipyard has floating drydock with 35,000-ton lifting capacity.	Natural harbor, well protected by inland location and high surrounding terrain; 18–300-ft. general depths.	Alongside—14 medium, 45 small naval vessels; 4 ocean-type tankers; 1 coaster-type tanker. Mooring—18 Mediterranean-mooring berths for small naval vessels as alternative to 4 small naval vessel alongside berths; 3 large naval vessels at free-swinging mooring berths.
Tiksi 71°39′N., 128°53′E. 1,000	Transshipment site for Lena river traffic and ocean-going traffic. Turnaround point for traffic coming from both ends of Northern Sea Route. Polar station. Fish canneries. Minor shipyard.	Natural harbor, partly protected by peninsula and mainland; 20-30-ft. general depths.	Alongside—2 ocean-type cargo vessels, 2 coasters, 11 lighters, 2 tank barges. Anchorage—Numerous berths for coasters or small naval vessels in harbor.
Zelenyy Mys 68°48′N., 161°21′E. 2,460	Supply point for mines and settlements in lower Kolyma river region. Principal cargoes handled: POL, foodstuffs, machinery, coal, building materials, timber, lumber. Large vehicle-storage facility.	Natural river harbor, well protected by inland location; general depths believed over 22 ft.	Alongside—5 ocean-type cargo vessels, 1 lighter, 1 coaster-type tanker. Anchorage—Only for small craft near port.

*The estimated military port capacity is the maximum amount of general cargo—expressed in long tons—that can be unloaded onto the wharves and cleared from the wharf aprons during a period of one 24-hour day (20 effective cargo-working hours). The estimate is based on the static cargo-transfer facilities of the port existing at the time the estimate is prepared and is designed for comparison rather than for operational purposes; it cannot be projected beyond a single day by straight multiplication.

The commercial ports are administered by the Ministry of Maritime fleet, subordinate to the U.S.S.R. Council of Ministers. The several merchant marine companies under the ministry are completely responsible within assigned geographic areas for operating the fleets, the ship-repair and commercial port facilities, and the maritime training schools. In each port the operations are controlled through a harbormaster's office; those that handle Ministry of Defense vessels, personnel, and cargoes also have a military officer assigned to the office. Many foreign trade organizations, including the U.S.S.R Chamber of Commerce, provide a large spectrum of port services dealing with the export and import of various specific products and commodities. At each port INFLOT (Maritime Agency for Servicing Foreign Ships in Soviet Ports) acts as agent for all foreign ships; its services include the handling of ships entering a port and informing foreign vessels of local port regulations and related shipping matters. Crew members calling at the commercial ports are referred to the ship-chandler provisioning organization *Glavtorgmortrans*. Directly subordinate to the Ministry of Maritime Fleet is *Soyuzmorniproyekt*, which plans and does research to determine development trends and desirable port projects. The Ministry of Fishing Industry supervises the fishing harbors at commercial ports, and the Ministry of Food Industry supervises shore-based fish-processing facilities.

Administrative control over naval ports is vested in the operating base commanders, who also control the fleet units assigned them and other naval activities in their region. The commanders are under the general direction of the commanders-in-chief of the four major naval fleets.

Coast Guard activities are under the jurisdiction of the Committee for State Security (KGB). The mission of a local office of the KGB Maritime Border Guard is to prevent violation of territorial waters, illegal entry or exit via Soviet waters, and smuggling; it also performs security patrol-boat reconnaissance, enforces customs regulations, conducts seaman inspections, authorizes clearances for vessel arrivals and departures, and is responsible for ship surveillance in port. Usually a two-pass system is enforced to control the movements of visiting foreign seamen.

Significant details of the 62 major ports are summarized in Figure 17.

H. Merchant marine (C)

As of 1 January 1973, the U.S.S.R. merchant marine ranked fifth in number of ships and eighth in deadweight tonnage (d.w.t.) among the merchant fleets of the world. During the 1966-70 Five Year Plan the Soviet merchant fleet increased by nearly 500 new or used ships totaling over 4.4 million d.w.t. The announced Soviet goal for the 1971-75 Five Year Plan is 550 new ships totaling 5.5 million d.w.t.

During the 1966-70 period, Soviet Merchant Fleet acquisitions averaged nearly 100 ships of 890,000 total d.w.t. annually. In contrast, for the first 2 years of the 1971-75 Five Year Plan, they have averaged only 64 ships of 496,000 total d.w.t. annually. Construction of prototype units has always taken considerable time, and the shipyard conversion time for the construction of a prototype unit is probably one determining factor. Another factor contributing to the decline of ship acquisition during 1971-72 could be the increase of ships built for export by the Soviets in their effort to offset a shortage of hard currency. This shortage of hard currency may be the most significant factor associated with the 1971-72 ship construction lull, as it was during the previous Five Year Plan, when ship production fell short of the planned goal. At that time, the Minister of the Merchant Fleet claimed that unspecified budget constraints had caused the failure to complete planned acquisitions.

The merchant marine comprises a commercial fleet of general-service ships and a fleet of special-service ships. On 1 January 1973 the commercial fleet had 1,482 general-service ships of 1,000 or more gross register tons (g.r.t.), aggregating 9,708,380 g.r.t. or 12,616,036 d.w.t.[2] The composition was as follows:

	No.	G.R.T.	D.W.T.
Cargo:			
General	644	4,170,516	5,423,751
Refrigerator	18	85,483	80,328
Container	4	19,148	28,000
Bulk	105	587,384	788,898
Timber	351	1,236,063	1,565,936
Total	1,122	6,098,594	7,886,913
Combination:			
Cargo-passenger	8	14,859	9,359
Cargo-training	10	55,404	49,178
Total	18	70,263	59,537
Passenger	64	393,407	121,421
Tanker:			
POL	266	3,116,277	4,515,687
LPG	2	6,968	5,028
Wine	10	22,871	28,450
Total	278	3,146,116	4,549,165
Grand Total	1,482	9,708,380	12,616,036

As of 1 January 1973 the fleet of 75 special-service ships (1,000 g.r.t. upward)—including icebreakers,

[2]Excludes Caspian Sea fleet; river/seagoing ships subordinate to the Ministry of River Fleet, R.S.F.S.R.; and cargo ships and tankers subordinate to the Ministry of Fishing Industry. The latter were formerly inventoried with the commercial fleet.

training, scientific research, and space-event support vessels—totaled 349,884 g.r.t. or 190,052 d.w.t. The Caspian Sea fleet, a valuable supplement to the oceangoing fleet, comprised 24 dry cargo ships, 47 tankers, and 3 passenger ships and had a combined total of 247,955 g.r.t. and 296,291 d.w.t. Although employed independently, and largely confined to Caspian Sea operations, ships of this fleet are frequently moved through the Volga-Don Canal and connecting rivers, transporting cargoes to ports in the Black and Mediterranean seas.

Although the Soviets have been designing and building large-size new ships since 1960, their average-size merchant ship of 6,500 g.r.t. and 8,500 d.w.t. is still considerably smaller than the worldwide average of 10,000 g.r.t. and 16,000 d.w.t. Nearly 61% of the commercial fleet's ships are less than 10 years old, 29% of the ships are from 11 to 20 years old, and the remaining 10% are over 20 years old. The number of ships which can attain speeds of 14 knots or more is 735, and about 105 (14%) of these can achieve 18 knots or more.

Over 85% of the commercial fleet ships have diesel propulsion; about 1% have gas turbine propulsion; and the remainder have steam propulsion systems. It is estimated that diesel systems will continue as the principal propulsion method for the majority of newly built ships.

The Ministry of Maritime Fleet, directly subordinate to the U.S.S.R. Council of Ministers, provides policy guidance, defines objectives, and directs all functions related to the maritime industry. The ministry's operating groups—marine steamship companies—in effect own and manage all maritime assets within their assigned geographical areas. In addition to normal carrier functions, each company is responsible for operating the repair yards, commercial port facilities, and intermediate training schools for seagoing personnel.

The Soviet merchant fleet is home-based in four geographic areas, and with the establishment of the Primorskoye Marine Steamship Company in January 1972, is organized into 15 companies. In addition there is the Baku-headquartered Caspian Marine Steamship Company, which controls the merchant ships based in the Caspian Sea. The base area, the number of major companies, plus the steamship headquarters is as follows:

Base area	No. of companies	Company headquarters
Baltic Sea	4	Baltic Marine Steamship Co., Leningrad Estonian Marine Steamship Co., Tallin Latvian Marine Steamship Co., Riga Lithuanian Marine Steamship Co., Klaypeda
Black Sea	5	Black Sea Marine Steamship Co., Odessa Georgian Marine Steamship Co., Batumi Novorossiysk Marine Steamship Co., Novorossiysk Azov Marine Steamship Co., Zhdanov Danube Marine Steamship Co., Izmail
Far East	4	Far Eastern Marine Steamship Co., Vladivostok Kamchatka Marine Steamship Co., Petropavlovsk Sakhalin Marine Steamship Co., Kholmsk Primorskoye Marine Steamship Co., Nakhodka
Arctic	2	Murmansk Marine Steamship Co., Murmansk Northern Marine Steamship Co., Archangel'sk

The distribution of the fleet by ship type and tonnage according to the base areas is given in Figure 1c.

While the U.S.S.R. has made great strides in modernizing its merchant fleet, their plan to retire by 1971 all ships built prior to 1945 did not materialize. Although 35 ships in this category were either scrapped, reported to be laid up, or converted to floating warehouses between July 1970 and January 1973, the present fleet still includes 97 ships which the Soviets had planned to retire by 1971, including 33 U.S. lend-lease Liberty ships. Meanwhile during this period two ships were lost, four others were given to Bangladesh, and another 12 were transferred to one of the other services (naval, fishing, research, or Caspian Sea fleet).

Based on the degree of achievement of the planned goal and projected deletions, it is estimated that the Soviet merchant fleet will consist of around 1,800 ships totaling nearly 16 million d.w.t. by 1976 and about 2,300 ships totaling nearly 21 million d.w.t. by 1982.

Figure 19 indicates ships built by domestic and foreign shipyards for the Soviet merchant fleet during 1970-72.

In terms of merchant ships built during the last 3 years for the fleet, the Soviet Union has built about 39% in domestic shipyards; the Communist countries have built over 47%; and the non-Communist countries have built 14%. In terms of deadweight tonnage, the Soviets have built 35%; Communist countries, 56%; and non-Communist countries, 9%.

East Germany and Poland have been the primary Communist shipbuilders for the Soviet merchant fleet; Finland has been the leading non-Communist shipbuilder.

The Soviet seaborne foreign trade for 1972 is estimated at 150 million tons with approximately 56%

of the volume carried on Soviet flag ships and 44% on foreign ships. This has been a significant increase from 1965, when the Soviet seaborne foreign trade was 101 million tons with 50% of the volume transported on Soviet ships. In contrast, the United States carries less than 6% of the volume of its trade in its own ships.

In recent years the Soviets have extended their inland waterway operations into the maritime field, primarily through the development and increasing use of relatively large, dual-purpose, river/seagoing ships.

Foreign seaborne trade by river/seagoing ships has developed in each of the four major sea basins of the U.S.S.R.—Baltic Sea, Black Sea, Arctic, and Far East—with most of the activity originating in the Baltic and Black Sea basins. The river/seagoing ships supply only a small portion of the overall Soviet maritime cargo-carrying capacity; however, because of the frequency of voyages and short shipping routes, they do carry a substantial part of the seaborne trade to Scandinavia, Western Europe, and the Black and Mediterranean Sea areas. A small number of river/seagoing ships have been operating between the Soviet Far East and Japanese ports since 1966.

The All-Union Association for Importing Ships (V/O SUDOIMPORT), the state trading agency which does all the external buying and selling for the shipbuilding and shipping industries, is making a determined effort to secure a share of the world ship market. In terms of trade, ships built for export are considered by the Soviets as among the best earners of foreign exchange and are used to pay for equipment and "technical know-how" imported from industrially advanced countries, many of which are in the "hard-currency" trading area. Since 1958 the Soviet Union has exported 62 merchant ships, 18 major fishing vessels, 1 icebreaker, and 1 salvage tug, for a combined total of about 1.1 million d.w.t. Approximately 60% of the total ships were exported to non-Communist countries and the remaining 40% to other Communist countries. Figure 20 gives the number, type, and disposition of merchant and fishing ships exported during 1958-72.

According to current contracts the U.S.S.R. has orders to build during 1973-75 four 12,500-d.w.t. cargo ships, two 36,000-d.w.t. bulk carriers and three 16,300-d.w.t. tankers for foreign shipping firms. The increase in Soviet ship exports has resulted from the expansion of domestic shipbuilding facilities and the desire to accumulate needed foreign exchange. These two factors indicate that the Soviet Union will become increasingly involved in exporting new merchant and fishing vessels in the world shipbuilding market. In this connection, it was announced that V/O SUDOIMPORT intends to publicize worldwide the Soviet shipbuilding industry at various maritime exhibitions in foreign countries during 1973.

During the past few years when leading maritime nations were augmenting their fleets with giant tankers, large bulk carriers, and large combination ore-bulk-oil carriers and container ships, the Soviet Union continued to build and acquire relatively small universal general-cargo ships, tankers, and timber carriers. With the delivery of four container ships during 1972, however, the Soviet ship acquisition trend is turning toward building a fleet of container ships, as well as specialized ships. Under the present Five Year Plan, the Soviet Union has ordered tankers of 150,000 d.w.t., bulk cargo ships of 50,000 d.w.t., and container ships of 200 and 300 standard 20-foot International Standards Organization (I.S.O.), container capacity from domestic shipyards. Communist shipyards, primarily in East Germany and Poland, are building ore-bulk-oil carriers of 105,000 d.w.t., bulk cargo ships of 32,000 d.w.t., and semi-container and container ships. Roll-on/roll-off container ships have been ordered by the U.S.S.R. from Finland and France. Additionally, nuclear icebreakers from domestic yards and conventional icebreakers from Finnish yards are being built.

To compete with other leading maritime nations in international trade, both economically and politically, it is probable that the Soviet merchant fleet will soon begin placing larger and more sophisticated ships on their main services. Although ships in the "super" category (200,000 d.w.t. upward) are not presently projected, the largest ship in the fleet is to be a 150,000-d.w.t. tanker built in the Black Sea and scheduled for delivery in 1974. This notwithstanding, there will always be a need in Soviet trade for ships of medium and small tonnage. It is by design that the majority of the ships in the Soviet merchant fleet are in this category, as these ships operate most economically on domestic shipping lines and on near-seas trade routes; e.g., Black Sea to Mediterranean, Baltic Sea to Western Europe, and Soviet Far East to Japan.

The Soviet Union has contributed to promoting the development and establishment of new and profitable international trade opportunities. During 1972, Soviet merchant ships called at over 1,000 foreign ports in over 100 countries.

In October 1970, when the United States Federal Maritime Commission approved the Soviet bid to establish freight service to U.S. west coast ports, the Soviet Union achieved the first step in a campaign designed to share in the world's largest and most valuable foreign trade. Furthermore, in October 1972

the U.S.S.R. agreed to settle the lend-lease World War II debt for US$722 million payable over a 30-year period. Concurrently, a trade agreement between the U.S.S.R. and the United States was concluded for at least $750 million in trade over a 3-year period or until yearend 1975. Transport of cargoes was scheduled to be one-third on Soviet ships, one-third on U.S. ships, and the remainder on third-country ships. Forty U.S. ports and 40 Soviet ports are to be opened under the terms of the agreement to which vessels of the other nation could gain access upon 4-day notice. The U.S. ports included in this group are located on the West coast, East coast, Gulf of Mexico, and the Great Lakes. Additionally, a Soviet passenger ship is scheduled to open a new service between New York and Leningrad by 1974 with three sailings a year contemplated. The opening of this new service is a follow-on to the U.S.-Soviet Union trade and shipping pact signed in October 1972.

With the trend for specialized shipping developing, one of the main tasks under the current Five Year Plan is the development of ports to keep pace with the new ships. The erection of highly mechanized transshipping complexes for the loading and unloading of containers, bulk goods, and timber must be developed. Soviet plans include the construction or reconstruction of wharves, erection of mechanized piers, and building of special berths for container ships in a number of ports.

The modernization and expansion of ship repair yards in Nakhodka, Novorossiysk, Tuapse, and Riga are planned, in order to raise the quality of ship repairs and to increase the life of ships.

The Ministry of the Maritime Fleet initiated the necessary preparations for the establishment of an automated information control system for sea transport in early 1970. The entire fleet computer-control system was originally scheduled for completion by 1971, but to date is only about 55% completed. When this system is completed, the Soviets hope for a 5% to 6% increase in ship operation and cargo-handling efficiency.

The Soviet fishing fleet is now the largest and most modern fleet of its kind in the world, and its operations span the globe. On 1 January 1973, the fishing fleet comprised 4,630 fishing, whaling, and support and scientific research ships over 100 g.r.t. Selected data on the fleet are as follows:

	Ships over 1,000 G.R.T.	Ships under 1,000 G.R.T.	Total
Number	1,153	3,477	4,630
C.R.T.	4,989,545	3,308,314	8,297,859
D.W.T.	1,253,180	693,465	1,946,645

This fleet is well organized and can provide its own bunkering and replenishment at sea. In spite of its commercial function, there is a possibility that this fleet can be used to carry military troops and equipment and also for mine and antisubmarine warfare. A number of trawlers have been converted to light cargo ships and intelligence collectors. The fishing fleet's supporting tankers, salvage tugs, base and factory ships are well suited for use in complementing a mobile naval force, and the entire fishing fleet can routinely function as intelligence collectors without detriment to their fishing operations.

The Soviet Union has the world's largest oceanographic research fleet consisting of more than 200 ships which are subordinated to the naval, civilian, and fishing services. The specific objectives of Soviet oceanographic research are both military and civilian related.

In expanding its merchant fleet the Soviet Union has had economic, political, and military objectives in mind. The economic objectives include an announced determination to transport 75% of the volume of Soviet exports and imports in Soviet flag ships. Over the past 12 years the percentage of Soviet foreign trade carried in Soviet ships has increased from 33% to an estimated 56%. A second economic objective is to offset or eliminate completely all hard currency expenditures for the charter of foreign ships. This goal is to be met through increased earnings of Soviet ships operating in cross trades. The transport of foreign trade in her own ships ensures control of the goods transported and reduces the expenditure of hard currency outside the country. The political objectives associated with the fleet expansion are more difficult to identify, but recent experience indicates these objectives have included enhancing Soviet image and prestige abroad, extension of Soviet influence, and neutralization, if not elimination, of free world influence in certain strategic areas. Soviet aid to developing countries serves to inject a legitimate presence in these countries. In turn, this presence also sometimes aids the Soviets in making available the use of shore facilities for logistic support, which in turn has extended the overall operating areas of the Soviet fleets. The Soviet procedure is to first make short visits to a particular country and port, then increase the length of time for subsequent ship visits, to finally achieve the ultimate Soviet goal of a permanent presence in the area. The principal military objective of the development and expansion of the Soviet merchant fleet has been to provide for a naval auxiliary force.

FIGURE 18. Merchant fleet strengths by base area, 1 January 1973 (C)

TYPE	BALTIC SEA	BLACK SEA	FAR EAST	ARCTIC
Tanker:				
Number	44	173	59	2
G.R.T.	337,743	2,521,664	281,116	5,593
D.W.T.	469,979	3,694,813	378,533	5,840
Cargo:				
Number	278	331	334	179
G.R.T.	1,359,394	2,436,309	1,546,425	756,466
D.W.T.	1,777,185	3,143,239	2,006,657	959,832
Cargo-passenger/Cargo-training:				
Number	4	5	8	1
G.R.T.	22,482	26,202	20,373	1,206
D.W.T.	20,212	22,544	15,061	720
Passenger:				
Number	8	29	20	7
G.R.T.	66,597	186,463	124,218	16,129
D.W.T.	19,836	54,903	42,599	4,083
Total:				
Number	334	538	421	189
G.R.T.	1,786,216	5,170,638	1,972,132	779,394
D.W.T.	2,287,212	6,915,499	2,442,850	970,475

FIGURE 19. Ships constructed for the Soviet merchant fleet, 1970–72 (C)
(Thousand tons)

	CARGO			TANKER			PASSENGER			TOTAL		
YEAR BUILT BY	No.	G.R.T.	D.W.T.	No.	G.R.T.	D.W.T.	No.	G.R.T.	D.W.T.	No.	G.R.T.	D.W.T.
1970:												
U.S.S.R.	30	144.2	183.4	8	29.9	38.5	0	0	0	38	174.1	221.9
Communist countries	44	291.7	366.5	9	134.4	193.1	2	2.2	0.6	55	428.3	560.2
Non-Communist countries	14	70.9	94.0	5	15.3	20.3	0	0	0	19	86.2	114.3
Total	88	506.8	743.9	22	179.6	251.9	2	2.2	0.6	112	688.6	896.4
1971:												
U.S.S.R.	26	140.9	182.7	2	3.5	3.3	0	0	0	28	144.4	186.0
Communist countries	26	138.3	166.5	3	46.7	67.8	0	0	0	29	185.0	234.3
Non-Communist countries	6	16.9	20.9	4	11.1	13.5	0	0	0	10	28.0	34.4
Total	58	296.1	370.1	9	61.3	84.6	0	0	0	67	357.4	454.7
1972:												
U.S.S.R.	20	137.9	183.4	4	31.9	46.7	0	0	0	24	169.8	230.1
Communist countries	23	170.0	225.9	2	8.0	11.3	1	19.9	6.0	26	197.9	243.2
Non-Communist countries	0	0	0	4	14.7	20.2	0	0	0	4	14.7	20.2
Total	43	307.9	409.3	10	54.6	78.2	1	19.9	6.0	54	382.4	493.5

FIGURE 20. Merchant and fishing ships exported by U.S.S.R., 1958–72 (C)
(Thousand tons)

	1958–69			1970–72			TOTALS		
	No.	G.R.T.	D.W.T.	No.	G.R.T.	D.W.T.	No.	G.R.T.	D.W.T.
Communist countries:									
Merchant ships	10	47.3	65.3	7	77.5	116.2	17	124.8	181.5
Fishing ships	8	34.5	24.4	6	35.6	31.7	14	70.1	56.1
Other	2	3.1	1.0	0	0	0	2	3.1	1.0
Total	20	84.9	90.7	13	113.1	147.9	33	198.0	238.6
Non-Communist countries:									
Merchant ships	18	226.3	313.8	27	377.8	532.9	45	604.1	846.7
Fishing ships	4	12.7	5.2	0	0	0	4	12.7	5.2
Total	22	239.0	319.0	27	377.8	532.9	49	616.8	851.9
Grand total	42	323.9	409.7	40	490.9	680.8	82	814.8	1,090.5

I. Civil air (S)

Civil aviation in the U.S.S.R. serves three basic purposes: support of the economy through domestic and international transport services; facilitation of administrative and political contact throughout the Soviet Union and other Communist areas; and advancement of the Soviet military effort, indirectly in support of industrial undertakings and directly in terms of contributions to the military airlift potential. Priority among these functions is shifted in accordance with Soviet economic, political, and military objectives. In 1972, the nation's international and domestic trunk air route networks covered about 400,000 miles; about 82 million passengers and 1.8 million tons of cargo and mail were transported by air. The Soviets are attempting to establish air transport as one of the primary means of passenger travel within the U.S.S.R.; air fares are now competitive with the railroads.

The Ministry of Civil Aviation (MGA) is responsible for all civil aviation activities in the Soviet Union. It is a component of the U.S.S.R. Council of Ministers, and its headquarters staff holds legislative, judicial, and administrative authority over all civil aviation matters. MGA conducts its operations within the framework of the prevailing national development plan. Its operating scope includes policymaking, regulation, and the responsibility for the provision and administration of airfields, air transport operations, and airwork.

MGA's flight operations complex (air transport and airwork) is known by the trade name Aeroflot. The various activities of Aeroflot are controlled by MGA through 29 Directorates of Civil Aviation. Twenty-six of the directorates are established within geographic and political boundaries throughout the U.S.S.R., and each is responsible for the actual conduct of air transport and general aviation operations originating in its territory. Each has an assigned aircraft fleet, operates airports, and provides air traffic control and other support services within its assigned area—governed by goals and standards established by MGA. The remaining three directorates are located at Moscow, and because of the volume of air activity in the Moscow region, they divide the multiple duties normally assigned to a single directorate. One is responsible for most international flights, another for long-haul domestic and major trunk route operations, and the third for special purpose aviation (airwork), local air route services, and polar aviation activities.

The operation of Aeroflot is an intricate one, resulting in part from the tremendous scope and variety of activities that are combined in a single organization. In addition to the management and conduct of the air transportation system, including scheduled, nonscheduled, charter, and other special purpose flights, Aeroflot flight operations include a wide variety of airwork. Its scheduled services are divided among three distinct types of air routes: international routes, domestic routes "of national importance" (trunk routes), and local routes (feeder lines).

Aeroflot's international air route network, estimated to cover approximately 93,000 route-miles, connects the Soviet Union with 74 foreign cities—15 in Communist nations and 59 in non-Communist countries. Most non-Communist services originate in

Moscow and link the Soviet capital with major cities in Europe, Asia, the Middle East, Africa, North America, and Cuba. The carrier's scheduled services also extend to all of the Communist nations of the world except Albania. Within the European Communist area, Soviet air services connect with those of the other Warsaw Pact nations to form a closely integrated transport system.

Scheduled domestic services on Soviet trunk routes total about 16,000 flights weekly during the peak summer period. Air route mileage is about 300,000 miles linking nearly 4,000 cities and towns. About 15% of the domestic flights originate in Moscow, connecting the capital with the major population and industrial areas of the country. The cities that are headquarters of the more important regional directorates are also hubs of domestic air traffic. In addition to domestic trunk-route operations, each regional directorate conducts services on local routes within its area of responsibility. These local services consist of trunk-route feeder flights and flights to points not served by other means of transportation. The full extent of local service operations is not known, but it is estimated that the larger directorates operate as many as 400 scheduled services daily.

