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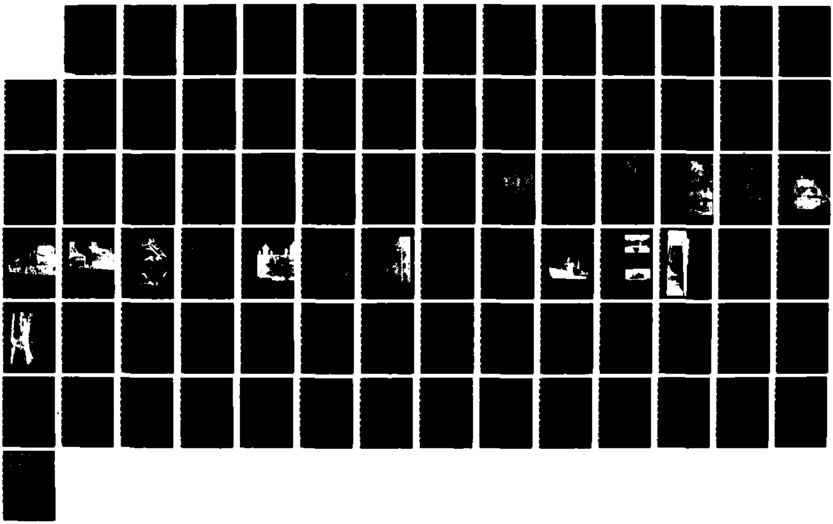

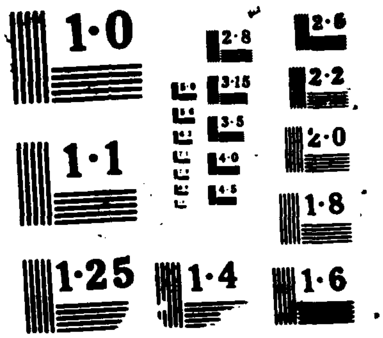
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ABSTRACT

The tremendous size of the Siberian land mass, its system of northward leading waterways, and its frozen Arctic coast have historically posed insurmountable geographic barriers to unlocking the region's vast natural economic wealth. Recognizing the necessity of transportation systems as a prerequisite for the achievement of development as well as for communication and defence