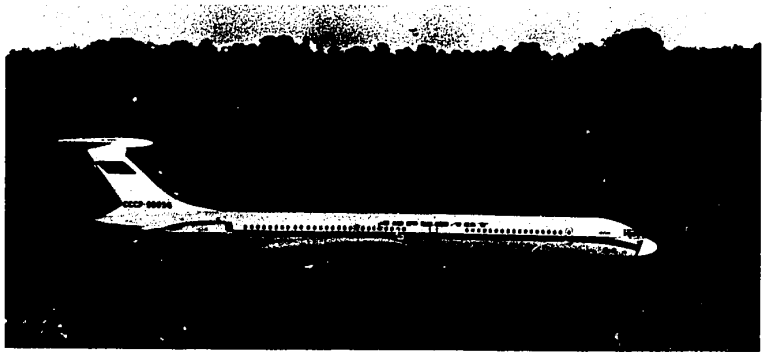
Several of the Aeroflot directorates are engaged in extensive helicopter passenger services. Many of these services are believed to be in resort areas, such as the Crimea (Yalta, Simferopol') and the Caucasus (Sochi, Sukhumi), and a substantial number are in remote areas where there are few airfields. There is a large commercial helicopter operation at Baku, where thousands of workers are flown annually between the city and offshore oil installations. In the Moscow area Aeroflot operates airport to downtown and interairport helicopter commuter services.

The Soviet carrier meets its international schedule with a fair degree of regularity. Domestic operations are somewhat less regular, flights often being delayed because of adverse weather conditions, lack of a full complement of passengers, or being held to meet some governmental demand. Another contributing factor is the number of so-called "special notice flights." Flights in this category presumably depend on the number of passengers requiring air transportation to a given point at a given time and on the travel priority assigned by MGA. Many of these flights are utilized to augment scheduled operations.

In addition to air transport operations the regional directorates perform a variety of airwork services. These include: agricultural work (cropdusting, spraying, fertilizing); forestry patrol and firefighting; mosquito control; aerial spotting for the fishing industry; iceberg reconnaissance; surveillance of navigational aids; supply and service to scientific expeditions; air ambulance and medical services; and air-sea and air-ground rescue operations. Airwork associated with the Soviet astronautics and atomic energy programs include atmospheric soundings, geodetic surveys, and aerial cartography. Widespread use is made of helicopters as cranes and in such activities as pipeline laying and powerline surveillance.

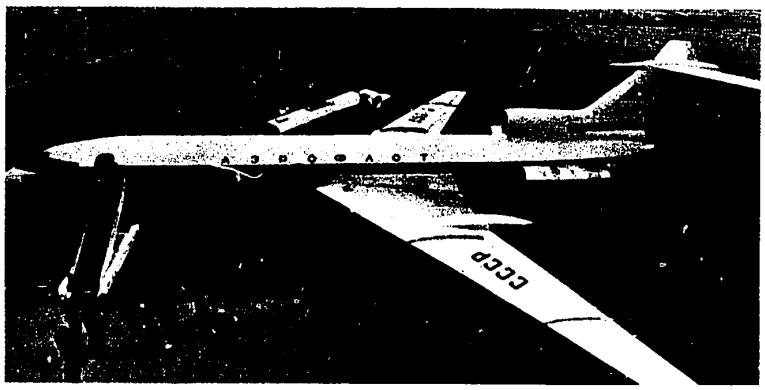
As of November 1973, MGA's multiengine major transport (20 or more passengers) inventory was estimated at 2,840 aircraft: 45 CLASSIC (Il-62) (Figure 21), 30 CARELESS (Tu-154), 3 COCK (An-22), 80 CRUSTY (Tu-134), 30 CLEAT (Tu-114), 400 COOT (Il-18), 160 CAMEL (Tu-104), 80 CAT (An-10), 200 CUB (An-12), 75 COOKPOT (Tu-124), 600 COKE (An-24), 350 CODLING (Yak-40), 410 CRATE (Il-14), 2 COACH (Il-12), and 375 CAB (Li-2). About 200 of these aircraft are allocated for training and research purposes and for support of the aircraft industry. The remainder, plus an estimated 3,200 single-engine COLT (An-2) light transports, are assigned to Aeroflot's operating fleet. Utility, training, and liaison services are performed by about 1,000 light aircraft of several types, including the CREEK (Yak-12), MAX (Yak-18), and the Czechoslovak-manufactured Morava (L-200). In addition, Aeroflot operates over 1,000 helicopters, primarily of the HARE (Mi-1), HOPLITE (Mi-2), HOUND (Mi-4), HOOK (Mi-6), and HIP (Mi-8) types. The larger jet and turboprop transports (CLASSIC, CLEAT, COOT) are used on long-haul international and domestic services, while the medium and light transports (CAMEL, CAT, COKE, COOKPOT, CRUSTY, CODLING, CRATE, CAB, and COLT) are primarily employed on the domestic trunk and local routes. CRUSTY and COKE are also utilized for short-haul international services. The CARELESS joined the Aeroflot fleet for the first time in 1971, and is expected to become the workhorse of the fleet, eventually replacing aging CAT, COOT, and CAMEL aircraft. Presently it is being flown on a few medium-range domestic and international services. The COCK has not been assigned to scheduled services but has been used on nonscheduled international and domestic cargo operations. The CUB is used primarily for cargo transport, and the COACH for utility and logistic supply services. COKE and CODLING are replacing old CRATE and CAB aircraft on Aeroflot local services.

The civil air establishment includes its own maintenance and supply systems. General maintenance and repair are provided at line maintenance and repair workshops situated at one or more airfields



CLASSIC (IL-62). Jetliner used almost exclusively on long-range international routes.

HOOK (MI-6). Heavy general-purpose helicopter used for aerial crane operations and some passenger services.



CARELESS (TU-154). Expected to become the workhorse of Aeroflot's fleet, eventually replacing the COOT, CAMEL, and CAT aircraft.

FIGURE 21. Soviet aircraft (U/OU)

within each regional directorate's area. Major overhaul and repairs are accomplished at several air repair bases, most of which are at the principal aircraft factories throughout the country. The Aeroflot maintenance system is well organized and workable for the Soviet Union and results in a level of aircraft availability fully sufficient to meet Aeroflot's schedule.

All aircraft in the civil fleet, with the exception of about 2,800 Polish-produced COLT's and a small number of Czechoslovak light aircraft, are manufactured in the U.S.S.R. The Soviet Union produces and supplies almost all aircraft spare parts and components and related equipment, as well as aviation fuels and lubricants. Stocks are sufficient to support current civil air operations, and no deficiencies are known to exist in any of these areas.

The number of MGA employees is estimated to be over 300,000, including a maximum estimated pilot strength of 32,000. The principal source of Aeroflot personnel are the aeroclubs (the aviation arm of the Soviet youth organization DOSAAF—Voluntary

Society for Cooperation with the Army Aviation, and the Fleet), which provide elementary aviation training in the interests of both civil and military aviation. Although most new Aeroflot employees have had only aeroclub training, some also have completed military aviation training.

MGA conducts its own training system. Three-year courses are offered for flight personnel and ground technicians at several ministry schools. Pilot graduates are usually first assigned to Aeroflot units equipped with light aircraft, then progress to advanced flight training schools. After job assignment, pilots and other technical personnel receive conversion and on-the-job flight training. The effectiveness of the training system and the proficiency of Aeroflot's crews cannot be accurately assessed. The magnitude and success of the domestic operations attest to a satisfactory degree of competence, but no statistics on the numbers and causes of domestic aircraft accidents have been released by the government. The Soviet press seldom reports air crashes unless foreign passengers are aboard, but during the period August 1971 through February 1973 at least five major Aeroflot aircraft are known to have crashed, resulting in the loss of 550 lives. This fact alone should not, however, be taken as indicative of incompetence of the part of Aeroflot personnel, since many other factors could be, and probably were, responsible for these accidents. Crews observed on international flights, probably selected from the best available personnel, are technically well trained and efficient. Strict adherence to flight safety procedures is, however, sometimes spotty.

On 15 October 1970 the Soviet Union submitted formal notification of adherence to the 1944 Chicago Convention on International Civil Aviation, a prerequisite to membership in the International Civil Aviation Organization (ICAO). In accordance with the ICAO charter, actual membership by the U.S.S.R. became effective 30 days later on 14 November 1970. ICAO is a specialized agency of the United Nations and the principal multilateral aviation organization concerned with the orderly development of international air transport services. The U.S.S.R. is also signatory to the Convention for the Unification of Certain Rules Relating to International Carriage by Air (Warsaw Convention, 1929) and to the 1955 Hague Protocol to the Warsaw Convention. The Warsaw Convention and its protocol govern the liability of an air carrier in case of injury to passengers or damage to baggage or cargo on international flights. Aeroflot is not a member of the International Air Transport Association (IATA), a rate-fixing and coordinating association of scheduled international air carriers. However, the U.S.S.R. sends observers to IATA conferences, and the Soviet Government continues to show interest in active membership.

The Soviet Government has entered into bilateral civil aviation agreements and arrangements with 73 countries, 13 Communist nations and 60 non-Communist nations. The non-Communist countries with date of agreement are as follows:

Africa

Algeria—1964
Burundi—1973
Cameroon—1967
Central African Republic—1965
Congo—1964
Ghana—1962
Guinea—1962
Kenya—1965
Libya—1970
Mali—1962
Morocco—1962
Niger—1962
Nigeria—1967
Senegal—1965
Somalia—1963
Sudan—1962
Tanzania—1965
Tunisia—1964
Uganda—1965

Europe

Austria—1968
Belgium—1958
Denmark—1956
Finland—1956
France—1958
Greece—1973
Italy—1965
Luxembourg—1963
Netherlands—1958
Norway—1956
Sweden—1956
Switzerland—1966
United Kingdom—1959
West Germany—1971

Middle East

Cyprus—1964
Egypt—1958
Iraq—1962
Jordan—1970
Lebanon—1966
Syria—1962
Turkey—1967
Yemen (Aden)—1969
Yemen (Sana)—1967

Asia

Afghanistan—1956
Bangladesh—1972
Burma—1964
India—1958
Indonesia—1961
Iran—1964
Japan—1966
Laos—1970
Malaysia—1969
Pakistan—1963
Singapore—1969
Sri Lanka—1964
Thailand—1971

Western Hemisphere

Canada—1966
Chile—1972
United States—1966
Colombia—1972
Peru—1973

With the exception of those agreements with Niger, Luxembourg, and Colombia, all of the above provide for regularly scheduled air services between the U.S.S.R. and the country involved. The three agreements which are exceptions provide only for overflight rights for Soviet civil aircraft proceeding to a destination in a third country. Even though the Soviet Union has agreements with 73 countries, Aeroflot provides services to only 66 of them.

The Soviet Union is served by 28 foreign air carriers. The international airlines of Bulgaria, Czechoslovakia,

East Germany, Hungary, Poland, Romania, and Yugoslavia conduct flights between their respective countries and cities in European U.S.S.R. The national airlines of the People's Republic of China and Mongolia operate from their respective capitals to Irkutsk in central Siberia. The U.S.S.R. is also served by 19 carriers from non-Communist countries: Air Algerie, Air Canada, Air France, Air India, Alitalia, Ariana Afghan Airlines, Austrian Airlines, British European Airways, BOAC British Airways, Egyptair, Finnair, Iran National Airlines, Iraqi Airways, Japan Air Lines, KLM Royal Dutch Airlines, Lufthansa German Airlines, Pan American World Airways, SAS Scandinavian Airlines System, and Swissair. All of these fly into Moscow, except Ariana Afghan Airlines, which serves only Tashkent. BEA, SAS, and Finnair serve Leningrad in addition to Moscow, and Japan Air Lines conducts services to Khabarovsk. Five carriers have obtained rights to conduct operations between Europe and Tokyo via Moscow along the trans-Siberian route: Japan Air Lines, SAS, KLM, BOAC, and Air France.

J. Airfields[3] (S)

The air facilities system of the Soviet Union consists of more than 3,250 airfields and a few seaplane stations. About 300 airfields are in regular use by military aircraft. Information on the number used by civil aviation is unavailable; however, the large amount of transport and nontransport operations conducted by Aeroflot and the flight training and sports flying activities of DOSAAF would account for the majority of Soviet airfields. Many Aeroflot airfields are shared jointly with the air forces. Some airfields are believed to be closed, abandoned, or used infrequently by either military or civil aircraft, but these are considered usable or easily restorable. A substantital number are military reserve bases, many of which are used occasionally during deployment training exercises. Because all Soviet airfields are government owned, conversion to either military or civil use is easily accomplished. Since the Soviet Navy no longer uses flying boats, the former major naval flying boat bases have all been closed, abandoned, or converted to other marine activities. The few seaplane stations still in use are of a very minor character with limited support facilities. Used only by light, float-equipped civil aircraft, they are located mainly where airfields are difficult to build, primarily at small communities along the rivers of north Siberia. There they function only as warm weather substitutes for the landing strips commonly built on the ice during the Arctic winter.

Except in areas where permafrost, tundra, mountainous terrain, or problems of logistic support are limiting factors, the Soviet Union has an adequate, well-distributed air facilities system capable of supporting all types of air operations. The existing system could easily be expanded by the improvement of undeveloped airfields or by the construction of new installations. In addition, there are many hundreds of sites where airfields existed during World War II, particularly in the former combat zones of European U.S.S.R. Most of them were sod fields, since returned to cultivation, but a large percentage of these sites would be suitable for construction of modern airfields.

The distribution pattern of Soviet airfields generally follows the population and surface transport patterns. Density is greatest in European U.S.S.R., with important complexes or concentrations around Moscow, Leningrad, Arkhangel'sk, the Kola Peninsula, Gor'kiy, Kuybyshev, Saratov, Kiyev, Khar'kov, along the Poland and Czechoslovakia borders, in the Crimea, and elsewhere along the Black Sea coast. The Trans-Caucasus region, which extends into Asia Minor, has important complexes from Krasnodar to Baku, including the areas of Stravropol', Groznyy, Tbilisi, and Kutaisi.

In Soviet Central Asia, air facilities are located mainly along the Trans-Siberian and other railroad systems of the area. There is a small concentration of airfields among the industrial cities just east of the Urals and a relatively heavy concentration in the border areas of southern Kazakhstan. Near the central Siberian cities of Omsk, Novosibirsk, Irkutsk, and Chita there are significant airfield complexes. Elsewhere in central Siberia air facilities are widely scattered and are generally minor installations whose principal function is to support regional air transportation. There are large areas of desert in Kazakhstan and Soviet Central Asia where the lack of water and transportation has retarded or even precluded airfield development. Vast expanses or marshland have had the same effect in western Siberia.

Most of the air facilities in the Soviet Far East are located in the southern half of that area. The southern maritime region has one of the heaviest and most important airfield concentrations in the U.S.S.R. Other concentrations and complexes are located near Belogorsk, Khabarovsk, Komsomol'sk, Sovetskaya Gavan', and in central and southern Sakhalin. There is a chain of airfields in the Kuril Islands, but most of

[3]Details on individual airfields are available in *Airfields and Seaplane Stations of the World*, volumes 33 through 39, published by the Defense Intelligence Agency.

them are minor installations. Airfields in northeastern Siberia are generally widely dispersed except for the small but important complexes at Magadan, Petropavlovsk-Kamchatskiy, Anadyr', and Provideniya.

In the Soviet Arctic, airfields are distributed in a thin but fairly regular pattern along the coast, on the offshore islands, and along the principal rivers flowing into the Arctic Ocean. There is a major concentration on and near Kola Peninsula and a lesser one on Chukotsk Peninsula. Isolated, minor airfields are thinly scattered throughout the Soviet Arctic hinterland to provide settlements with air communications to the more important urban centers. Airfield distribution in much of the Soviet Arctic is inadequate for optimum deployment of air defense fighters. Although additional major airfields could be built in the area, most of the region is dependent on the Northern Sea Route and the northward flowing river systems for logistic support. Without a more adequate supply system, additional airfields would be of limited value.

Soviet military airfields used for basing units of regimental or larger size generally have a permanent-surface runway and taxiway system, on-field POL storage, extensive housing, and other support facilities, and they are served by railroads or other adequate means of logistic access. Special weapons storage and handling facilities are located at or near most of the more important bases. Hangars, formerly found only at airfields having a depot maintenance function, are becoming more prevalent than in the past. Major civil airfields are similar except for the absence of extensive housing, ordnance storage, and other features required only by military users. In place of these, civil airfields generally have the terminal and cargo handling facilities needed for civil air operations.

Heavy and medium bomber home bases usually have a concrete runway 8,200 to 13,100 feet in length. Jet light bomber and jet fighter bases generally have runways of concrete or asphalt in the 6,600- to 8,200-foot range. A few military transport bases have shorter runways. Concrete is the predominant surfacing material at major airfields, although asphalt is also used, especially for resurfacing old concrete runways. Although multiple intersecting runways were prevalent at major airfields built during and before World War II, postwar development has featured the single-runway layout.

Most Soviet fighter and bomber bases have an auxiliary graded earth or sod runway or landing area. These are usually situated parallel to the main, permanent-surface runway and are often of greater length. Soviet air units continue to operate several types of jet fighters, bombers, and transports from runways having graded earth, steel mat, sod, or other temporary surfaces. For training and during redeployment exercises, generally in the summer, jet fighter units often use undeveloped airfields having only a temporary runway surface. Many of these landing grounds and temporary runways are of considerable size and would be suitable for recovery or redeployment operations in the event of war. When tactical units use natural-surface landing grounds, a runway area is usually marked out and used until the surface deteriorates. A new area is then marked out and used while the former is being restored.

Taxiways and parking facilities are generally built of the same material as the runway. All major military airfields and most of the larger civil airfields have a loop or parallel taxiway system. Some civil airfields which do not have enough traffic density to warrant a loop or parallel system have only a link taxiway from one end or from the center of the runway to the parking area. Parking facilities consist of either hardstands or aprons; most military airfields have both. In many instances disused secondary runways have been converted to parking aprons. Where adequate hard-surface parking facilities are not available, general field parking is used extensively.

Soviet navigational aids have improved steadily since World War II but are not yet as sophisticated as those of the United States and other Western nations. Nearly all major airfields have a radar ground-controlled approach (GCA) system and an instrument landing system. There are two types of Soviet instrument landing systems. The older is the beacon approach system, consisting of a pair of nondirectional radio beacons aligned with the runway and located in its approach zone. Marker beacons are usually collocated with both the outer and inner nondirectional beacons. The newer system is a localizer, glide path, and marker beacon arrangement, similar but not identical to the U.S. instrument landing system. Ultra high frequency omnirange and distance measuring equipment is often incorporated with the newer system to provide a more adequate means of navigation and approach. Various types of air surveillance and navigation radar are generally available, in addition to GCA. Older types of navigation equipment, such as direction finders and nondirectional radiohoming beacons, are located at nearly all operational airfields and are still an important point-to-point navigational aid. Control towers are in general use and are occasionally supplemented by mobile control vehicles positioned near the downwind end of the runway.

Runway and approach lights of various types are generally available at major Soviet airfields. Other standard lighting facilities, including boundary, obstruction, identification, and floodlights, are also available. Minor airfields have at least floodlights and, usually, obstruction and boundary lights. Portable runway flares are also used.

Most of the major maintenance and overhaul of aircraft in the Soviet Union are accomplished by centralized maintenance depots, each of which serves many operational bases. Aircraft factories are also used for this purpose. This practice reduces the need for extensive maintenance facilities, with their associated hangars and large shops, at most operational airfields. Consequently, although numerous small shops are normally present, hangars are seen less often than they are at comparable U.S. bases. Mobile maintenance units, temporary canvas shelters, and mobile heating units are used in performing field maintenance on a year-round basis.

From 3 million to 12 billion or more gallons of onbase fuel-storage capacity is believed to be available at medium and heavy bomber bases and the more important civil airfields. Fighter and light bomber bases usually have from 1 million to 3 million gallons of storage capacity. Airfields basing smaller units and those not regularly used by jet aircraft have substantially lower capacities. Fuel is usually stored in cylindrical underground, semiburied, or aboveground tanks, grouped in one or more POL areas near the flight line and served by a railroad spur. Large off-base fuel-storage depots are sometimes located within a few miles of major airfields or airfield complexes. Where fuel requirements are not great and good access to fuel depots is available, some airfields are supplied directly from tank cars. Portable fuel-storage facilities are often used at lesser airfields, especially those in seasonal use for redeployment exercises. These generally consist of horizontal cylindrical tanks that are frequently deposited at random in the servicing area and may be removed when units return to their home bases. Bladder-type fuel cells are also coming into use. Refueling trucks are the predominant means of refueling aircraft, although many major airfields are known to have a hydrant system for rapid, simultaneous refueling of aircraft.

Adequate housing and messing facilities are available at most operational airfields. On-base housing at the better developed airfields usually consists of numerous masonry barracks and often includes quarters for dependents. Local civilian housing is frequently used to supplement on-base housing. Tents are used at undeveloped airfields where no other housing exists, particularly during deployment exercises.

Ammunition and high-explosive storage facilities are believed to be available at all airfields intended for use by combat aircraft. Storage, assembly, and loading facilities for special weapons, including nuclear weapons and air-to-surface and air-to-air missiles, are available in accordance with the mission of the units based on the airfields. Other supplies and equipment are stored in conventional warehouses at the major airfields.

All military home bases and the major civil airfields are capable of supporting sustained operations of military aircraft. Nearly all home bases could be further expanded if necessary. A large proportion of the airfield construction work undertaken since 1960 has consisted of runway extension to accommodate newer or larger types of combat aircraft. Activity of this type is believed to be continuing, but at a reduced pace.

Information on projected military construction is not available. In the light of declining numbers of military aircraft it would appear that the Soviets have a surplus of military airfields; however, a few new major military airfields have been built in recent years, and some are believed to be still under construction. These new permanent facilities are probably needed to supply airfields in areas considered to be deficient, notably along the Sino-Soviet border. A substantial number of temporary-surface airfields, of the type the U.S.S.R. has traditionally used for reserve, redeployment, training, and recovery purposes, have been built in recent years. It is believed this trend will continue. Such airfields, while not suitable for intensive use over an extended time period nor on an all-weather basis, would be useful as back-up or dispersal facilities in the event of hostilities.

Since 1967-68 a large-scale program to develop passive defenses at military airfields has been in progress. This program has provided dispersed and revetted hardstands at heavy and medium bomber bases and the extensive construction of hardened aircraft shelters at fighter bases. The shelters, commonly called hangarettes, are aboveground bunkers designed to completely enclose one or two aircraft in an ordnance-resistant structure. Two main types have emerged. One, by far the most common, is constructed of concrete arches bolted together. The other is built of concrete slabs fastened to an I-beam frame. Both types are placed on concrete slabs and footings and are mounded over with sod-covered earth. Each has heavy, usually sliding, doors at the front and jet effluxes at the rear. Other types can be expected to appear as the Soviets improve their aircraft protection technology.

Selected major airfields are listed in Figure 22. Other important airfields are listed in Figure 23.

FIGURE 22. Selected major airfields* (S)

NAME AND LOCATION	LONGEST RUNWAY: SURFACE; DIMENSIONS; ELEVATION ABOVE SEA LEVEL	RUNWAY LOAD CAPACITY (LARGEST AIRCRAFT SUPPORTABLE)	REMARKS**
	Feet		
Akhtyubinsk/Vladimirovka 48°19′N., 46°14′E.	Concrete 13,100 x 250 30	*est* BEAR	Joint. POL capacity: *na.* Major development and test facility; also SAF (Soviet Air Forces) fighter base.
Alekseyevka 49°14′N., 140°11′E.	Concrete 8,200 x 260 570	BADGER	Military. POL capacity: 8,795,000 gal. Naval medium bomber base.
Anadyr'/Leninka 64°44′N., 177°45′E.	Concrete 11,500 x 260 150	BEAR	Military. POL capacity: 15,000,000 gal. SAF medium bomber, fighter, and staging base.
Anisovo Gorodishche 54°13′N., 34°22′E.	Concrete 8,200 x 270 700	BADGER	Military. POL capacity: 5,399,000 gal. SAF medium bomber base.
Arkhangel'sk/Kholm 64°23′N., 40°44′E.	Concrete 8,900 x 200 70	*do*	Military. POL capacity: 2,200,000 gal. Naval medium bomber base.
Artem North 43°24′N., 132°10′E.	Concrete 8,200 x 200 43	*do*	Joint. POL capacity: 3,341,000 gal. Naval medium bomber base and civil jet transport facility for Vladivostok.
Baranovichi 53°06′N., 26°03′E.	Concrete 9,800 x 300 600	BLINDER	Military. POL capacity: 4,930,000 gal. SAF medium bomber and fighter base.
Belaya 52°55′N., 103°34′E.	Concrete 9,800 x 260 1,475	BADGER	Military. POL capacity: 9,622,000 gal. SAF medium bomber and fighter base. Used occasionally by civil aircraft as alternate for Irkutsk.
Belaya Tserkov' 49°48′N., 30°02′E.	Concrete 8,200 x 260 570	*do*	Military. POL capacity: 6,700,000 gal. SAF medium bomber base.
Bobruysk 53°06′N., 29°12′E.	Concrete 8,200 x 260 470	*do*	Military. POL capacity: 3,000,000 gal. SAF medium bomber base.
Bykhov 53°31′N., 30°12′E.	Concrete 8,200 x 260 530	*do*	Military. POL capacity: 4,300,000 gal. Naval medium bomber base.
Chervono Glinskoye 45°57′N., 29°23′E.	Concrete 8,200 x 260 310	*do*	Military. POL capacity: 5,757,000 gal. SAF medium bomber and jet fighter base.
Dolon' 50°32′N., 79°10′E.	Concrete 13,200 x 260 680	BEAR	Military. POL capacity: 5,789,000 gal. SAF heavy bomber base
Engel's 51°29′N., 46°13′E.	Concrete 11,500 x 300 110	BISON	Military. POL capacity: 3,000,000 gal. SAF heavy bomber base.
Gomel' Pribytki 52°18′N., 31°10′E.	Concrete 9,800 x 260 490	BLINDER	Military. POL capacity: 3,100,000 gal. SAF medium bomber base.
Gvardeyskoye 45°07′N., 33°59′E.	Concrete 8,200 x 260 470	BADGER	Military. POL capacity: 1,300,000 gal. Naval medium bomber base.
Irkutsk Southeast 52°16′N., 104°24′E.	Concrete 9,000 x 220 1,660	CLEAT	Joint. POL capacity: *na.* Major Aeroflot base; also believed to be SAF maintenance facility.
Kalinin 56°50′N., 35°45′E.	Concrete 8,200 x 260 460	BADGER	Military. POL capacity: 5,400,000 gal. SAF medium bomber base.

Footnotes at end of table.

FIGURE 22. Selected major airfields* (S) (*Continued*)

NAME AND LOCATION	LONGEST RUNWAY: SURFACE; DIMENSIONS; ELEVATION ABOVE SEA LEVEL	RUNWAY LOAD CAPACITY (LARGEST AIRCRAFT SUPPORTABLE)	REMARKS**
	Feet		
Kaliningrad/Proveren..... 54°46′N., 20°24′E.	Concrete..... 9,900 x 200 115	BLINDER.....	Military. POL capacity: 4,800,000 gal. Naval medium bomber base.
Kazan' North..... 55°52′N., 49°08′E.	Concrete..... 10,200 x 300 215	....*do*.....	Joint. POL capacity: *na.* SAF and Soviet aircraft industry. Test and flyway facility for aircraft plant.
Khabarovsk Northeast..... 48°31′N., 135°11′E.	Permanent..... 11,500 x 240 230	CLEAT.....	Civil. POL capacity: 6,000,000 gal. Main civil airfield for Khabarovsk, center of civil air transportation in the Soviet Far East.
Khorol' East..... 44°27′N., 132°08′E.	Concrete..... 12,200 x 300 350	BEAR.....	Military. POL capacity: 2,823,000 gal. SAF and naval medium bomber base.
Kiev/Borispol'..... 50°21′N., 30°54′E.	Concrete..... 11,500 x 210 410	BADGER.....	Joint. POL capacity: *na.* SAF fighter base and civil jet transport facility for Kiev.
Kipelovo..... 59°11′N., 39°08′E.	Concrete..... 11,500 x 240 590	BEAR.....	Military. POL capacity: 6,780,000 gal. Naval heavy reconnaissance bomber base.
Kuybyshev/Bezymyanka..... 53°14′N., 50°20′E.	Concrete..... 9,200 x 350 130	....*do*.....	Joint. POL capacity: *na.* Test and flying field for adjoining aircraft factories.
Leningrad..... 59°48′N., 30°18′E.	Concrete..... 11,200 x 230 65	CAMEL.....	Civil. POL capacity: 4,300,000 gal. Main civil airfield for Leningrad.
Malyavr..... 68°52′N., 33°44′E.	Concrete..... 8,200 x 260 600	BADGER.....	Military. POL capacity: 4,600,000 gal. Naval medium bomber base.
Minsk/Machulishche..... 53°46′N., 27°35′E.	Concrete..... 9,800 x 280 670	BLINDER.....	Military. POL capacity: 8,100,000 gal. SAF medium bomber and fighter base.
Mirgorod..... 49°56′N., 33°39′E.	Concrete..... 8,200 x 250 410	BADGER.....	Military. POL capacity: 9,600,000 gal. SAF medium bomber base.
Moscow/Domodedovo..... 55°25′N., 37°54′E.	Concrete..... 12,800 x 200 550	CLEAT.....	Civil. POL capacity: *na.* Newest of Moscow's 3 major civil airports.
Moscow/Ramenskoye..... 55°34′N., 38°07′E.	Concrete..... 18,000 x 360 400	*est* BOUNDER.....	Joint. POL capacity: *na.* Main research, development, and flight test center. Longest paved runway in the U.S.S.R.
Moscow/Sheremet'yevo..... 55°58′N., 37°25′E.	Concrete..... 11,500 x 260 623	CLEAT.....	Civil. POL capacity: 6,000,000 gal. Main international airport of entry.
Moscow/Vnukovo..... 55°35′N., 37°16′E.	Asphalt..... 10,000 x 190 640	....*do*.....	Civil. POL capacity: *na.* One of Moscow's 3 major civil airports; used mainly for domestic flights.
Mozdok..... 43°47′N., 44°36′E.	Concrete..... 11,500 x 300 470	BEAR.....	Military. POL capacity: 6,300,000 gal. (min.). SAF heavy bomber base.
Mys Shmidta..... 68°52′N., 179°23′W.	Concrete..... 8,200 x 200 80	BISON.....	Joint. POL capacity: 7,600,000 gal. One of the most important SAF staging bases in the Arctic; also used by Aeroflot.

Footnotes at end of table.

FIGURE 22. Selected major airfields* (S) (*Continued*)

NAME AND LOCATION	LONGEST RUNWAY: SURFACE; DIMENSIONS; ELEVATION ABOVE SEA LEVEL	RUNWAY LOAD CAPACITY (LARGEST AIRCRAFT SUPPORTABLE)	REMARKS**
	Feet		
Nezhin 51°05′N., 31°52′E.	Concrete 9,800 x 260 420	BADGER	Military. POL capacity: 2,900,000 gal. SAF medium bomber base.
Novosibirsk/Tolmachevo 55°01′N., 82°39′E.	Concrete 11,800 x 260 390	CAMEL	Joint. POL capacity: *na.* Main civil airport for Novosibirsk; SAF fighter base and aircraft repair depot.
Oktyabr'skoye 45°19′N., 34°06′E.	Concrete 8,200 x 200 250	BADGER	Military. POL capacity: 4,900,000 gal. Naval medium bomber base.
Olenegorsk 68°09′N., 33°28′E.	Concrete 11,500 x 260 650	BISON	Military. POL capacity: 8,200,000 gal. Naval medium bomber and Arctic staging base.
Omsk Southwest 54°58′N., 73°18′E.	Permanent 8,200 x 270 300	CAMEL	Joint. POL capacity: *na.* Main civil airport for Omsk; also used by SAF.
Orsha Southwest 54°26′N., 30°18′E.	Concrete 8,200 x 290 640	BADGER	Military. POL capacity: 2,750,000 gal. SAF medium bomber base.
Ostrov/Gorokhovka 57°18′N., 28°26′E.	Concrete 9,500 x 260 250	BLINDER	Military. POL capacity: 5,160,000 gal. Naval medium bomber base.
Petropavlovsk/Yelizovo 53°10′N., 158°27′E.	Concrete 8,200 x 200 270	BADGER	Joint. POL capacity: 7,875,000 gal. Naval medium bomber and SAF fighter base; also used by Aeroflot.
Poltava 49°38′N., 34°29′E.	Concrete 9,800 x 250 500	*do*	Military. POL capacity: 3,000,000 gal. SAF medium bomber base.
Priluki 50°35′N., 32°19′E.	Concrete 8,200 x 260 440	*do*	Military. POL capacity 6,200,000 gal. SAF medium bomber base.
Romanovka West 43°14′N., 132°20′E.	Concrete 8,200 x 200 50	*do*	Military. POL capacity: 2,059,000 gal. Naval medium bomber base.
Ryazan'/Dyagilevo 54°39′N., 39°34′E.	Concrete 9,800 x 260 420	*do*	Joint. POL capacity: *na.* SAF medium bomber base and main civil airport for Ryazan'.
Saki 45°06′N., 33°36′E.	Concrete 10,500 x 200 40	*do*	Military. POL capacity: 2,500,000 gal. Naval medium bomber base.
Severomorsk 69°02′N., 33°26′E.	Concrete 9,800 x 260 230	BEAR	Military. POL capacity: 7,400,000 gal. Naval medium bomber base.
Siauliai 55°54′N., 23°24′E.	Concrete 11,500 x 260 420	BISON	Military. POL capacity: 9,135,000 gal. SAF fighter base.
Sol'tsy 58°08′N., 30°20′E.	Concrete 9,800 x 260 130	BADGER	Military. POL capacity: 4,800,000 gal. SAF medium bomber base.
Spassk-Dal'niy East 44°37′N., 132°53′E.	Concrete 10,000 x 260 340	*do*	Military. POL capacity: 5,569,000 gal. SAF medium bomber and fighter base.
Stryy 49°15′N., 23°47′E.	Concrete 8,200 x 200 1,020	*do*	Military. POL capacity: 2,500,000 gal. SAF medium bomber and fighter base.

Footnotes at end of table.

FIGURE 22. Selected major airfields* (S) *(Continued)*

NAME AND LOCATION	LONGEST RUNWAY: SURFACE; DIMENSIONS; ELEVATION ABOVE SEA LEVEL	RUNWAY LOAD CAPACITY (LARGEST AIRCRAFT SUPPORTABLE)	REMARKS**
	Feet		
Tartu 58°24′N., 26°46′E.	Concrete 8,200 x 260 210	BADGER	Military. POL capacity: 5,250,000 gal. SAF medium bomber base.
Tashkent 41°19′N., 69°23′E.	Concrete 8,200 x 240 1,500	CLEAT	Joint. POL capacity: *na*. Test and flyway field for the adjoining aircraft factory. Used by SAF and Soviet aircraft industry.
Tashkent South 41°16′N., 69°17′E.	Concrete 11,500 x 200 1,385	*....do*	Joint. POL capacity: *na*. Main civil airfield for Tashkent; also used by military transports.
Tiksi 71°42′N., 128°54′E.	Concrete 8,200 x 220 50	BISON	Joint. POL capacity: 27,400,000 gal. One of the most important SAF Arctic staging bases; also used by Aeroflot and SAF fighters.
Ukraina 51°10′N., 128°27′E.	Concrete 11,500 x 260 750	*....do*	Military. POL capacity: 3,197,000 gal. SAF heavy and medium bomber base.
Ussuriysk/Vozdvizhenka 43°54′N., 131°56′E.	Concrete 9,800 x 270 130	BADGER	Military. POL capacity: 4,239,000 gal. SAF medium bomber base.
Uzin/Chepelevka 49°47′N., 30°26′E.	Concrete 11,500 x 330 570	BEAR	Military. POL capacity: 6,990,000 gal. SAF heavy bomber base.
Veseloye 45°35′N., 34°17′E.	Concrete 8,200 x 260 110	BADGER	Military. POL capacity: 5,100,000 gal. Naval medium bomber base.
Zhitomir/Skomorokhi 50°10′N., 28°44′E.	Concrete 9,800 x 250 740	*....do*	Military. POL capacity: 4,900,000 gal. SAF medium bomber base.

na Data not available.
*The selected major airfields are shown on the Terrain and Transportation Map.
**POL capacities are estimated.

FIGURE 23. Other important airfields (S)

NAME AND LOCATION	RUNWAY*	USAGE	NAME AND LOCATION	RUNWAY*	USAGE
Afrikanda 67°27′N., 32°48′E.	8P	M	Chortkov 48°59′N., 25°44′E.	8P	M
Alma-Ata 43°21′N., 77°02′E.	14P	J	Chuguyev 49°50′N., 36°39′E.	8P	M
Amderma 69°46′N., 61°34′E.	8P	J	Dagiyar 40°53′N., 45°57′E.	7P	M
Andizhan 40°44′N., 72°18′E.	8P	J	Daugavpils Northeast 55°57′N., 26°40′E.	8P	M
Andreapol 56°39′N., 32°19′E.	8P	M	Dnepropetrovsk/Voloshkoye 48°21′N., 35°06′E.	7P	J
Arkhangel'sk 64°27′N., 40°25′E.	6P	M	Dobrynskoye 56°15′N., 40°35′E.	7P	M
Arkhangel'sk/Talagi 64°36′N., 40°43′E.	8P	J	Dolinsk/Sokol 47°16′N., 142°46′E.	8P	J
Armavir 44°58′N., 41°06′E.	8P	M	Dombarovskiy 50°48′N., 59°31′E.	7P	M
Ashkhabad/Bezmein 38°01′N., 58°12′E.	8P	M	Dzhankoy 45°42′N., 34°25′E.	6P	M
Ashkhabad Northwest 37°59′N., 58°22′E.	9P	J	Fergana 40°22′N., 71°45′E.	7P	J
Aspidnoye 69°22′N., 161°33′E.	14T	M	Galenki Northeast 44°06′N., 131°49′E.	8P	M
Astrakhan' Northwest 46°24′N., 47°53′E.	8P	M	Gdov 58°49′N., 28°01′E.	8P	M
Baku/Bina 40°28′N., 50°03′E.	9P	J	Gissar 38°31′N., 68°40′E.	8P	M
Baku/Kala 40°25′N., 50°12′E.	6P	M	Gorodok 49°44′N., 23°40′E.	8P	M
Bereza 52°33′N., 24°53′E.	8P	M	Gromovo 60°43′N., 30°07′E.	8P	M
Bezhetsk 57°44′N., 36°39′E.	8P	M	Groznyy East 43°18′N., 45°47′E.	8P	M
Blagoyevo 46°54′N., 30°42′E.	8P	M	Gudauta 43°06′N., 40°35′E.	7P	J
Bobrovichi 52°17′N., 29°21′E.	8P	M	Irkutsk Northwest 52°22′N., 104°11′E.	8P	J
Bobrovka 53°09′N., 50°43′E.	8P	M	Ivano-Frankovsk 48°53′N., 24°42′E.	6P	J
Borisovskiy 57°39′N., 34°06′E.	8P	M	Kaliningrad/Yezau 54°34′N., 20°36′E.	8P	M
Burevestnik 44°55′N., 147°38′E.	7P	J	Kamyshin Northwest 50°12′N., 45°12′E.	8P	M
Chekurovka 71°04′N., 127°20′E.	13T	J	Karshi/Khanabad 38°50′N., 65°55′E.	8P	M
Chelyabinsk/Balandino 55°18′N., 61°30′E.	10P	C	Kazi Magomed 40°02′N., 48°54′E.	6P	M
Chernyakhovsk 54°36′N., 21°47′E.	8P	J	Kedainiai 55°19′N., 23°57′E.	6P	J
Chimkent 42°22′N., 69°28′E.	8P	M	Kem'/Uzhmana 64°55′N., 34°15′E.	8P	M
Chirchik 41°31′N., 69°35′E.	7P	M	Kerch'/Bagerovo 45°25′N., 36°15′E.	11P	M
Chita Northwest 52°04′N., 113°26′E.	8P	M	Khabarovsk/Blagodatnoye 48°25′N., 135°25′E.	7P	M
Chita/Kadala 52°01′N., 113°19′E.	9P	C	Khar'kov 49°56′N., 36°18′E.	5P	J
Chokurdakh 70°37′N., 147°54′E.	6P	J	Khar'kov North 50°02′N., 36°16′E.	5P	J

Footnotes at end of table.

FIGURE 23. Other important airfields (S) (*Continued*)

NAME AND LOCATION	RUNWAY*	USAGE
Kiev/Zhulyany 50°24′N., 30°27′E.	5P	J
Kilpyavr 69°06′N., 32°24′E.	8P	M
Kirovabad 40°44′N., 46°19′E.	7P	M
Kirovskoye 45°10′N., 35°11′E.	8P	M
Kizyl-Arvat 38°59′N., 56°22′E.	7P	M
Klyuchevoye 60°28′N., 28°45′E.	6P	M
Kokayty 37°37′N., 67°31′E.	7P	M
Kolomyya 48°32′N., 25°08′E.	6P	J
Komsomol'sk 50°36′N., 137°05′E.	8P	J
Komsomol'sk South 50°24′N., 136°56′E.	6P	M
Kramatorsk 48°42′N., 37°38′E.	8P	M
Krasnodar 45°05′N., 38°57′E.	8P	M
Krasnovodsk 40°04′N., 53°00′E.	8P	J
Krechevitsy 58°38′N., 31°23′E.	6P	M
Krichev 53°44′N., 31°55′E.	8P	M
Krivoy Rog East 47°53′N., 33°32′E.	7P	M
Krustpils 56°32′N., 25°53′E.	6P	M
Krymsk 44°58′N., 38°00′E.	8P	M
Kubinka 55°37′N., 36°39′E.	8P	J
Kupino 54°21′N., 77°22′E.	8P	M
Kuybyshev/Kurumoch 53°30′N., 50°09′E.	8P	C
Kyurdamir 40°16′N., 48°10′E.	8P	M
Kyzylagadzh 39°00′N., 48°48′E.	6P	M
Leningrad/Gorelovo 59°46′N., 30°05′E.	8P	M
Lida 53°53′N., 25°23′E.	8P	M
Limanskoye 46°40′N., 30°01′E.	8P	M
Lodeynoye Pole 60°43′N., 33°34′E.	8P	M
Luchki 44°13′N., 132°13′E.	7T	M
Lugovoy 42°58′N., 72°44′E.	8P	M
Magadan Northwest 59°55′N., 150°44′E.	9P	J
Makharadze 41°56′N., 41°52′E.	7P	M
Marinovka 48°38′N., 43°47′E.	8P	M
Markuleshty 47°52′N., 28°13′E.	8P	M
Mary North 37°40′N., 61°50′E.	8P	M
Mary Northeast 37°37′N., 61°54′E.	8P	M
Melitopol' 46°53′N., 35°18′E.	8P	M
Mikha-Tskhakaya 42°14′N., 42°03′E.	7P	M
Mineral'nyye Vody 44°13′N., 43°05′E.	10P	C
Monchegorsk 67°59′N., 33°01′E.	7P	M
Morshansk 53°26′N., 41°44′E.	7P	M
Moscow/Shchelkovo 55°53′N., 38°03′E.	11P	M
Mukachevo 48°24′N., 22°41′E.	8P	M
Nasosnyy 40°35′N., 48°34′E.	8P	M
Natal'iya 76°50′N., 68°25′E.	13N	M
Nebit-Dag 39°29′N., 54°22′E.	8P	M
Nikolayov/Kul'Bakino 45°56′N., 32°06′E.	11P	M
Nikolayevka 43°05′N., 133°12′E.	6P	M
Nizhniy Tagil Northeast 57°59′N., 60°14′E.	8P	M
Noril'sk Northwest 69°23′N., 87°53′E.	14T	M
Novorossiya 43°21′N., 132°34′E.	6P	M
Novosibirsk Northeast 55°05′N., 83°00′E.	10P	J
Oborzerskiy Southeast 63°23′N., 40°24′E.	8P	M
Odessa Central 46°26′N., 30°41′E.	9P	J
Omsk East 54°58′N., 73°33′E.	9P	J
Orel Southwest 52°56′N., 36°00′E.	6P	M
Osinovka 44°01′N., 132°13′E.	8P	M
Ovruch 51°19′N., 28°51′E.	6P	M
Panevezys 55°44′N., 24°28′E.	6P	M

Footnotes at end of table.

FIGURE 23. Other important airfields (S) *(Continued)*

NAME AND LOCATION	RUNWAY*	USAGE	NAME AND LOCATION	RUNWAY*	USAGE
Parnu 58°25′N., 24°28′E.	8P	M	Starokonstantinov 49°45′N., 27°16′E.	6P	M
Perm/Bolshesavino 57°55′N., 56°02′E.	6P	M	Sverdlovsk/Koltsovo 56°45′N., 60°49′E.	7P	J
Petrozavodsk Northwest 61°53′N., 34°09′E.	8P	M	Tallinn/Lasnamae 59°27′N., 24°53′E.	6P	M
Pirsagat 39°51′N., 49°20′E.	6P	M	Tapa 59°14′N., 25°57′E.	8P	M
Pochinok 54°20′N., 32°28′E.	8P	J	Tbilisi/Marneuli 41°28′N., 44°47′E.	8P	M
Postavy 55°07′N., 26°46′E.	8P	M	Tbilisi/Novo Alekseyevka 41°40′N., 44°57′E.	8P	J
Pravdinsk 56°31′N., 43°29′E.	8P	M	Tbilisi/Vaziani 41°38′N., 45°02′E.	8P	M
Provideniya/Urelik 64°23′N., 173°15′W.	7T	J	Tiksi West 71°42′N., 128°42′E.	13T	M
Pushkin 59°41′N., 30°20′E.	8P	J	Tiraspol 46°52′N., 29°36′E.	8P	M
Riga West 56°56′N., 23°58′E.	6P	M	Troitsk 54°07′N., 61°32′E.	6P	M
Riga/Rumbula 56°53′N., 24°14′E.	6P	J	Tukums 56°57′N., 23°13′E.	8P	M
Ross 53°18′N., 24°22′E.	8P	M	Tula North 54°14′N., 37°36′E.	6P	M
Rzhev 56°16′N., 34°25′E.	8P	M	Tyura Tam 1 45°37′N., 63°13′E.	10P	M
Sal'yany 39°39′N., 48°59′E.	7P	M	Uglovoye Northwest 43°21′N., 132°04′E.	8P	M
Samtredia East 42°11′N., 42°29′E.	7P	M	Ul'yanovsk Southwest 54°16′N., 48°14′E.	8P	C
Sandagou 44°05′N., 133°52′E.	6P	M	Unashi 42°57′N., 133°07′E.	8P	M
Sangachaly 40°08′N., 49°27′E.	7P	M	Vainode 56°24′N., 21°53′E.	8P	M
Saratov West 51°32′N., 45°51′E.	6P	M	Vasalemma 59°16′N., 24°12′E.	6P	M
Sary Shagan 46°02′N., 73°30′E.	9P	M	Vasil'kov 50°14′N., 30°18′E.	6P	M
Semipalatinsk 50°21′N., 80°14′E.	10P	J	Velikaya-Kema 45°30′N., 137°11′E.	8T	M
Sernovodsk 43°57′N., 145°42′E.	6T	J	Verino 48°00′N., 135°05′E.	8P	M
Sevastopol'/Bel'bek 44°41′N., 33°34′E.	8P	M	Volgograd/Gumrak 48°47′N., 44°21′E.	6P	J
Shchuchin 53°36′N., 24°46′E.	8P	M	Vorkuta East 67°28′N., 64°19′E.	13T	M
Simferopol' North 45°02′N., 33°59′E.	9P	J	Voznesensk 47°31′N., 31°16′E.	8P	M
Sital-Chay 40°49′N., 49°26′E.	6P	M	Vyborg East 60°40′N., 29°10′E.	7P	M
Smirnykh 49°44′N., 142°52′E.	8P	M	Yakutsk 62°05′N., 129°46′E.	8P	C
Smolensk 54°49′N., 32°02′E.	6P	J	Yaroslavl'/Tunoshnoye 57°34′N., 40°[illegible]E.	8P	M
Sovetskaya Gavan'/Vanino 49°02′N., 140°14′E.	6P	M	Yefremov 53°07′N., 38°15′E.	8P	M

Footnotes at end of table.

FIGURE 23. Other important airfields (S) *(Continued)*

NAME AND LOCATION	RUNWAY*	USAGE	NAME AND LOCATION	RUNWAY*	USAGE
Yerevan/Parakar 40°09′N., 44°24′E.	10P	C	Zavitinsk Northeast 50°11′N., 129°30′E.	10P	M
Yoshkar-Ola 56°40′N., 48°02′E.	7P	J	Zemo Kedi 41°23′N., 46°22′E.	8P	M
Zaporozh'ye East 47°52′N., 35°19′E.	8P	M			

*Runway length in thousands of feet.

Abbreviations:

C..... Civil.
J..... Joint Military-Civil.
M..... Military.
N..... Natural (ice, packed snow, or unimproved turf).
P..... Permanent (concrete, asphalt, bitumen-bound macadam, brick).
T..... Temporary (water-bound macadam, graded earth, steel mat, graded gravel).

K. Telecommunications (S)

Telecommunications are particularly important in the U.S.S.R. because of the highly centralized government control system and the need to maintain rapid communications with civil and military authorities located in all parts of the country. Developments have been determined by the political, economic, and military requirements of the state rather than by the needs of the general public. Consequently, telecommunication (telecom) facilities are unevenly distributed, and many communities have no services. In recent years, the establishment of a modern and versatile telecom system capable of providing efficient services for the entire country has been one of the primary goals of the government. All telecom facilities are government owned; most are controlled and operated as state enterprises.

The major national telecom complex of the Soviet Union is known as the Unified Communications System of the U.S.S.R. This system forms a comprehensive and relatively modern structure which supports the state requirements and also affords services to private citizens. Facilities of the unified system include modern, high-capacity cable and radio-relay trunk routes traversing the entire country; supplementary open-wire line networks and point-to-point radiocommunication stations; a communication satellite system; manual, semiautomatic, and automatic telegraph and telephone terminals; and extensively developed broadcast networks. Services available include domestic and international telephone, telegraph, telex (teleprinter subscriber service), facsimile, data transfer, radiobroadcasting, wired broadcasting, and TV. Moscow is the major control center for the entire system and has the greatest concentration of facilities.

Basically, the overall telecom structure of the U.S.S.R. is extensive and very similar to modern systems found in other industrially developed countries. Communication facilities are still undergoing modernization and expansion, however, and the availability of adequate and efficient telephone services is somewhat limited. Telegraph communication is more readily available to most areas of the country, and telex and facsimile services generally are provided by the main urban telegraph offices. International communication services are available to most world centers. Figure 24 compares the density of selected telecom facilities in the U.S.S.R. with other selected countries.

The U.S.S.R. has the second most powerful AM radiobroadcast system in the world, being surpassed only by the United States. Radiobroadcast services for domestic and foreign audiences are provided by efficient and extensive networks of AM stations operating on low, medium, and high frequencies (LF, MF, HF). FM radio facilities are used to provide high-quality broadcasting in densely populated areas. The FM stations are being established in conjunction with TV developments through the joint use of antenna towers and other facilities. TV facilities have been developed under high-priority expansion efforts, and the system is one of the largest in the world. Wire-broadcast networks are located throughout the country; most small rural communities are served by this medium.

Special-purpose wire and radiocommunication networks also are maintained to support defense activities, to control transportation, and for many other functional purposes. These networks are formed from circuits leased from the unified system, plus separate facilities of the individual users. Special-purpose international facilities are maintained for air-traffic control, the exchange of meteorological data, and official civil and military communications.

Nominally, the Council of Ministers of the Soviet Union is the final authority for all civil and military telecom matters and makes the decisions on high-level planning and policies. Central telecom management is vested in the Ministry of Communications (MOC) of the U.S.S.R., with headquarters in the central telegraph office at 7 Ulitsa Gor'kogo, Moscow (Figure 25). Several national-level ministries, departments, and agencies are involved in the final decisionmaking processes concerning general and special-purpose communication requirements, equipment supply, technical standards, education, security, and miscellaneous coordinating and planning functions. The Ministry of Defense is known to exert a strong influence on new construction and planning, and probably makes direct budgetary contributions to the MOC for the construction of facilities that are to be used largely by the military. The State Committee of Radiobroadcasting and Television is responsible for broadcast and telecast program content and for the international exchange of programs.

Administration of communications is organized on a union republic basis, with the national MOC responsible for the system as a whole and supported by 14 subordinate republic ministries of communications. Responsibilities of the MOC are defined in a charter promulgated by the Council of Ministers. The charter charges the MOC with responsibility for general management problems pertaining to all forms of communications including planning, construction,

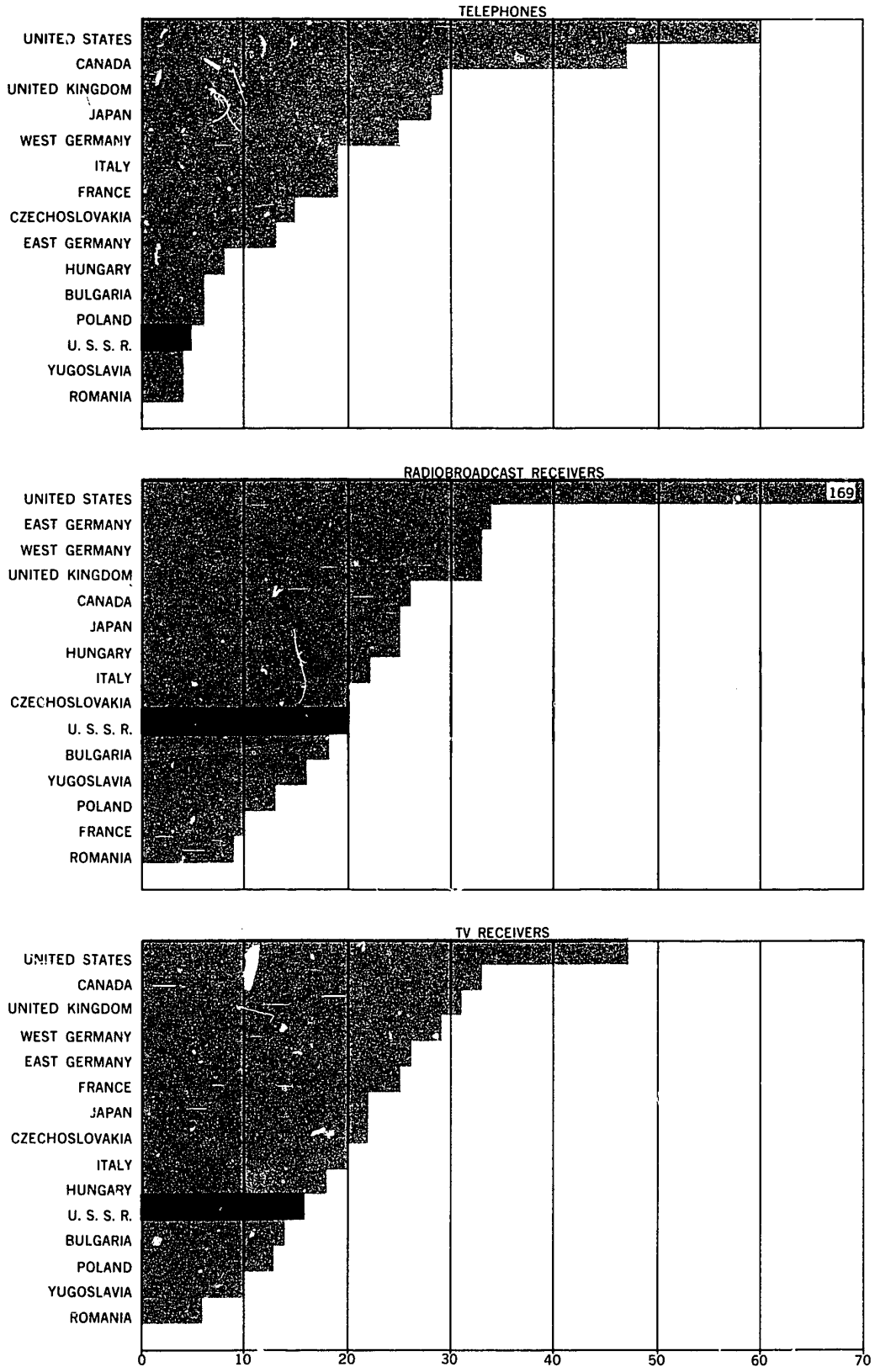


FIGURE 24. Comparison of telecom densities (per 100 population), U.S.S.R. and other selected countries. 1972 (U/OU)

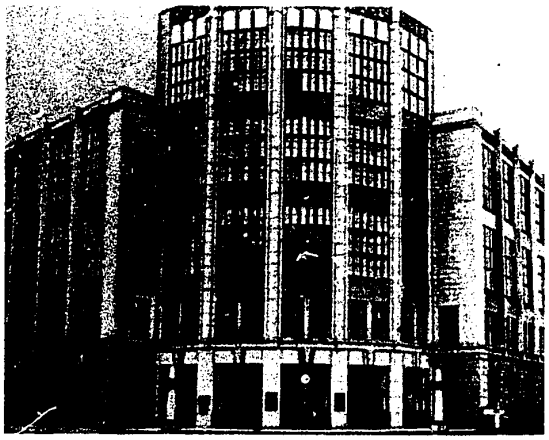


FIGURE 25. National Telegraph Center, Moscow (U/OU)

operation, maintenance, and quality of services provided, and for direct operational control over all common-user facilities (including circuit allocations) of national significance. The MOC also is responsible for the technical control of facilities maintained by other economic organizations.

Republic ministries are subordinate to the Council of Ministers as well as to the MOC. These ministries are responsible for the development and functioning of all installations within their respective areas of jurisdiction, including those within the lower-level oblast and rayon administrative territories. Below republic level, communication directorates in the oblast and rayon centers are responsible for services to the various subscribers. All R.S.F.S.R. telecom facilities are controlled by the national MOC through 72 communication administrations in *krays*, *oblasts*, autonomous republics, and autonomous *oblasts*.

The Soviet Government exercises a strong influence on the content of telecom traffic. All international transmissions are monitored and censored, and all incoming traffic is filtered through government channels. Censorship is primarily the responsibility of the Committee for State Security (KGB), which also has the function of observing employees of the Ministry of Communications; censoring letters, telegrams, and literature; monitoring telephone calls; and operating the government's secure telephone system. Employees of the KGB are stationed in every major governmental department and in industrial enterprises, often as an integral part of the organization to which they are assigned.

The U.S.S.R. participates in international telecom activities through membership in the International Telecommunication Union (ITU), the Organization for Communication Cooperation (*Organizatsiya Sotrudvichestva Svyazi*—OSS), the International Radiobroadcasting and Television Organization—OIRT, and the "Intersputnik" Space Communications Organization. The ITU is the major international organization for planning worldwide radio-frequency allocations and for establishing technical telecom construction and operation standards. OSS was established in 1957 by the Soviet Union as a means of coordinating post and telecom matters throughout Soviet-oriented countries. OIRT is a Soviet-oriented organization dealing with the theoretical and practical problems concerning radiobroadcasting and TV. The "Intersputnik" Space Communications Organization is also a Soviet-oriented organization and was organized in 1971 to deal with the development and utilization of international space communications systems.

The Unified Communications System is the major domestic telecom complex of the Soviet Union. It is a nationwide system that includes a number of integrated subsystems which provide both general and special-purpose services. Extensive networks of cable and open-wire lines, radio-relay links, point-to-point radiocommunication stations, communication satellites, and associated terminal installations are incorporated into the system. The network facilities are divided into two main categories: 1) general-purpose facilities which form the basic national common-user complex affording telecom services for all subscribers, and 2) special-purpose facilities of independent functional networks. The common-user complex provides telephone, telegraph, telex, facsimile, data transfer, intercity broadcast and TV program transmission,[4] and leased circuits for special purposes. Independent functional networks are formed by the leased circuits, plus separate facilities maintained and operated by the individual users. Other domestic networks also are maintained for secure communications between high level authorities.

Facilities of the unified system are capable of fulfilling most requirements. Constantly increasing demands for more and better communication services, however, are a continuing problem for Soviet telecom planners. The pattern of network development largely has been controlled by the amount of government activity in a specific area and the resulting need for good communications. Consequently, most of the modern facilities serve European U.S.S.R. and the main government control and economic centers in

[4]Coaxial cables, broadband radio-relay links, and communication satellite facilities are the only transmission media with sufficient bandwidth for TV program transmission.

Soviet Central Asia. In the far eastern and arctic regions of the country, telecom facilities still are unevenly distributed, and many outlying communities have no services.

High-quality telecom connections are available between Moscow and most of the more important centers of the country. Traffic-handling capabilities are somewhat limited because modernization of many main terminal installations is incomplete, and not all trunk routes have an adequate channel capacity. In 1971, intercity telephone traffic amounted to 480 million long-distance calls or about 2 calls per individual, as compared with a total of 407 million intercity calls or 80.2 calls per individual in East Germany. The majority of intercity telephone traffic in the U.S.S.R. is still handled on a strict priority basis in which political, military, and administrative authorities receive first priority. Official traffic is handled with a minimum of delay, regardless of the distances involved, but telephone calls of an average citizen may be delayed for as long as 24 hours. Telegraph communication is more readily available in most areas of the country, and an average of 400 million domestic telegrams are handled annually. Routine telegrams normally are delivered within 1 hour and within 30 minutes for urgent messages.

General-purpose intercity facilities which form the common-user system include a compatible mixture of both new and old wire and radio transmission media. This system is designed to interconnect Moscow with capitals of all union republics, major urban centers, small rural and urban centers in the vicinity of major centers, and, to a limited degree, remote communities. The common-user system is subdivided into national (mainline), intrarepublic, intraoblast, and intrarayon subsystems. Mainline trunk routes are designed for very-long-distance, heavy-duty communications and interconnect the larger and more important cities. Intrarepublic and intraoblast subsystems comprise the long- and medium-distance regional and district facilities, and intrarayon networks include the secondary, short-haul rural lines.

New standard mainline transmission facilities, still under construction, include a basic framework of buried high-capacity coaxial and multiconductor cables, and line-of-sight broadband radio-relay and tropospheric-scatter relay installations. Communication satellites and stations of the associated ground-control-and-receive network are also a part of the new facilities. Older mainline facilities are a combination of cable, open-wire lines, and radiocommunication stations. Lower level intercity networks of the common-user structure are characterized by a maze of primary and alternate medium- and low-capacity routes which function as feeders for the mainline trunks. Selection of facility types depends on the geographic location and population density. Thus, in highly populated areas, new medium-capacity radio-relay links suitable for both message and TV program transmission are supplemented by modern cables as well as by older rehabilitated cables, open-wire lines, and point-to-point radio circuits. In remote and sparsely populated areas, limited open-wire line facilities supplemented by radiocommunication stations are still the basic means of communication between distant points. The total estimated length of intercity trunk routes with voice-grade circuits is 32.2 million channel-miles.

Soviet cables include a relatively large variety of both new and old types similar to those found in European countries. Most main cables are installed underground, but aerial and submarine cables also are used. Figure 26 includes technical characteristics of selected cables and the associated carrier telephone systems. Coaxial underground cables are used primarily on trunk routes with heavy communication traffic loads and in areas where there is a need for long-distance network TV transmission. The standard mainline underground cable has four coaxial tubes and is capable of accommodating an average of 1,920 two-way telephone conversations or 300 to 600 telephone conversations and 1 TV channel with sound. With suitable equipment, each telephone channel can be used for 18 to 24 telegraph channels.

Modern, Soviet-designed symmetrical pair carrier cables are installed on underground trunk routes that require capacities of up to 480 telephone channels. They commonly are installed as a two-cable system, one cable being used for each direction of transmission, and are used with 60-channel carrier telephone equipment. The Soviets also employ a modern type of lightly loaded, high-frequency quadded cable on underground and aerial routes where a relatively low capacity (up to 24 channels) is required; voice-frequency cables are being used for short-distance communications. Older underground cables are still used extensively in European U.S.S.R. These cables include composite multiple-twin cables with special shielded pairs for broadcast transmission and lightly loaded star-quad cables. An average of eight pairs in the multiple-twin cables have been modified to accommodate modern carrier techniques. These pairs are suitable for use with 12- and 24-channel carrier telephone equipment.

Domestic submarine cables include about 80 sections which traverse large bodies of water or

FIGURE 26. Selected long-distance cable and carrier telephone systems (C)

TYPE CABLE	NO. OF CABLES	NO. OF UNATTENDED REPEATERS	REPEATER SPACING	CARRIER TELEPHONE SYSTEM		
				Designation	Channels per pair	Frequency range
			Miles			*kHz*
4-tube coaxial..... 2.6/9.4 mm.	1	30	4.0	K-1920.....	1,920 or 300 voice and 1 TV.	273–8544
4-tube coaxial..... 1.2/4.4 mm.	1	40	4.0	K-300.....	300.....	60–1300
1-tube coaxial..... 2.1/9.4 mm.	1	19	6.2	K-120.....	120.....	60–552 812–1304
4-quad symmetrical pair..... 1.2 mm.	2	14	12.0	K-60P.....	60.....	12–252
1-quad symmetrical pair..... 1.2 mm.	2	22	6.2	K-60P.....	60.....	12–252

NOTE:
Abbreviations:
kHz..... Kilohertz.
2.6/9.4 mm..... Inner and outer conductor diameter in millimeters.
1.2 mm..... Conductor diameter in millimeters.

connect offshore islands with the mainland. At least 20 are multiconductor telephone or coaxial types and the rest are telegraph cables.

Although they still carry a significant portion of the intercity traffic, open-wire lines have become a secondary means of communication in well-developed parts of the U.S.S.R. There is a general trend to replace open-wire lines with low-capacity carrier cables because they are more reliable and can accommodate larger volumes of traffic. Open-wire lines are constructed in accordance with standard European practice—4- or 5-millimeter copper or copper-clad conductors are used on long-distance trunks and steel wire for shorter distances. Wooden supporting poles predominate, but reinforced-concrete poles and pole supports are replacing wooden ones in some areas. Regularly spaced repeater stations and the use of transposition methods help to maintain high-quality transmission standards. Carrier equipment has been developed to permit multiplexing up to 12 duplex voice channels.

The principal types of line-of-sight radio-relay equipment used on mainline and regional trunk routes are included in Figure 27. Tropospheric-scatter relay links are being used to traverse the more remote and not easily accessible northern areas of the country and also to span large bodies of water. The use of tropospheric scatter is particularly advantageous in areas with difficult terrain and adverse climate because the relay stations can be spaced at intervals of from 200 to 400 kilometers. Additional advantages include reasonably reliable transmission in regions with auroral atmospheric disturbances as well as the ability to provide multichannel connections to communities where HF radio formerly provided the sole means of communication. Soviet tropospheric-relay equipment operates in the 800- to 1,000-megahertz frequency range and is capable of transmitting from 60 to 120 voice channels.

The Soviet Union has the world's largest domestic communications satellite system. This system consists of close to 60 ground-based common-user terminals designated *Orbita*, and active, nonsynchronous radio-relay earth satellites designated *Molniya* (Lightning). Most of the *Orbita* station facilities are located in areas where mainline, ground-based broadband transmission facilities are not available. The *Orbita* stations are used primarily for TV reception, but they are being readjusted to accommodate multichannel message traffic.

The *Molniya* satellites revolve in elliptical orbits with the following parameters:

Altitude of apogee	21,596 nautical miles
Altitude of perigee	270 nautical miles
Angle of inclination	63.5 degrees
Period of revolution	12 hours

Each satellite makes two orbits around the earth every 24 hours; during one orbiting period it passes over the Soviet Union and the other orbit is over North America. The *Molniya* provides a usable time of 8 to 10 hours for communications while it is over the U.S.S.R., and three to four orbiting satellites can provide 24-hour coverage between any point in the

FIGURE 27. Selected radio-relay equipment (C)

EQUIPMENT DESIGNATION	RF BANDWIDTH	NO. OF DOUBLE RF TRUNKS		NUMBER OF CHANNELS PER RF TRUNK	RADIO TRANSMITTER POWER	REPEATER SPACING	MAXIMUM RANGE
		Active	Reserve				
	MHz				*Watts*	-----	*Miles* -----
R-60/120.....	1600-2000	2	2	60 to 120 voice, 1 simplex TV..	2.0	28-30	1,550 (voice)
		1	1				620 (TV)
R-600.....	3400-3900	2	1	600 voice or 2 simplex TV.....	2.0	28-30	1,550
R-600M.....	3400-3900	2	1	....*do*.....	2.0	28-30	1,550
R-6002M.....	3400-3900	2	1	600 to 1020 voice or 2 simplex TV.	5.0	28-30	1,550
R-6002MV.....	3400-3900	2	2	....*do*.....	5.0	28-30	3,100
R-6002MV.....	3400-3900	3	1	....*do*.....	5.0	28-30	3,100
Voskhod.....	3400-3900	4	...	1920 voice or 1 TV.....	10.0	25-35	3,100
Druzhba.....	5670-6170	3	1	....*do*.....	10.0	25-35	6,200
Do.....	5670-6170	5	2	....*do*.....	10.0	25-35	6,200
R-300.....	7900-8400	6	2	300 voice or 1 TV.....	0.3	22-25	*na*
Do.....	10700-11700	6	2	....*do*.....	2.0	19-25	*na*

na Data not available.
... Not pertinent.
Abbreviations:
MHz..... Megahertz.
RF..... Radio frequency.

country. The satellite relay equipment operates in the 800- to 1,000-megahertz frequency range with a transmitter power of 40 watts. On board equipment is suitable for relaying TV programs and two-way multichannel communications traffic. A *Molniya* 1 satellite and an *Orbita* station are shown in Figure 28.

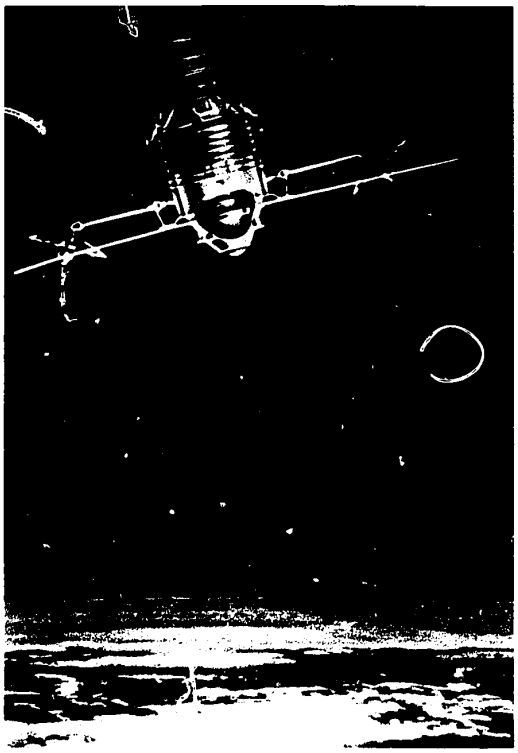
Point-to-point radio is employed extensively to supplement other transmission media and for long-haul, cross-country connections. Main radio centers, called "Radio Bureaus," established in urban centers and other strategic points throughout the country, serve as coordinating, operating, and control points for both general and special purpose communications. The control office normally is located in the main telegraph office or directly adjacent to it. Transmitter and receiver sites generally are built about 15 to 35 miles from major cities and 3 to 12 miles from an average size city. Direct lines, usually cables, connect the control office with the transmitter and receiver sites. Primary radio stations operate in the LF, MF, and HF range; radiotelegraph transmitter powers range from 5 to 80 kilowatts and radiotelephone transmitters include 5- and 15-kilowatt units.

The following radio call-sign series have been allocated to the U.S.S.R. by the ITU: EKA-EKZ, EMA-EOZ, ERA-ERZ, ESA-ESZ (Estonia), EUA-EWZ (Belorussia), EXA-EZZ, LYA-LYZ (Lithuania), RAA-RZZ, UAA-UQZ, URA-UTZ (Ukraine), UUA-UZZ, YLA-YLZ (Latvia) and 4JA-4LZ.

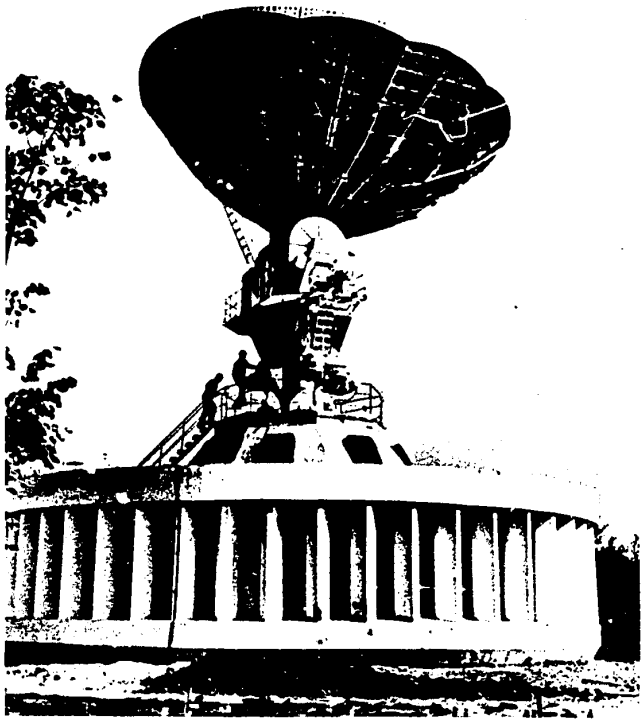
Intercity switching in the U.S.S.R. is in the process of being standardized and modernized in preparation for the introduction of the Unified Automated Communication System by the mid-1980's. The switching systems currently employed are a combination of direct and multiple switching. Intercity connections are made from the local long-distance exchanges to the nearest primary or secondary intermediate switching points, from where traffic is either routed direct or relayed through appropriate switching centers to the desired location. Equipment in long-distance switching and control centers include automatic, semiautomatic, and manual devices with a predominance of manual types.

For operational purposes, the Soviet Union has been divided into zones, with centrally located zonal communication offices serving as primary switching and control centers for long-distance traffic. The telegraph system has 140 zone centers and 7 major switching centers. There are 23,000 main and branch urban telegraph offices and 60,000 rural telegraph offices. Telex service is provided by the main urban telegraph centers to at least 25,000 commercial industrial subscribers. Telex service enables subscribers to communicate directly among themselves by means of teleprinters and also to transfer information from primary processing points to computer centers. Facsimile is available for business purposes and for the transmission of news papers formatted in Moscow to 20 distant urban telegraph centers for printing and distribution.

National telephone switching, still being developed, presently includes 200 zones that correspond to



Molniya I satellite



Orbita receiver station

FIGURE 28. Communications satellite facilities (U/OU)

primary outlets. The zones are assigned 3-digit area codes, and, for direct-distance-dialing, the subscriber must dial the appropriate area code before dialing the desired subscriber telephone number. The ultimate planned switching system will include primary, sectional, and regional switching and control centers, plus local long-distance trunk exchanges. Direct-distance-dialing is available between 20 major urban centers; other areas of the country are served by semiautomatic and manual facilities. Local telephone exchanges include 7,000 urban and 30,000 rural central offices. In many parts of the country local telephone systems are working at full capacity, and the systems are not capable of accommodating new subscribers. Modern telephone equipment is being installed continually, but the distribution of telephones is still handled on a priority basis.

The number of telephone sets in use at the beginning of 1972 was 15.1 million (about 90% automatic) as compared with 7.7 million at the beginning of 1965. Of the total sets in use, 2,858,000 were business phones serving the functional ministries. In terms of worldwide telephone statistics, of the 38 countries with more than 1 million telephone sets, the U.S.S.R. ranked fifth. However, on a per capita basis, the U.S.S.R. had only five general-purpose telephones per 100 population as compared with 6.2 and 6.0 sets per 100 population in Bulgaria and Poland, respectively. Moscow, with 1,625,000 telephones (22.3 per 100 population), was one of 19 cities in the world with more than 1 million sets. However, the city has 750,000 pending applications for telephone service, and the average increase in applications is about 10% annually.

Extensive nationwide independent functional communication networks are maintained for safety and control of air and marine navigation, railroad operations, electric power networks, gas and oil pipeline systems, police and military forces, and many other special-purpose activities. Most functional networks are an integral part of the Unified Communications System, but they also include separate landlines, radio-relay links, a large number of radiocommunication stations, and a variety of

terminal facilities. Since these networks are interconnected with the basic common-user complex, they can be used as supplementary or emergency communication media whenever necessary. Moscow is the main control center for most of the functional communication facilities.

Adequate international telecom services are provided over landlines, radio-relay links, radiocommunication circuits, and submarine cables. Although several major cities have facilities for international service, most of the traffic is handled by Moscow installations. Landline and radio-relay networks carry the bulk of international telephone and telegraph traffic to European and bordering Asian countries. International radiocommunication facilities provide telephone, regular telegraph, telex, and facsimile services to most worldwide centers. The U.S.S.R. has interconnections with the European Gentex (general telegraph traffic network) and the semiautomatic telephone dialing networks, and Moscow functions as a major switching center for the intracontinental transit traffic.

Landlines and radio-relay links are a continuation of the domestic common-user complex, with the more important connections concentrated in European U.S.S.R. The most significant link is an underground coaxial cable from Moscow via Kiyev and L'vov to Poland, Czechoslovakia, and East Germany. A second major coaxial cable interconnects Moscow with Finland via Leningrad and Vyborg. International radiocommunication facilities are controlled through the Moscow Radio Bureau. The major transmitting and receiving stations for these services are located at various sites in the Moscow area. Radio facilities at Alma-Ata, Irkutsk, Tashkent, Khabarovsk, and Vladivostok are also employed in international service.

The Soviets have international submarine cable connections with Bulgaria, Finland, Poland, North Korea, and Romania, but most of these cables are old, have limited carrying capability, and are no longer in use. By contractual agreement, four European and two Asian submarine telegraph cables owned by the Great Northern Telegraph Co., Ltd. (GNT) of Denmark land on U.S.S.R. territory. These cables interconnect Denmark with Finland and Japan. In accordance with an agreement among the U.S.S.R., GNT, and Japan, the laying of a submarine coaxial telephone cable between Nakhodka and Naoetsu, Japan, was completed in April 1969. The new cable replaces the older Asian telegraph cables originally laid by GNT and provides 60 two-way telephone channels which also can be used for telegraph, telex, and facsimile services. Connections to Europe are provided by circuits leased from the U.S.S.R. Because of the limited capacity of the GNT European submarine telegraph cables, most of the transit traffic is carried by Soviet landline circuits extending into Finland.

The *Molniya* communications satellite system is being used for international communications with Mongolia and Cuba. Other members of the "intersputnik" international organization also will have access to the *Molniya* system as well as a new synchronous satellite which is scheduled to be placed in a stationary position above the equator in an Indian Ocean region near 60 degrees east longitude.

Broadcast facilities in the U.S.S.R. are used primarily to circulate the official views and policies of the central government and secondarily to inform and entertain. Major domestic and international programs originate in Moscow and are carried by extensive national AM and FM radiobroadcast, wire-broadcast, and TV network facilities. Additionally, programs of regional or local interest originate in the capital cities of the union republics and other important centers throughout the country. The Soviets have comprehensive radio-jamming facilities which can be used effectively to block out undesired programs from other countries.

The AM radiobroadcast complex includes an estimated 135 main network transmitter stations which are equipped with at least 500 LF, MF, and HF transmitters with powers up to 1,000 kilowatts. In addition, there are slightly more than 1,000 low-power (5 to 10 kilowatts) AM transmitters throughout the country. The existing stations have sufficient power to provide effective coverage on a worldwide basis, and these facilities are being steadily expanded and improved. In aggregate transmitter power output the Soviet Union ranks second to the United States.

FM radiobroadcast stations in 280 localities and wired-broadcast networks complement the AM broadcast complex. FM broadcast facilities are being emphasized for high-quality, local coverage in main urban areas, and new stations are being established in conjunction with the construction of TV centers. The Soviets have the most extensively developed wire-broadcast networks in the world. In recent years, however, wire-broadcast networks have expanded much less rapidly than the FM and TV facilities. The most striking progress in Soviet broadcasting has been in the TV sector. Here, the number of centers and primary rebroadcast stations has almost doubled since the end of 1965; the present system is one of the largest in the world.

Main AM and FM radiobroadcast facilities transmit an average of two programs in 67 languages to domestic audiences for a total of 1,350 hours a day. Domestic broadcasts are divided into two categories, Home Service and Regional Service. Home Service programs, intended for the entire country, are prepared in the headquarters building of the State Committee of Radiobroadcasting and Television at Pyatnitskaya Ulitsa 25, Moscow. Basic programs include: 1) "First Program Service," which includes three separate programs designed for listeners in different parts of the country; 2) "Second Program Service" *Radio Mayak* (Lighthouse), a nationwide program on the air 24 hours a day; 3) "Third Program Service," intended for listeners in the central districts of European U.S.S.R.; and 4) "Fourth Program Service," intended for listeners in the Moscow area. Home Service includes live broadcasts as well as programs taped in advance. Network stations receive Home Service programs by means of direct "off-the-air" pickup and via circuits in the common-user networks. Regional service broadcasts originate in capital cities of administrative districts and include programs of local area interest.

The Soviet TV system has program-originating centers with transmitters and supplementary high- and low-power rebroadcast (relay) stations. Nearly 1,300 transmitting facilities are in operation, including about 135 centers, 230 high-power rebroadcast stations, and many low-power rebroadcast stations. Intercity broadband transmission facilities of the common-user networks are used for network program transmission. Figure 29 gives Soviet TV standards.

TV programs are transmitted an average of 3,000 hours per day and reach about 70% of the population. There are 220 cities with two TV programs available. Alma-Ata, Frunze, Kiev, Minsk, Moscow, Tashkent, and Tbilisi have from three to four programs, and other areas have only one program. The All-Union TV complex in Moscow is the most modern transmitter center in the country. This complex, known as Ostankino, consists of a 533-meter-high structure including a 385-meter reinforced concrete tower and a 148-meter antenna array (Figure 30). The TV studio center is within the same complex and has facilities for broadcasting 20 separate TV programs. Five TV and six FM broadcast programs originate at the center.

Color telecasting is still in the early stages of development, but programs are broadcast in Moscow, Baku, Kiyev, Leningrad, and Tashkent. Channels 4, 5, and 8 are scheduled to be used, and the French SECAM (*sequentiel couleur a memoire*)—III color TV system has been adopted. Because many of the mainline common-user networks have to be realigned for network color TV transmissions, the Soviets plan to use portable communications satellite ground stations consisting of 7-meter-diameter dishes while the other transmission media are being stabilized.

Wired-broadcast networks are located throughout the country, and most small rural communities are served by this medium. An estimated 49.1 million wired receivers are served by about 40,000 wired-broadcast distribution centers. The distribution centers receive programs over telephone lines or by radio receivers on direct "off-the-air" pickup. These programs are then fed to amplifying substations and subscriber loudspeakers via buried and overhead

FIGURE 29. Television standards (U/OU)

CHANNEL NUMBER*	CHANNEL LIMITS	CARRIER FREQUENCY	
		Video	Audio
	MHz		
R-1	48.5-56.5	49.75	56.25
R-2	58.0-66.0	59.25	65.75
R-3	76.0-84.0	77.25	83.75
R-4	84.0-92.0	85.25	91.75
R-5	92.0-100.0	93.25	99.75
R-6	174.0-182.0	175.25	181.75
R-7	182.0-190.0	183.25	189.75
R-8	190.0-198.0	191.25	197.75
R-9	198.0-206.0	199.25	205.75
R-10	206.0-214.0	207.25	213.75
R-11	214.0-222.0	215.25	221.75
R-12	222.0-230.0	223.25	229.75
R-33	584.0-590.0	585.25	589.75

Resolution	625 lines.
Video bandwidth	6 MHz.
Channel bandwidth	8 MHz.
Audio carrier relative to video carrier	+6.5 MHz.
Audio carrier relative to edge of channel	−0.25 MHz.
Line frequency	15.625 kHz.
Field frequency	50 Hz.
Frame rate	24 per second.
Video modulation	AM negative.
Audio modulation	FM.

*The channel designation "R" has been assigned to the U.S.S.R. and members of the International Radio and Television Organization (OIRT), excluding East Germany.

Abbreviations:

AM	Amplitude modulation.
FM	Frequency modulation.
Frame	One cycle of a cyclically recurring number of pulses.
Hz	Hertz (cycles per second).
kHz	Kilohertz (thousand cycles per second).
MHz	Megahertz (million cycles per second).
Resolution	Indication of the finest detail which can be recognized on the picture by a given pulse.

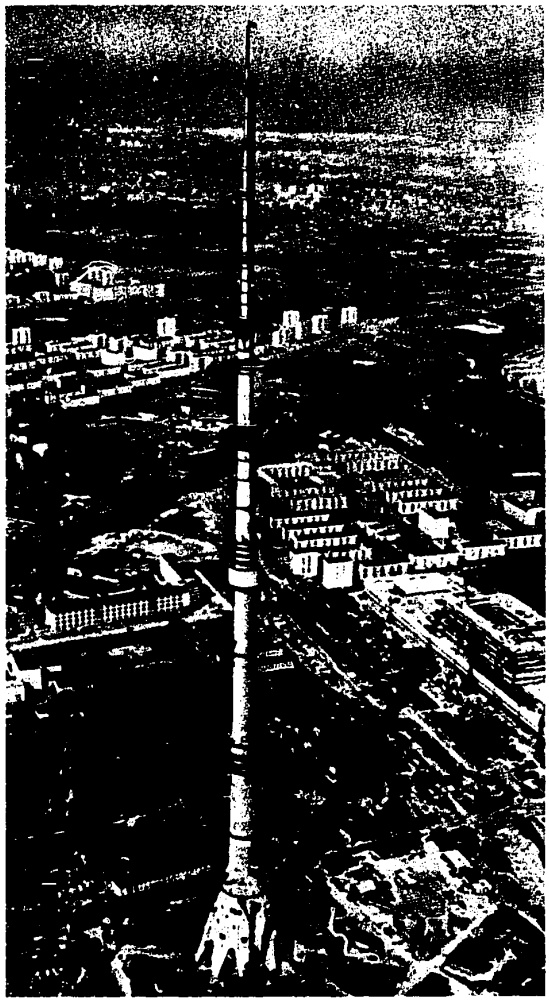


FIGURE 30. Ostankino TV Center in Moscow (U/OU)

landlines that are commonly installed on telephone or power-distribution lines. The Soviets are currently converting the wired-broadcast nets to a three-program system; 230 cities already have received the new system.

Radio and TV receivers and wired-broadcast receivers and loudspeakers are predominantly Soviet manufactured. There are at least 50 types of radiobroadcast receivers ranging from inexpensive transistorized sets for LF and MF reception to larger expensive all-wave sets for AM and FM reception. An estimated 72 million radio receivers currently are in use. There are close to 10 standard types of TV sets available, including color receivers; 39.2 million receivers were in use at the beginning of 1972.

Soviet radio and TV broadcasts also are directed to foreign audiences. Moscow is the major service outlet, with international broadcasting originating in some 72 languages. The Moscow International Service uses slightly more than 100 HF transmitters and 20 MF transmitters. International programs in 12 other languages are originated in Baku, Dushanbe, Kiyev, Minsk, Riga, Tallin, Tashkent, Vilnius, and Yerevan. Effective worldwide coverage is obtained by the use of high-power transmitters and highly efficient directional antenna systems. Among the HF transmitting sites utilized in international services, approximately 11 are in Siberia. The U.S.S.R. is a member of Intervision, the East European TV network, and also exchanges programs with Eurovision, the West European TV network.

The Soviet telecom complex is being systematically developed through successive programs which are part of a basic master plan. Under this master plan, modern engineering technology is being incorporated on a broad scale with major emphasis being placed on the complete and systematic renovation of the entire complex. The basic concept is to establish a modern, standardized, fully automated system which can be systematically expanded to meet the growing needs of both official and public subscribers. To achieve these goals, large-scale telecom redevelopment projects are to be carried out in successive stages through the mid-1980's. Under the present Five Year Plan (1971-75), capital investments amounting to 4.63 billion rubles have been allocated for additional telecom expansion. Emphasis is being placed on the further development of intercity communications and TV relay networks, automation of intercity telegraph and telephone switching facilities, expansion of local telephone facilities, improvement of broadcasting, and the expansion of color TV facilities.

Many parts of the telecom system are highly vulnerable to both natural phenomena and manmade interruptions, and the Soviets employ numerous methods to reduce interference from these sources. To prevent sabotage, all important installations are surrounded by fences and most are guarded by military or civilian personnel. The repeater and junction stations of interurban cables are well constructed, and many are underground. Above-ground structures are constructed of brick, concrete, or metal for fireproofing and durability. All cable huts, vaults, and junction boxes are protected by double metal doors. At all river crossings a reserve cable is laid in addition to the main cable. New long-distance cables are laid at sufficient depth to withstand blasts and are shielded to prevent damage by rodents. Ring

cables bypass strategic urban centers so that traffic c be diverted during emergencies and, in addi reserve underground communication centers are maintained.

Unattended radio-relay stations are vulnerable to sabotage, but most of the mainline links are paralleled by landlines. Open-wire lines in many parts of the country are subject to disruption because of adverse climatic conditions, but radio provides backup circuits. The susceptibility of the long-haul HF radio circuits to disruption by unfavorable atmospheric conditions is compensated by the availability of LF and MF communications. High-power, special-purpose VLF transmitters also are available for use in an emergency. All of the numerous radio circuits are vulnerable to interception and are susceptible to jamming.

Telecom facilities, including radiobroadcast and TV stations, generally are provided with emergency power sources so that operations can be maintained even if the normal source of electric power fails. Remote power for unattended coaxial cable repeater stations is supplied via the coaxial cable at 1,000 to 2,000 volts, alternating current, 50 cycles per second.

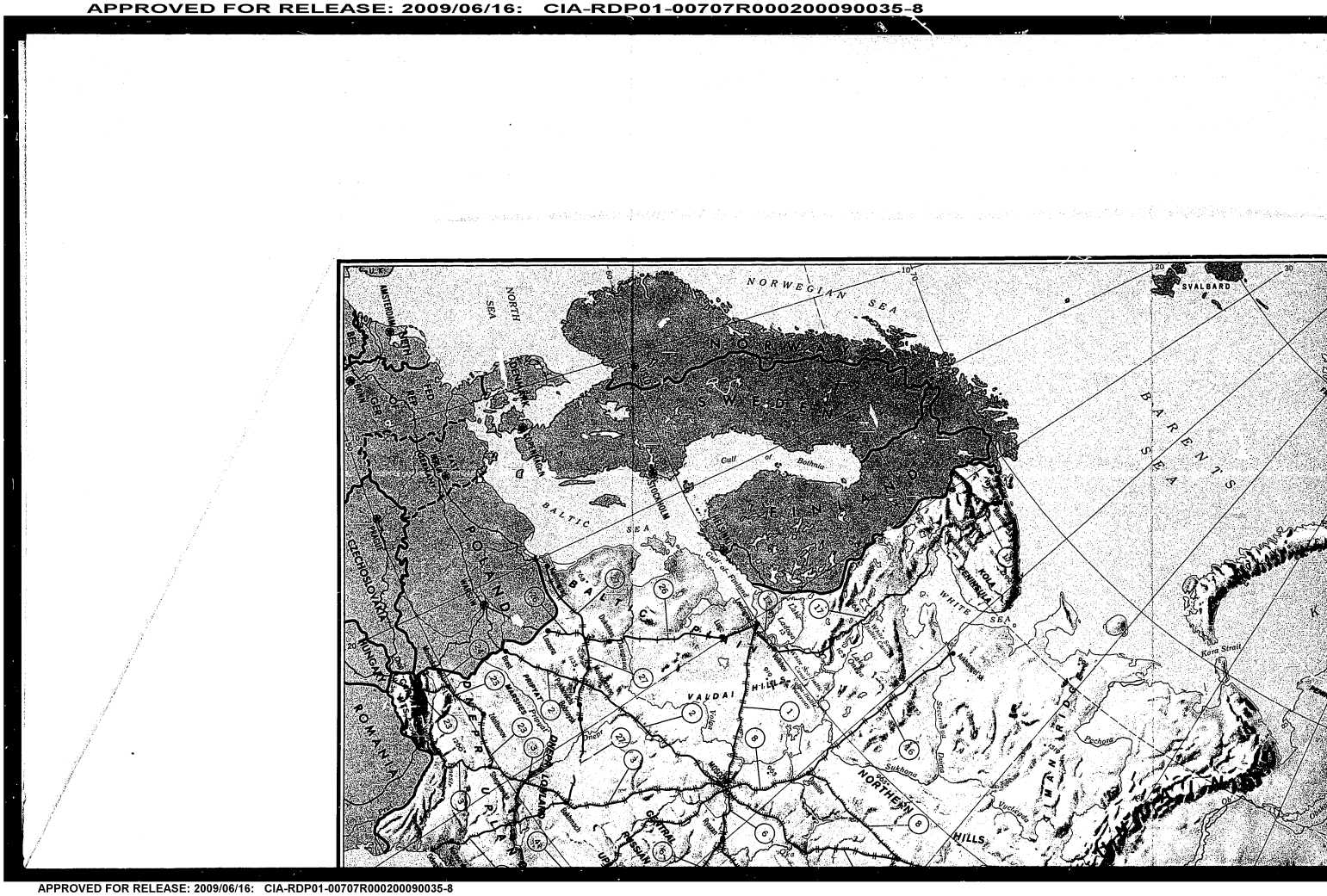
One of the major geographic factors adversely affecting telecom development is the vast area of the country, which necessitates much time and effort for engineering and construction of cables and radio-relay links on major routes. Additionally, construction is often hampered by slow delivery of equipment from distant supply sources.

Climatic conditions adversely affect telecom construction, operation, and maintenance in many parts of the country. Most of the telecom traffic in the permafrost area north of the 60th parallel is handled by radio because of the difficulty in building and maintaining cable and open-wire lines. Permafrost also affects the design and construction of telecom buildings. In the southern Ukraine, the Crimean Peninsula, and the northern Caucasus Mountains, heavy icing conditions and snowstorms cause severe damage to overhead lines and poles. Electrical interferences caused by the phenomenon aurora borealis hamper communications in parts of the country; its effect is greatest about latitude 65° north, although it frequently reaches 50° north, encompassing the Kamchatka Peninsula, northern Sakhalin, and the lower Amur river area.

The total volume of Soviet telecom and electronics industry production is second only to that of the United States. The industry consists of more than 300 plants, with major concentrations in Moscow and Leningrad, and is capable of providing the country's major civilian and military needs. Because of primary emphasis on military requirements, which account for about 70% of production, and on priorities assigned to electronic devices for scientific, industrial, and administrative uses, the industry has not met the equipment requirements for the expansion and modernization of the civil telecom systems. Difficulties and delays in domestic output of some major items, caused in part by a lack of certain high-quality components and the lack of coordination between development and production stages, have led to diversified purchases from worldwide sources of supply.

Soviet imports of telecom equipment reflect the increasing importance of related industries within the Eastern European Communist area; however, non-Communist countries continue to supply diverse types of technically advanced and specialized apparatus. Communist suppliers, in approximate order of importance, are Hungary, East Germany, Czechoslovakia, and Poland. Soviet imports from non-Communist countries include purchases from France, Italy, Japan, Sweden, the United Kingdom, and West Germany.

The MOC has 1.5 million employees engaged in management, engineering, maintenance, construction, and operations. Of this total, there are at least 26,000 highly qualified engineers and specialists and 84,000 medium-level technicians. Soviet telecom engineers are well trained and competent, but the demand for skilled manpower is increasing rapidly as more modern and complex facilities are introduced into the system. Telecom engineers and technicians are trained in 7 institutes and 23 technical colleges of the MOC. Other personnel receive on-the-job training and correspondence courses to improve their capabilities. Additional high-level training is also available through institutes under the Ministry for Radio Industry, the Ministry for Electronics Industry, and the Ministry for Higher Education.



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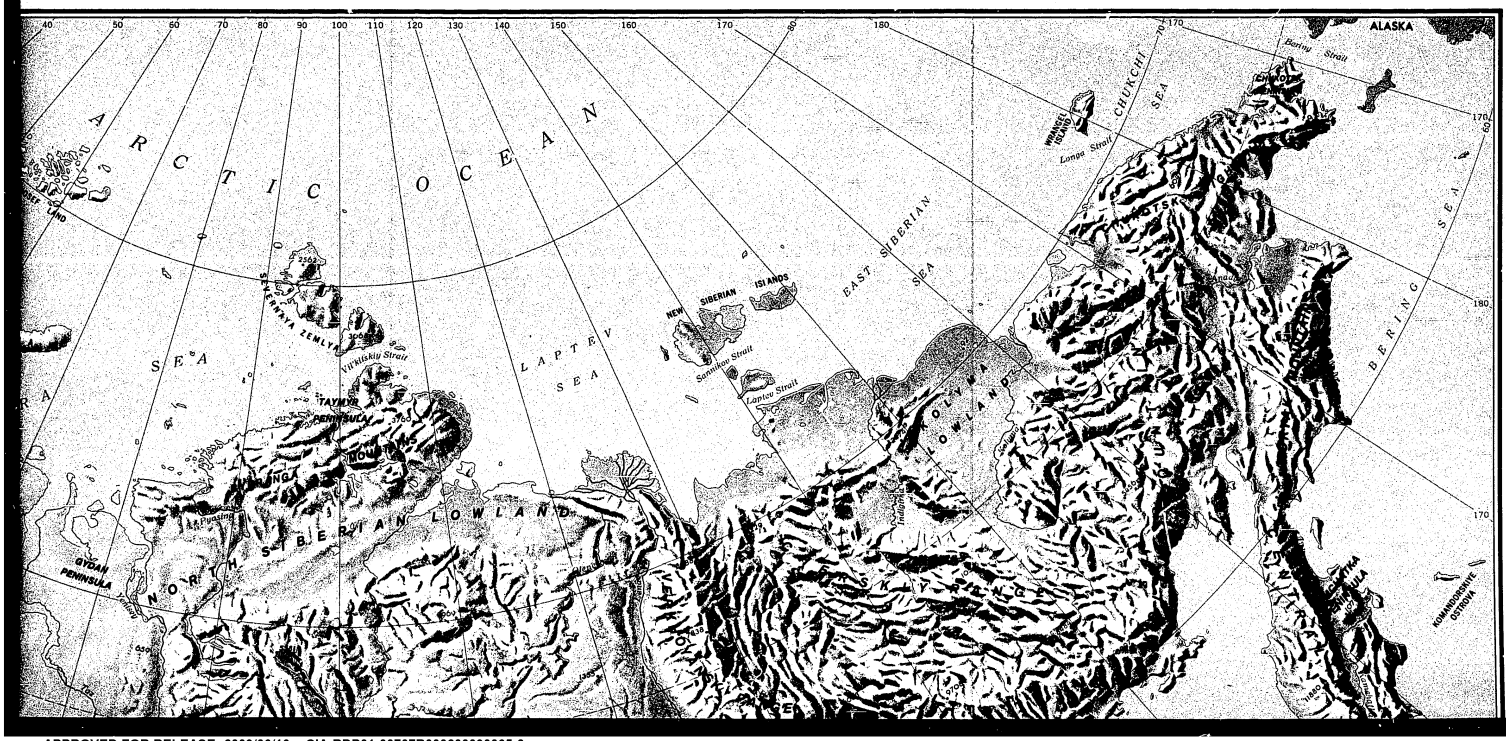

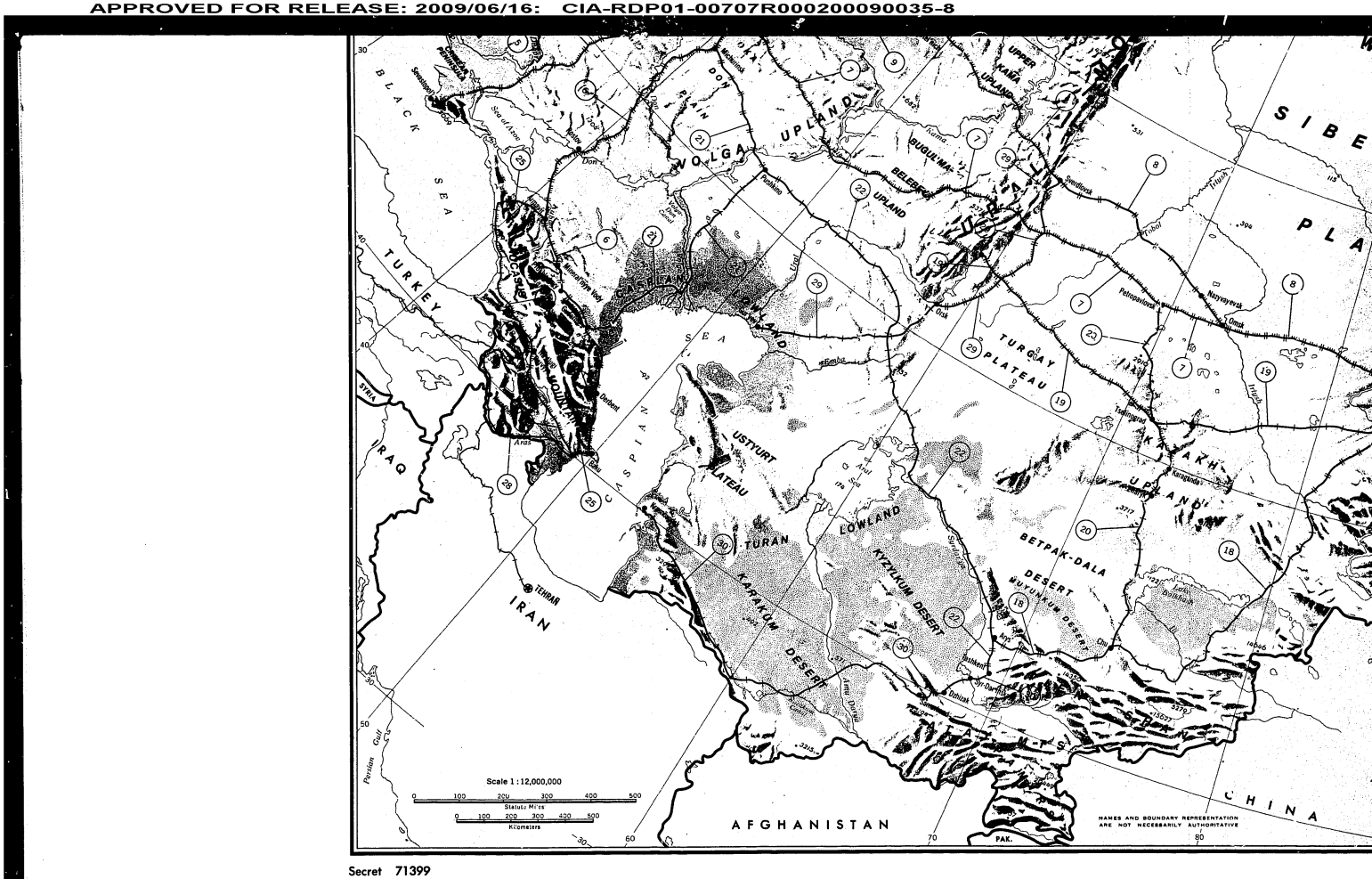

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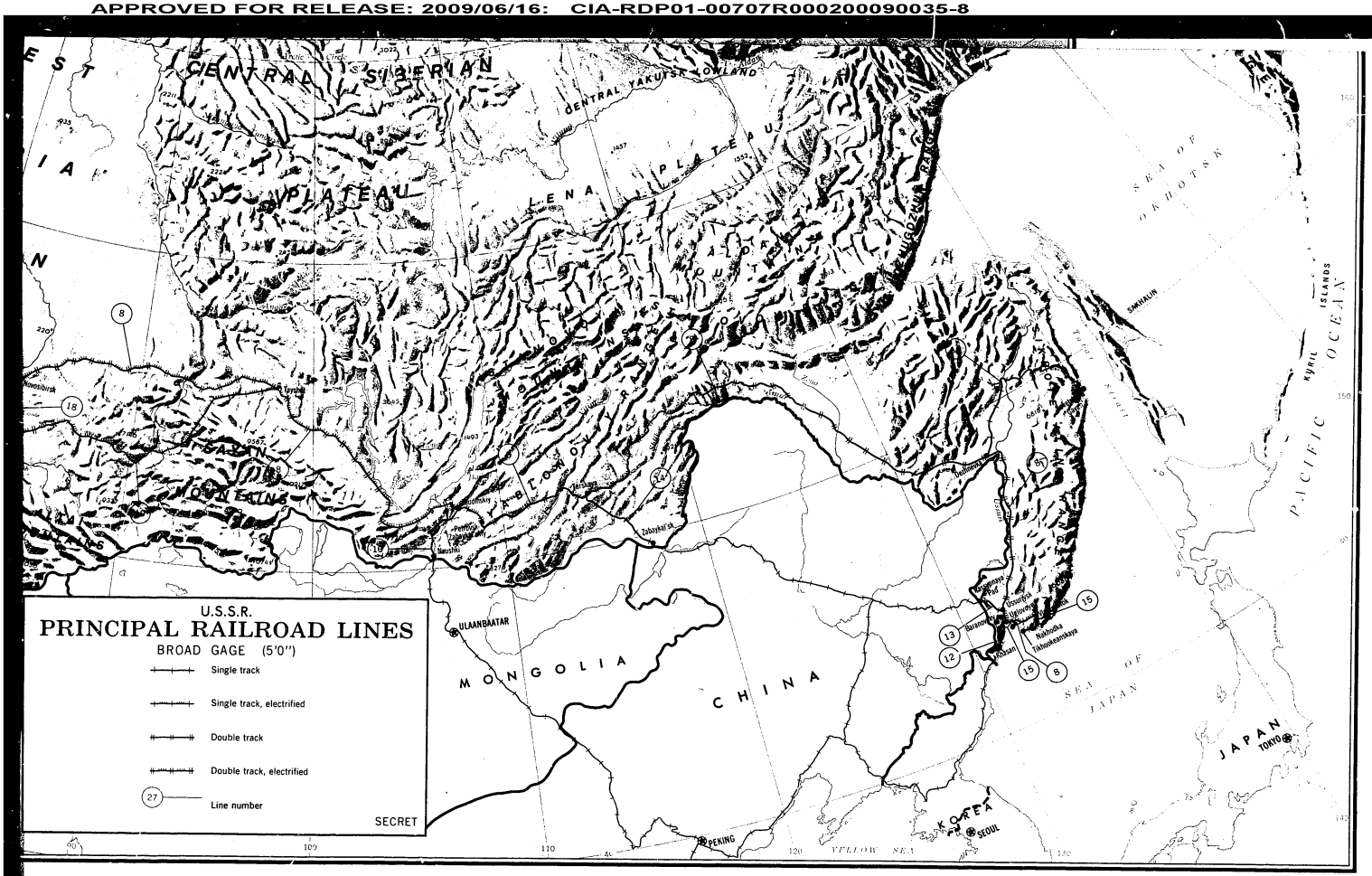
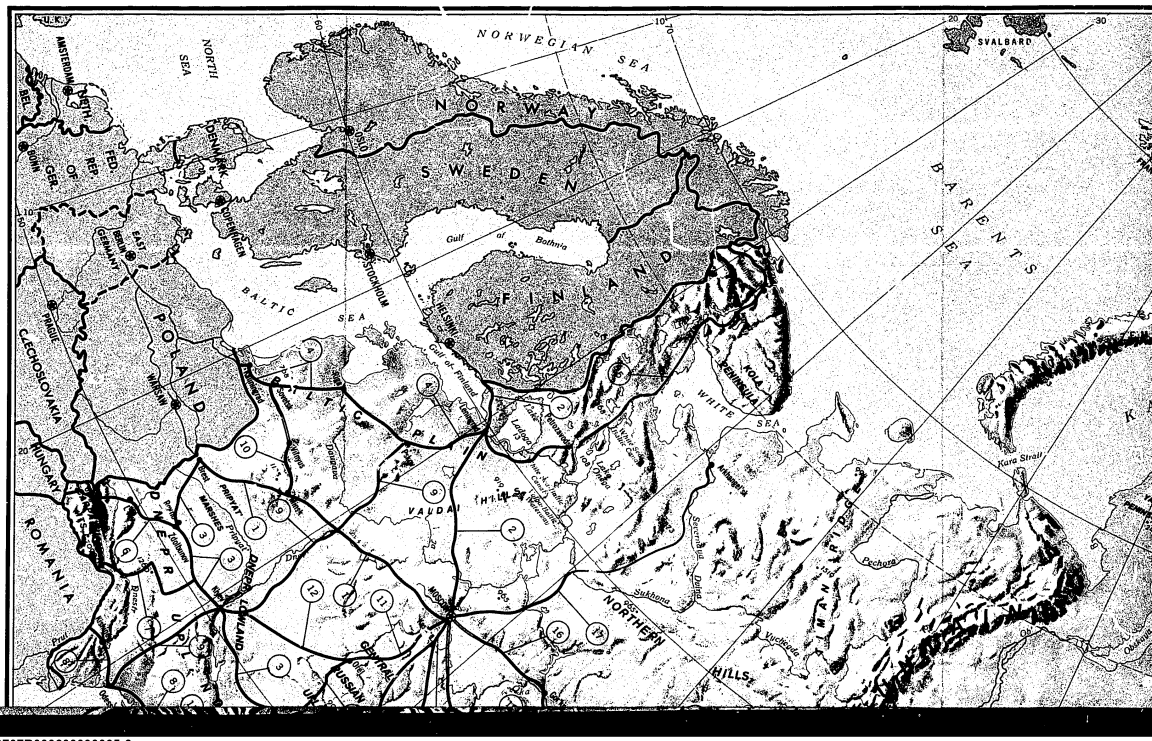
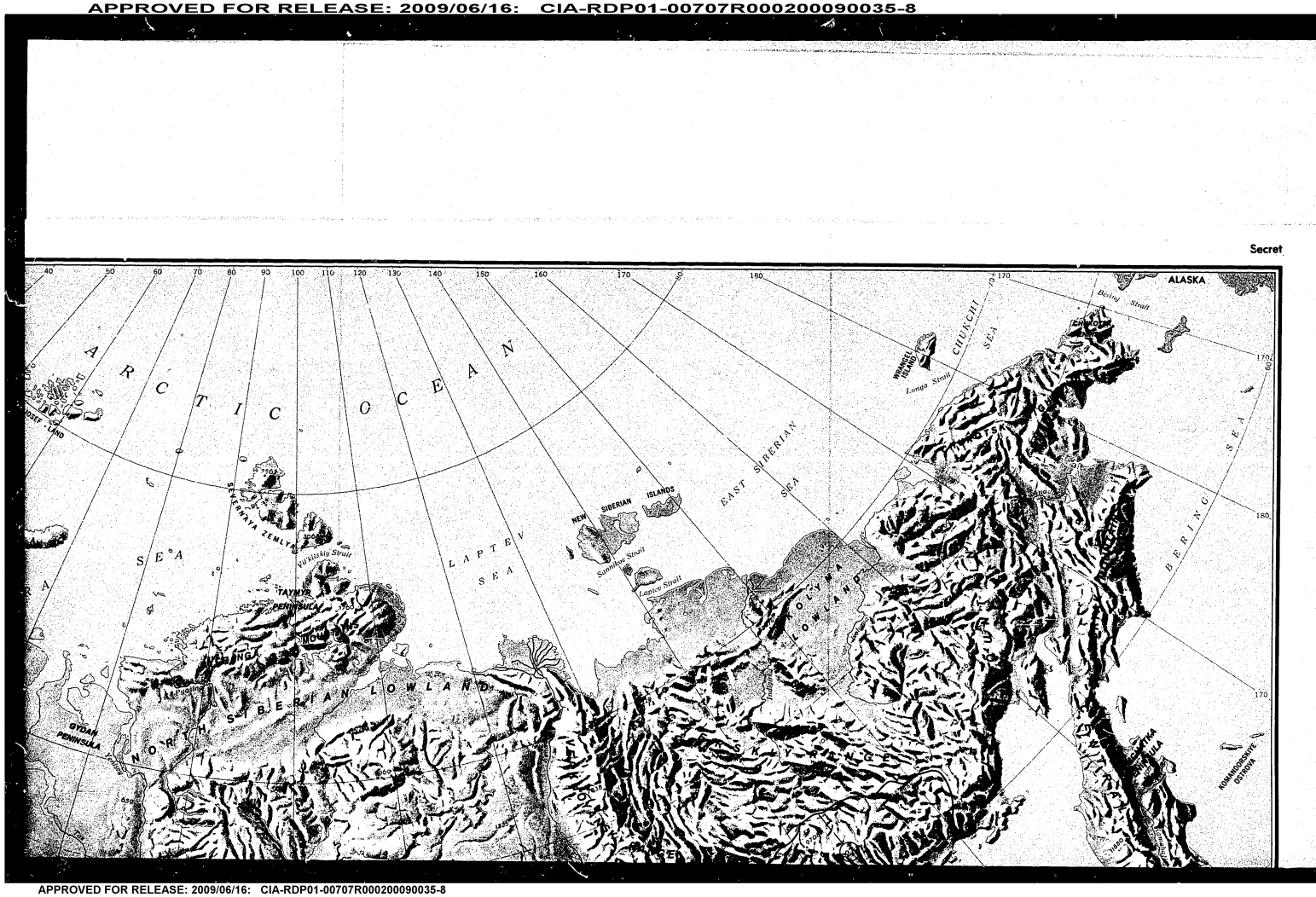
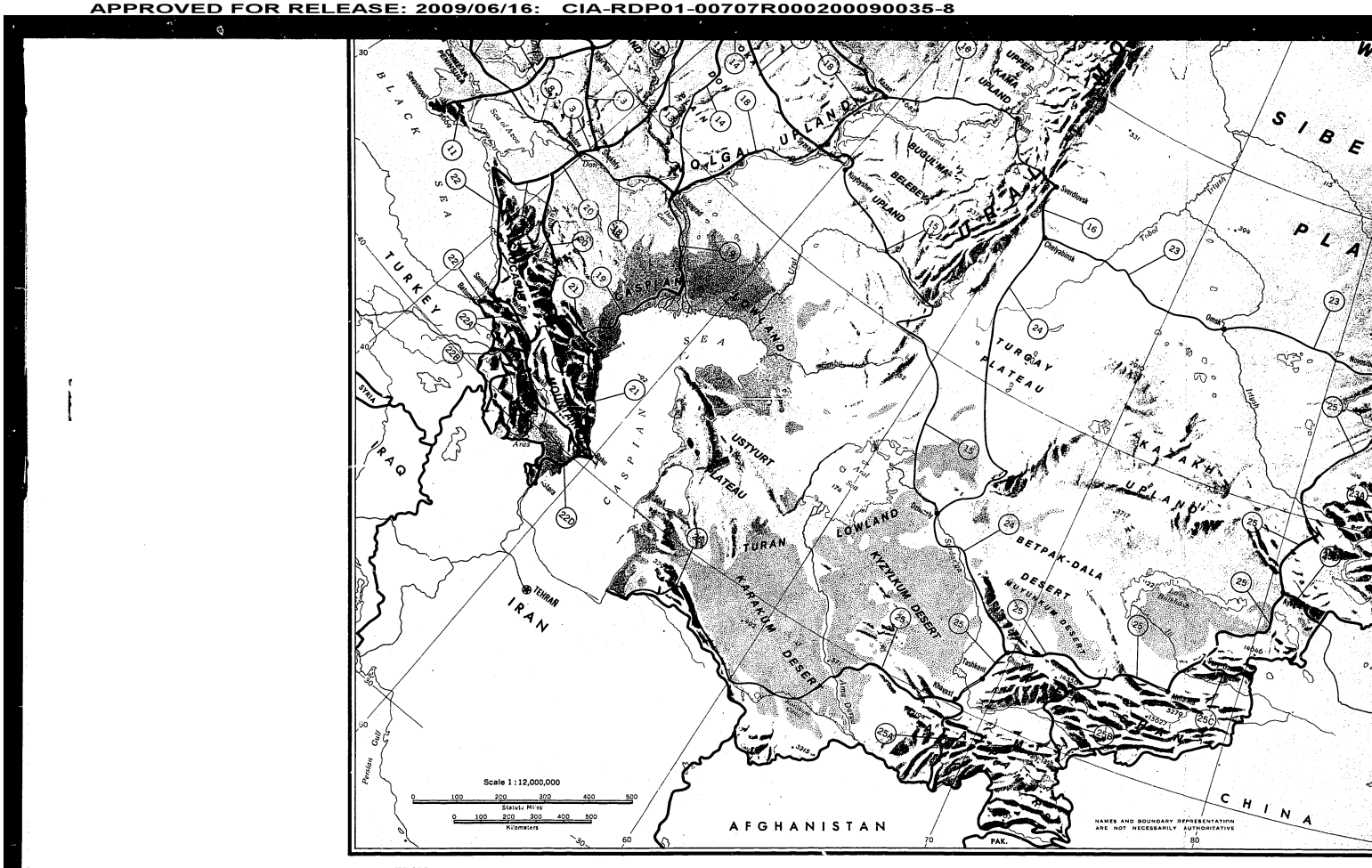


Selected principal railroad lines Figure 31







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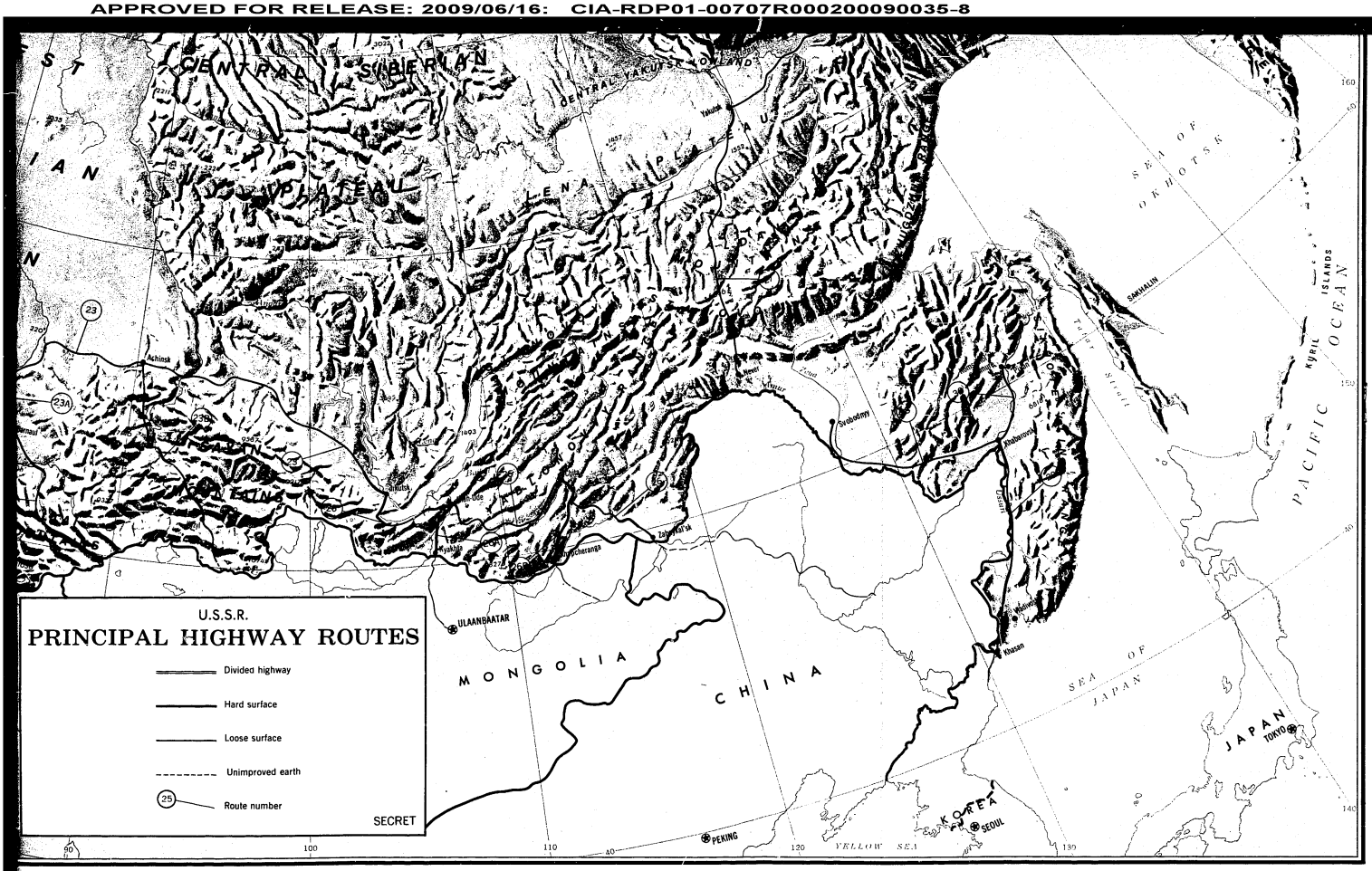
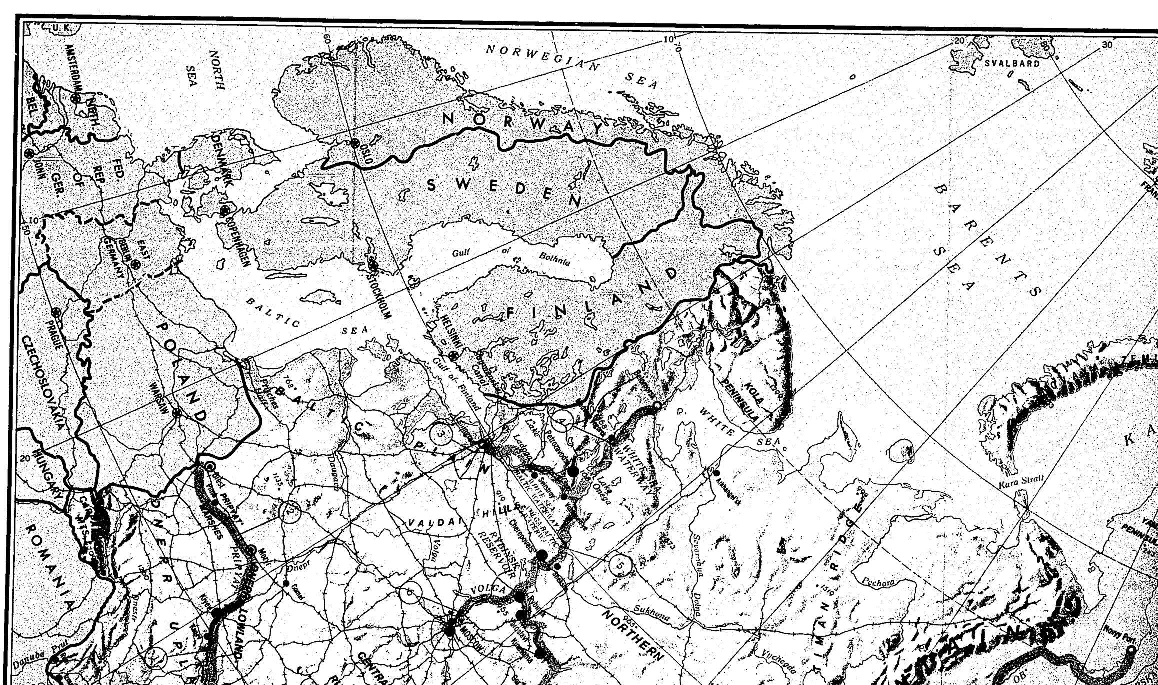
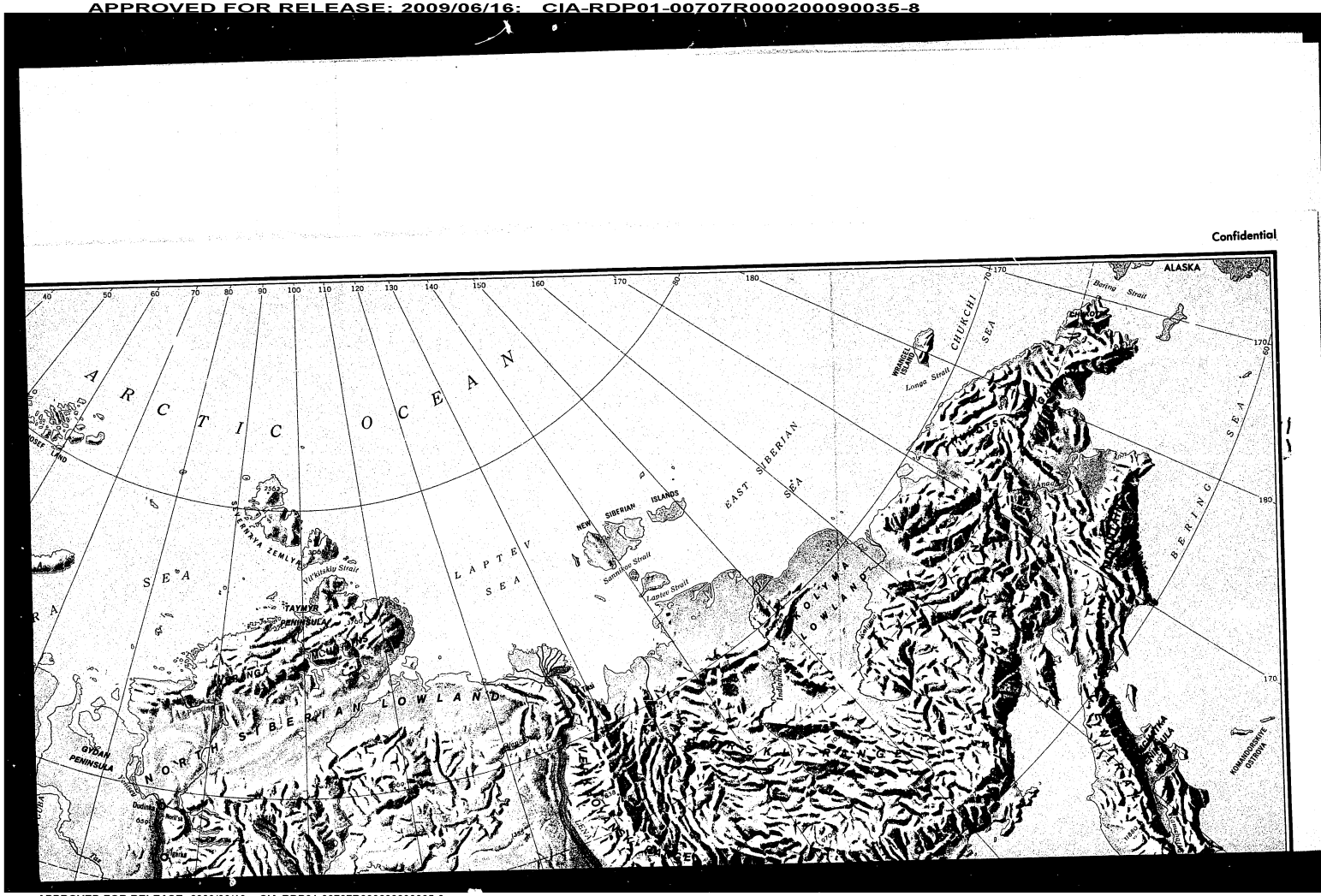
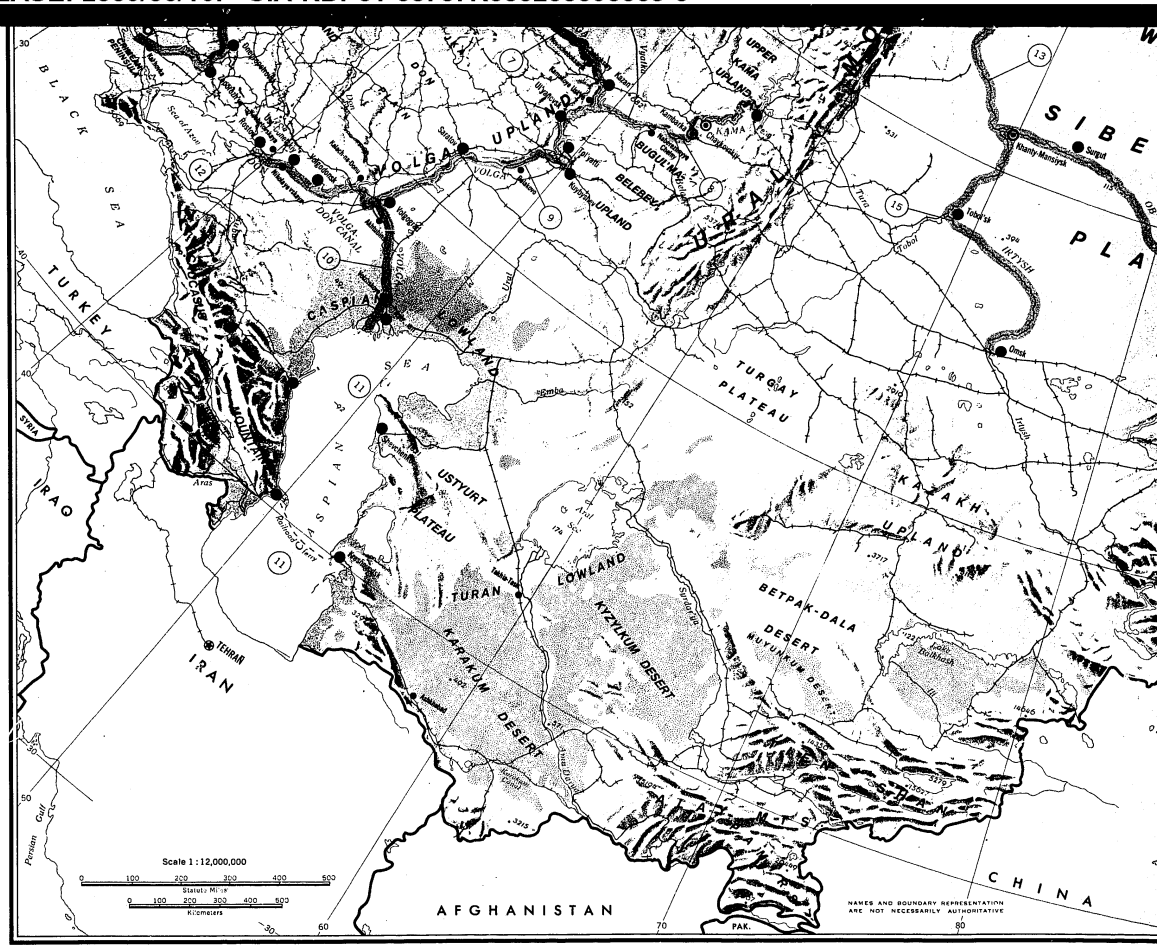


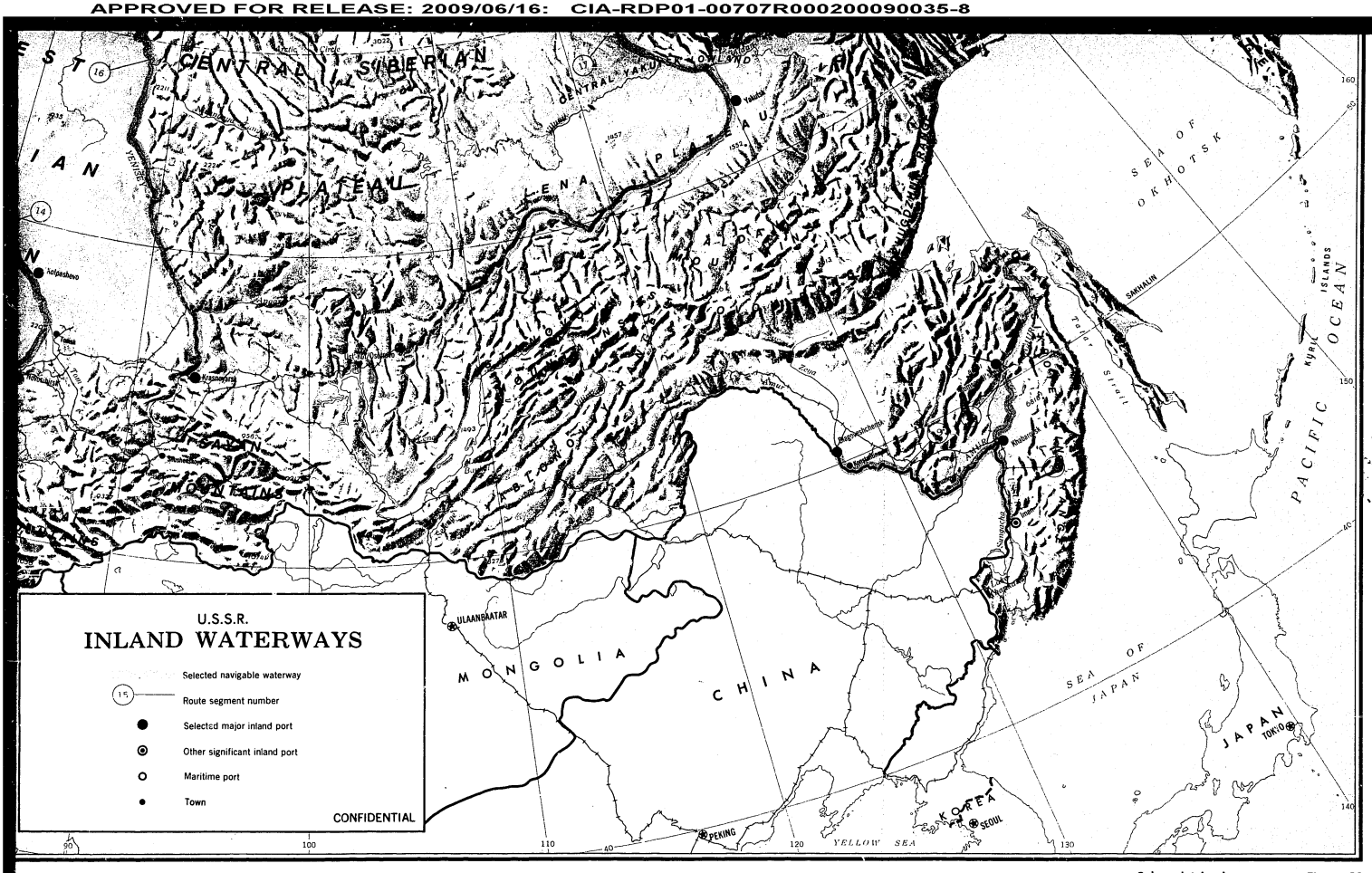
Selected principal highway routes Figure 32



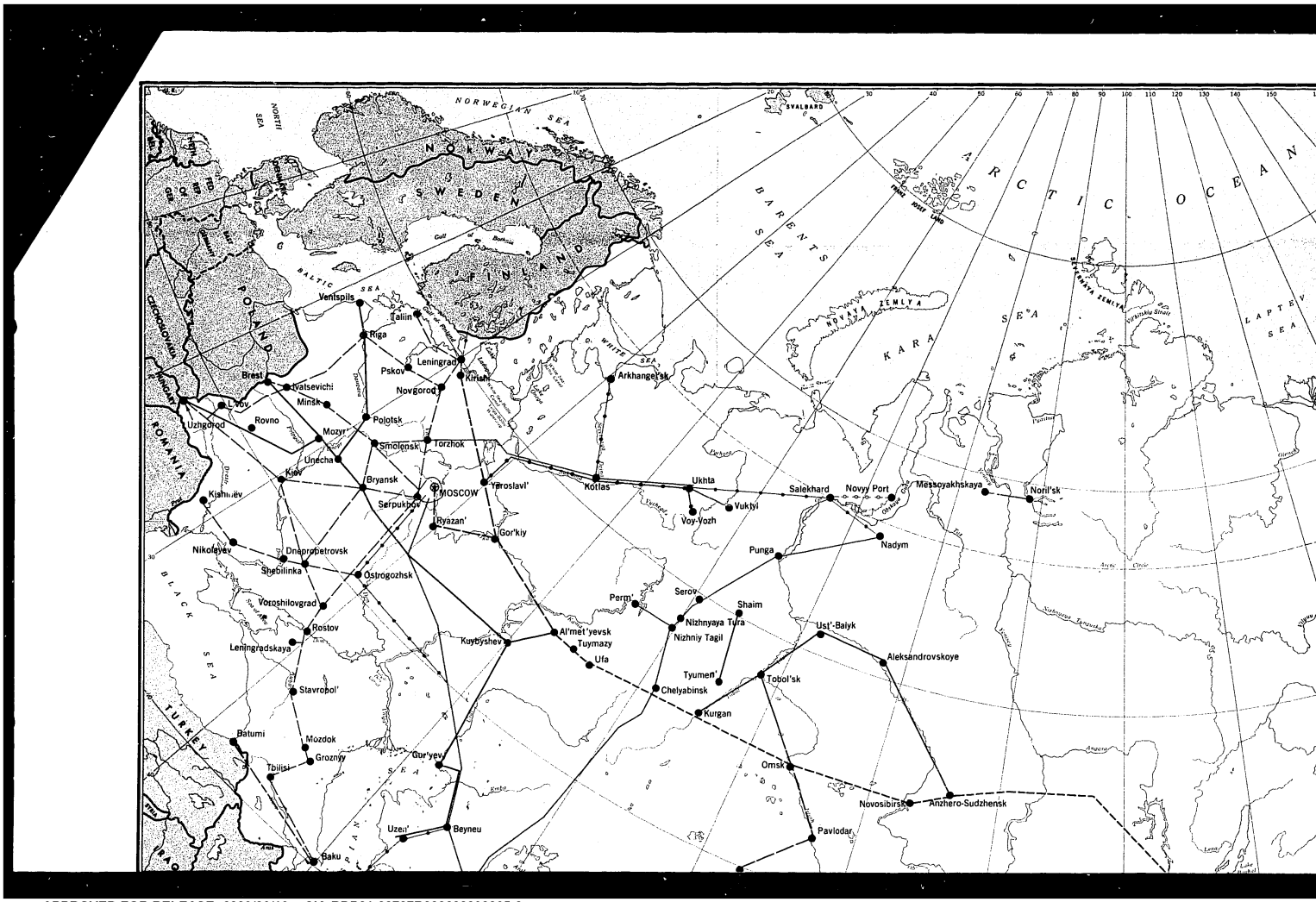




Confidential 71401



Selected inland waterways **Figure 33**



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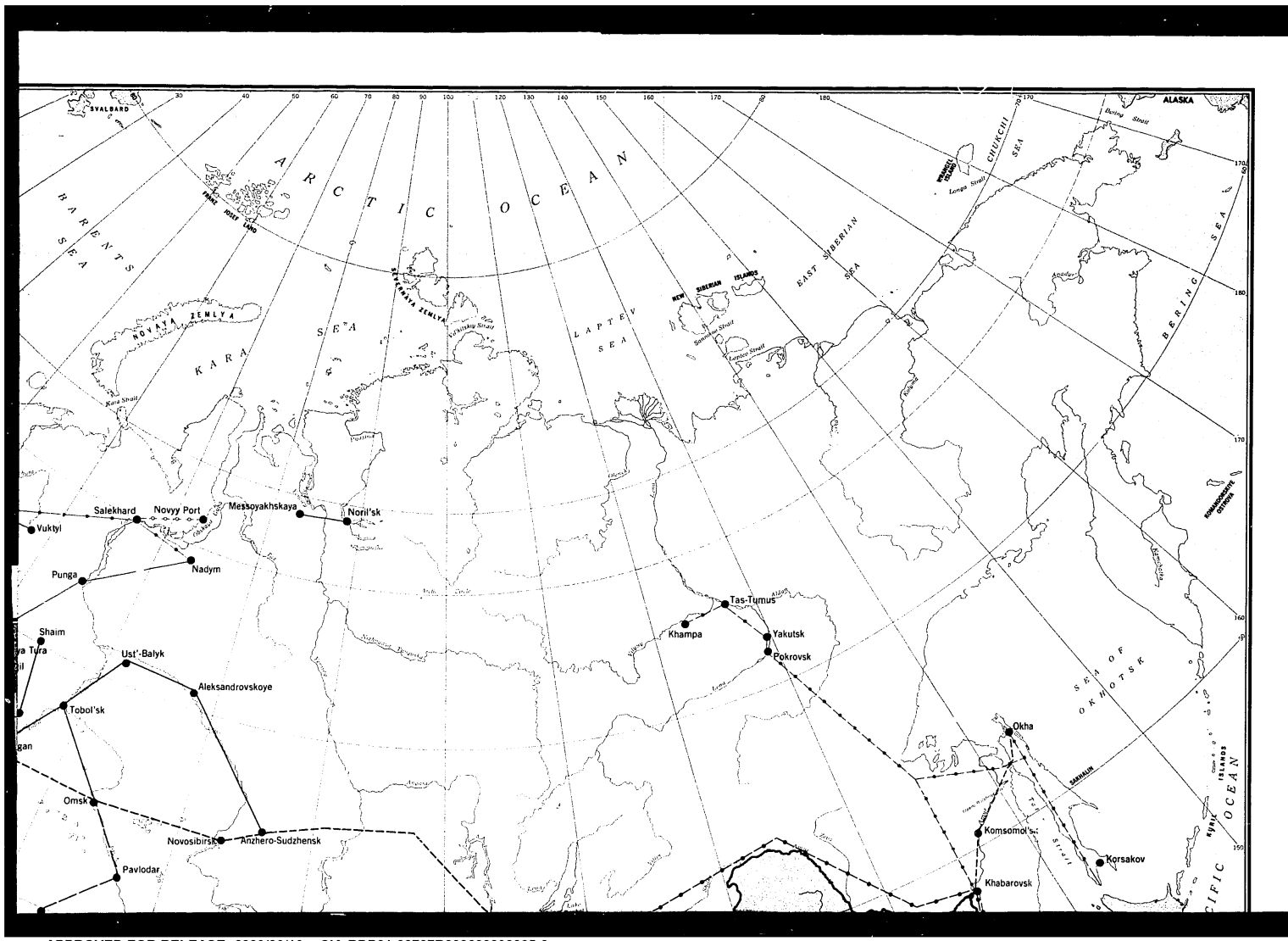

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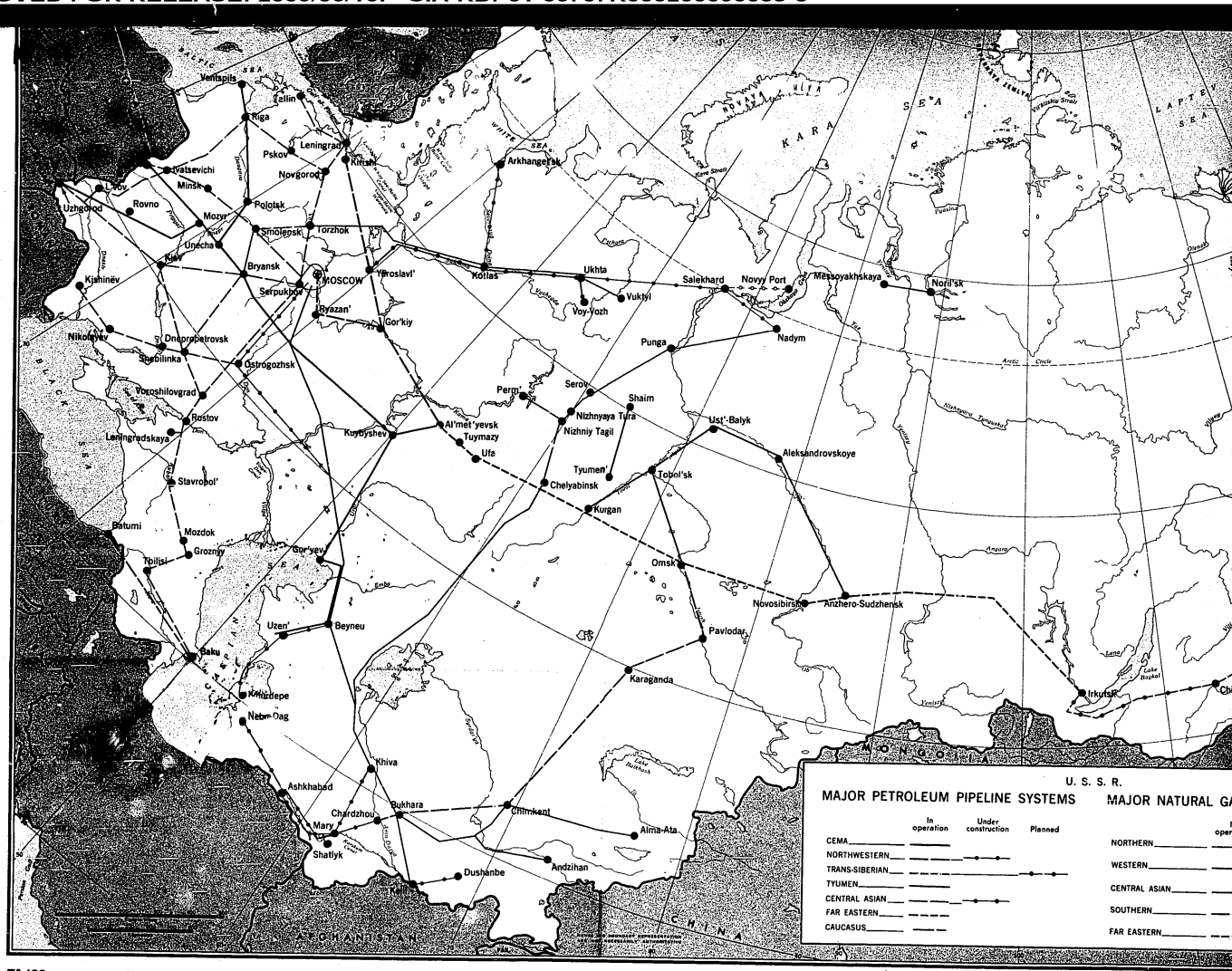

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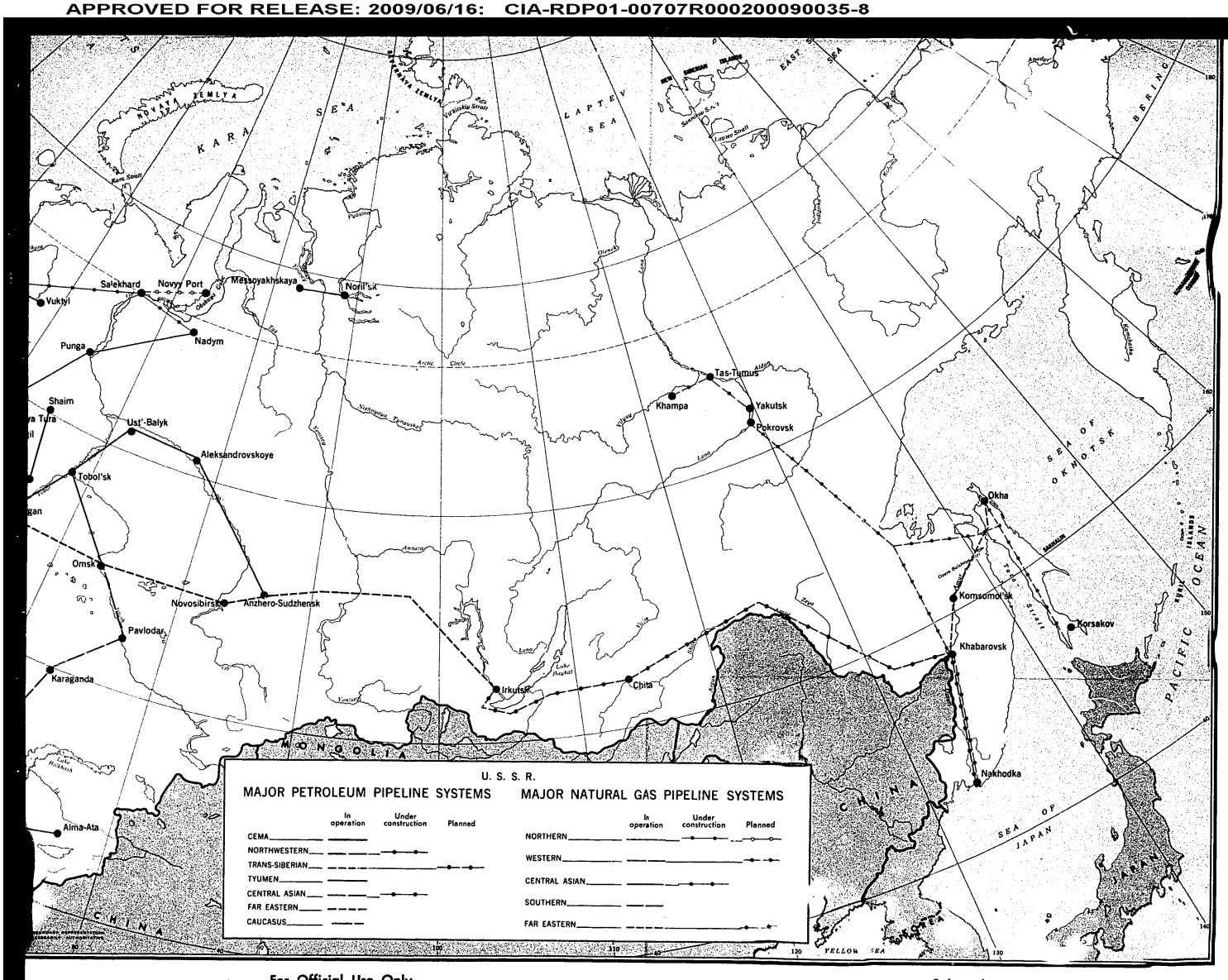

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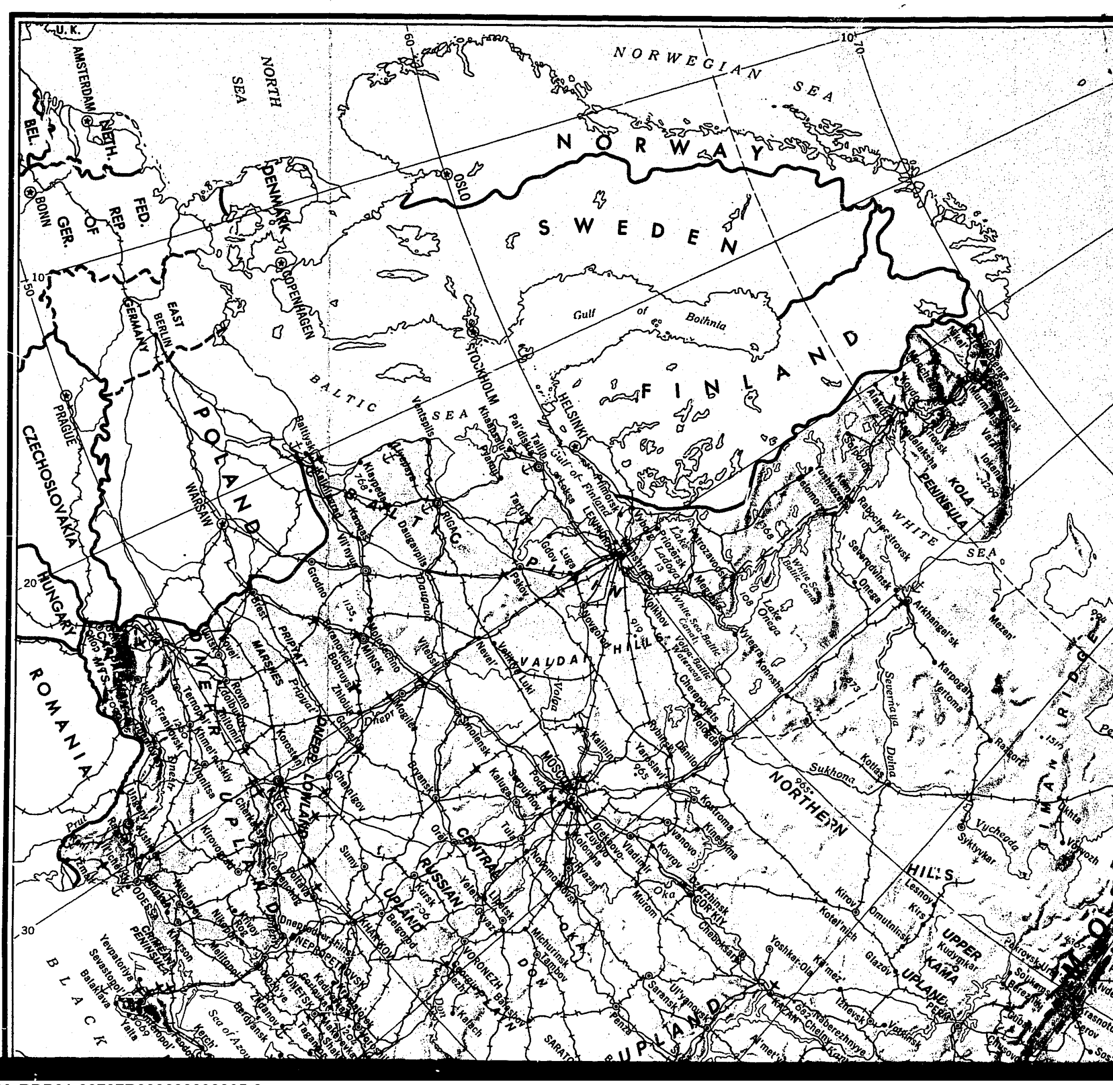
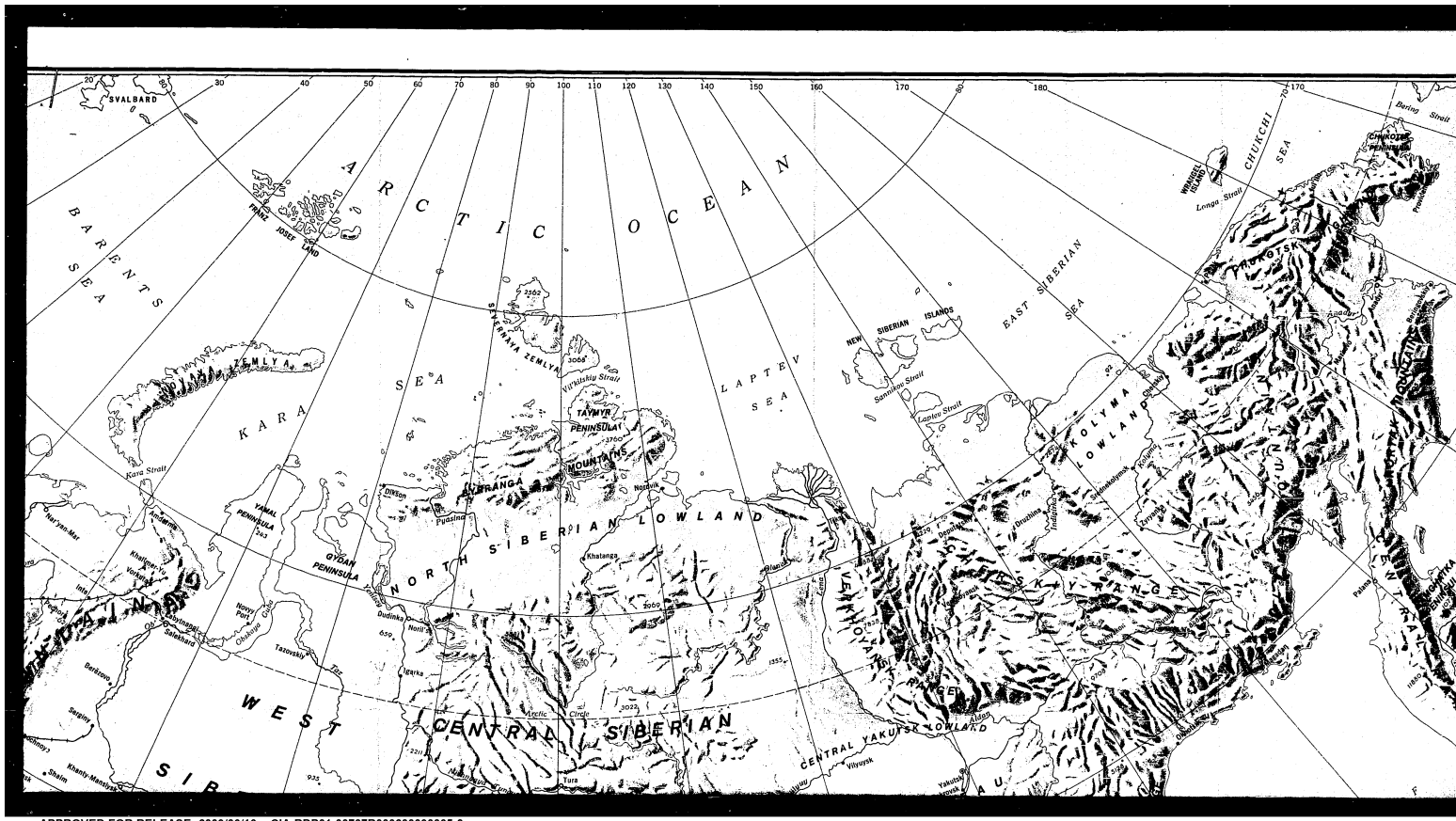
Selected major pipeline systems **Figure 34**

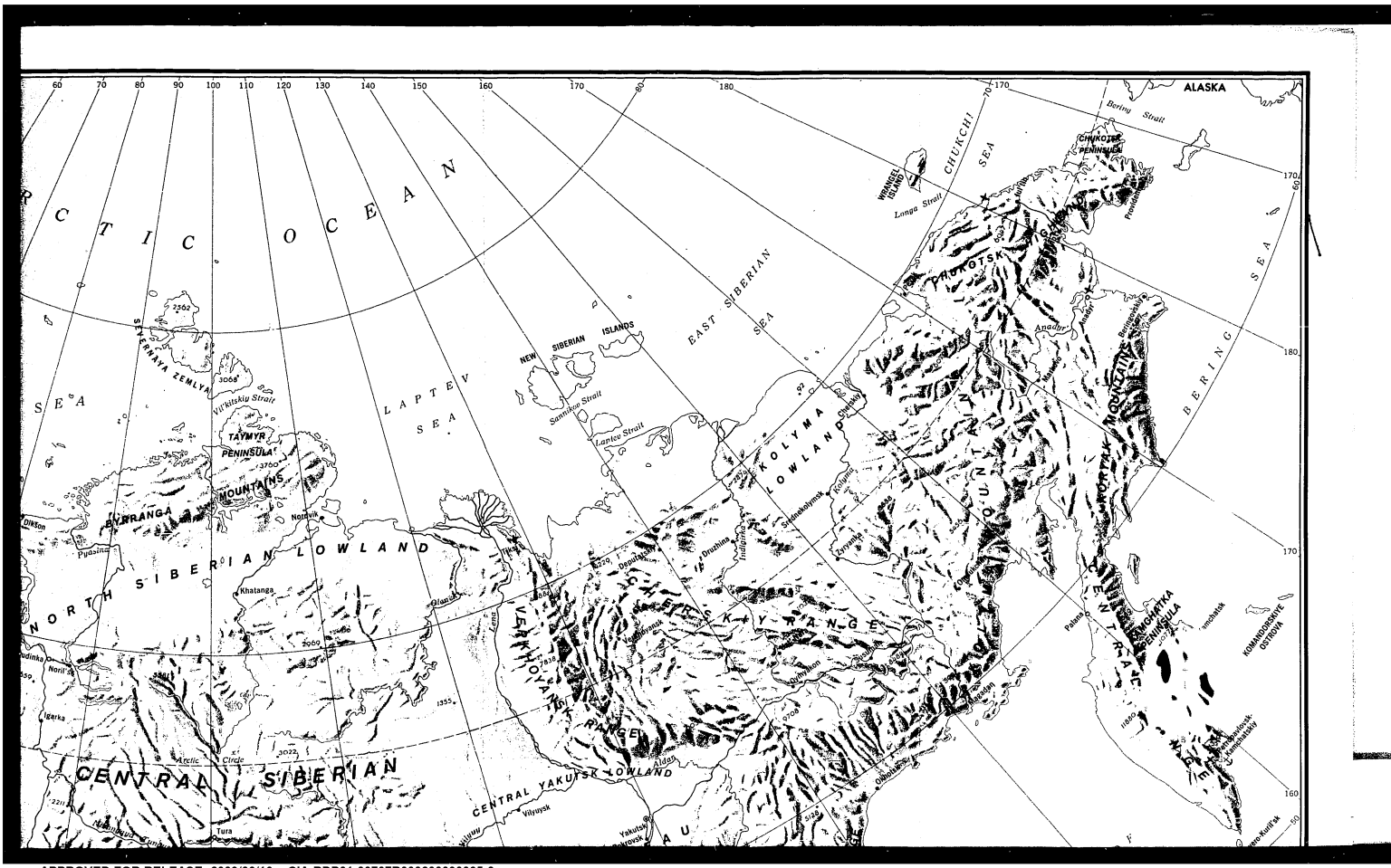
Places and features referred to in this General Survey (u/ou)

	COORDINATES	
	° ′N.	° ′E.
Abatskiy	56 18	70 28
Aldan (*strm*)	63 28	129 35
Aleksandrovskoye	60 26	77 50
Alma-Ata	43 15	76 57
Al'met'yevsk	54 53	52 20
Altayskaya (*rr sta*)	53 25	83 58
Alyat (*rr sta*)	39 58	49 25
Amudar'ya (*strm*)	43 40	59 01
Amur (*strm*)	52 56	141 10
Anadyr'	64 45	177 29
Andizhan	40 45	72 22
Angara (*strm*)	58 06	93 00
Angarsk	52 34	103 54
Angren	41 01	70 12
Anzhero-Sudzhensk	56 07	86 00
Apatity	67 34	33 22
Aral Sea (*sea*)	45 00	60 00
Arkhangel'sk	64 34	40 32
Armavir	45 00	41 08
Artëm	43 22	132 13
Artyshta	54 08	86 17
Arys'	42 26	68 48
Asha	55 00	57 16
Ashkhabad	37 57	58 23
Astara	38 26	48 53
Astrakhan'	46 21	48 03
Azgir	47 50	47 54
Azovstali, Port (*port*)	47 05	37 35
Baykal, Lake (*lake*)	54 00	109 00
Bakhmach	51 11	32 47
Baku	40 23	49 51
Balaklava (*sec. of* Sevastopol')	44 30	33 36
Balaklavskaya Bukhta (*bay*)	44 29	33 34
Baloži (*rr sta*)	56 51	24 03
Baltic Sea (*sea*)	56 00	18 00
Baltiysk	54 39	19 55
Baranovskiy (*rr sta*)	43 45	131 58
Barents Sea (*sea*)	74 00	36 00
Barnaul	53 22	83 45
Batumi	41 38	41 38
Groznyy	43 20	45 42
Gryazi	52 30	40 00
Gudermes	43 21	46 06
Gur'yev	47 07	51 53
Hailar, Communist China	49 12	119 42
Ieriķi	57 12	25 10
Igarka	67 28	86 35
Il'ichëvsk	46 18	30 40
Imeni Dvadtsati Shesti Bakinskikh Komissarov	39 20	54 08
Indigirka (*strm*)	70 48	148 54
Ingul (*strm*)	46 58	32 00
Iokanga	68 00	39 41
Irkutsk	52 16	104 20
Irtysh (*strm*)	61 04	68 52
Irtyshsk	53 21	75 27
Ishimbay	53 28	56 02
Ivatsevichi	52 43	25 21
Izhevsk	56 51	53 14
Izmail	45 21	28 50
Jelgava	56 39	23 42
Kalach-na-Donu	48 43	43 31
Kalinin	56 52	35 55
Kaliningrad	54 43	20 30
Kama (*strm*)	55 25	50 40
Kamchatka Peninsula (*peninsula*)	56 00	160 00
Kamysh-Burunskaya, Bukhta (*bay*)	45 17	36 26
Kandalaksha	67 09	32 25
Kanëv	49 45	31 28
Kanonerskiy, Ostrov (*isl*)	59 54	30 13
Kapustin Yar	48 34	45 45
Karaganda	49 50	73 10
Karakum Canal (*canal*)	37 35	65 43
Karshi	38 53	65 48
Kashtan (*rr sta*)	56 08	89 14
Kaunas	54 54	23 54
Kavkaz (*rr sta*)	45 20	36 40
Kazan'	55 45	49 08
Mikhaylovka	55 49	47 23
Mineral'nyye Vody	44 12	43 08
Minnibayevo	54 49	52 14
Minsk	53 54	27 34
Molodechno	54 19	26 51
Moscow	54 45	37 35
Moskal'vo	53 35	142 30
Mostiska	49 48	23 09
Mostiska Pervaya (*rr sta*)	49 49	23 08
Mozdok	43 44	44 40
Mozyr'	52 03	29 16
Mubarek	39 16	65 10
Mukachëvo	48 27	22 43
Murmansk	68 58	33 05
Myl'dzhino	59 01	78 29
Naberezhnyye Chelny	55 42	52 19
Nakhodka	42 48	132 52
Nakhodka, Bukhta (*bay*)	42 47	132 52
Naoetsu, Japan	37 11	138 15
Naushki	50 22	106 07
Navtlugi Pervyye (*rr sta*)	41 40	44 51
Neva (*strm*)	59 57	30 20
Nevel'	56 02	29 55
Nevel'sk	46 40	141 51
Nikitovka	48 21	38 02
Nikolayev	46 58	32 00
Nikolayevsk	53 08	140 44
Nikolayevskaya	47 37	41 30
Nikopol'	47 34	34 24
Nizhneudinsk	54 54	99 03
Nizhniy Tagil	57 55	59 57
Nizhnyaya Tura	58 37	59 49
Noril'sk	69 20	88 06
Novaya Zemlya (*isls*)	74 00	57 00
Novik, Bukhta (*bay*)	43 02	131 52
Novocherkassk	47 25	40 06
Novokuznetsk	53 45	87 06
Novorossiysk	44 43	37 47
Novosibirsk	55 02	82 55
Novovoronezhskiy	51 19	39 13
Shushenskoye	53 19	91 55
Šiauliai	55 56	23 19
Simeiz	44 25	34 01
Simferopol'	44 57	34 06
Siverskaya (*rr sta*)	59 21	30 04
Skovorodino	53 59	123 55
Smolensk	54 47	32 03
Sochi	43 35	39 45
Sovetskaya Gavan'	48 58	140 18
Stavropol'	45 03	41 58
Strelok, Zaliv (*bay*)	42 53	132 25
Suchan	43 07	133 05
Sukhumi	43 00	41 02
Sulina, Romania	45 09	29 41
Sumgait	40 36	49 38
Surovikino	48 36	42 51
Suslovo	55 25	55 41
Sverdlovsk	56 51	60 36
Sviyazhsk (*rr sta*)	55 48	48 30
Syzran'	53 11	48 27
Tallin	59 25	24 45
Tambov	52 43	41 27
Tarskaya (*rr sta*)	51 37	114 30
Tashkent	41 20	69 18
Tashtagol	52 47	87 53
Tas-Tumus	64 12	126 37
Tatar Strait (*strait*)	50 00	141 00
Taymyr Peninsula (*peninsula*)	76 00	104 00
Tayshet	55 57	98 00
Tbilisi	41 42	44 45
Temirgoye (*rr sta*)	43 08	47 09
Terespol'	52 52	24 18
Teriberka	69 10	35 10
Termez	37 14	67 16
Ternopol'	49 33	25 35
Tien Shan (*mts*)	42 00	80 00
Tikhookeanskaya (*rr sta*)	42 45	132 52
Tikhoretsk	45 51	40 07
Tiksi	71 36	128 48
Tin'govatovo	[illegible]	[illegible]

	COORDINATES	
	° 'N.	° 'E.
...ye	53 19	91 55
...	55 56	23 19
...	44 25	34 01
...	44 57	34 06
...(rr sta)	59 21	30 04
...	53 59	123 55
...	54 47	32 03
...	43 35	39 45
...Gavan'	48 58	140 18
...	45 03	41 58
...v (bay)	42 53	132 25
...	43 07	133 05
...	43 00	41 02
...anit.	45 09	29 41
...	40 36	49 38
...	38 39	42 51
...	55 25	55 41
...	56 51	60 36
...rr sta)	55 48	48 30
...	53 11	48 27
...	59 25	24 45
...	52 43	41 27
...r sta)	51 37	114 30
...	41 20	69 18
...	52 47	87 53
...	64 12	126 37
... (strait)	50 00	141 00
...insula (peninsula)	76 00	104 00
...	55 57	98 00
...	41 42	44 45
...rr sta)	43 08	47 09
...	52 52	24 18
...	69 10	35 10
...	37 14	67 10
...	49 33	25 35
...nts)	42 0[illegible]	80 00
...kaya (rr sta)	42 45	132 52
...	45 51	40 07
...	71 36	128 48







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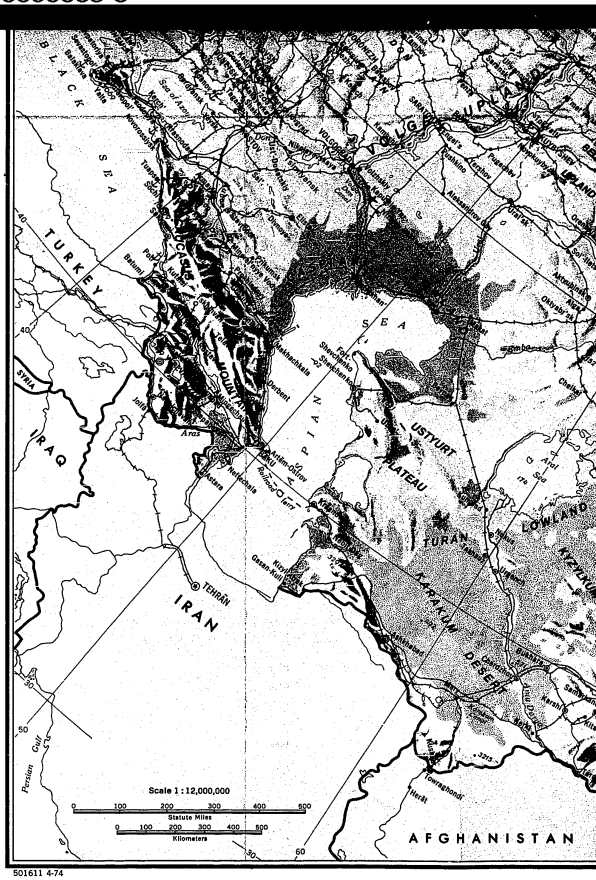

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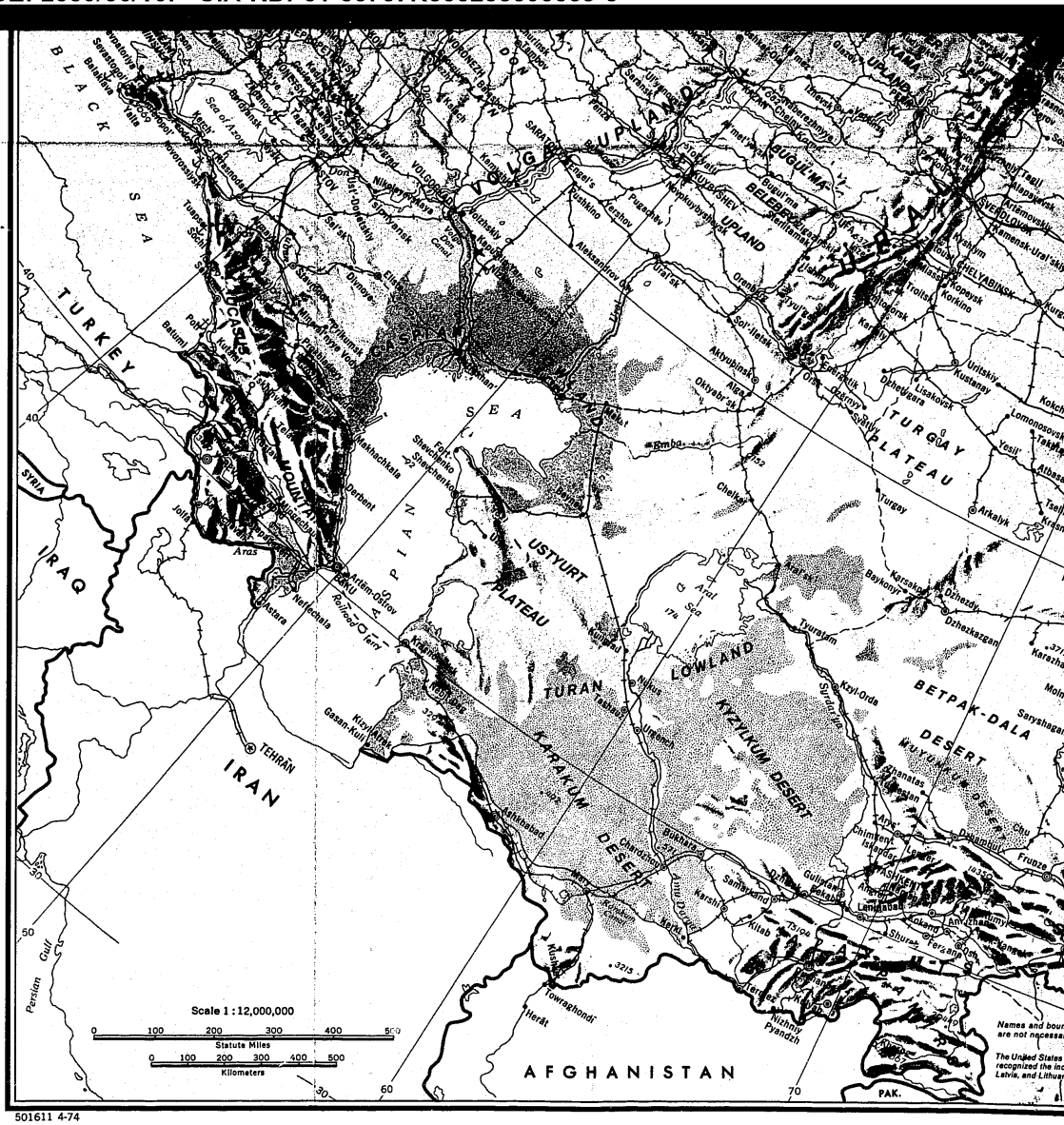

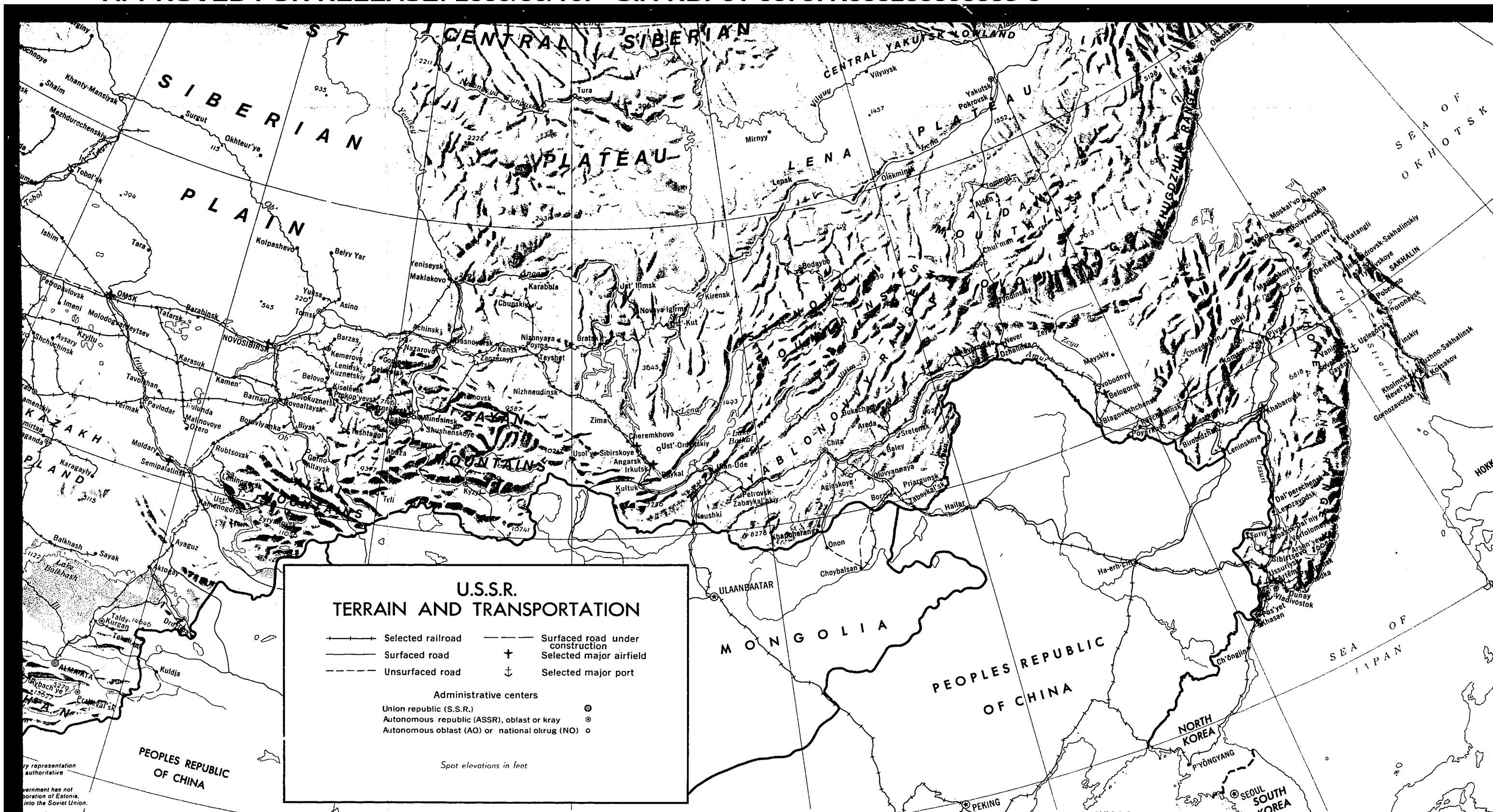

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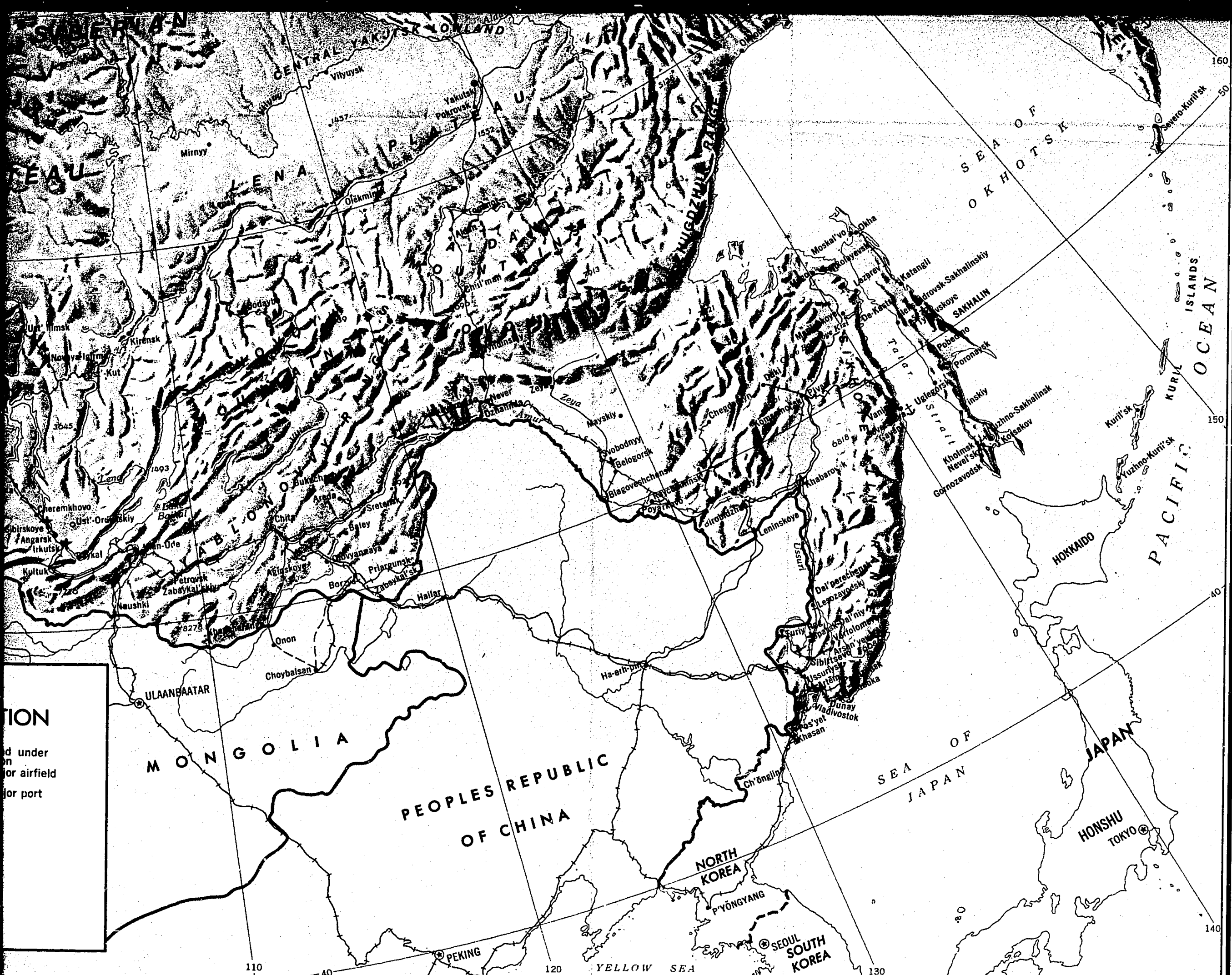

Terrain and Transportation Figure 35

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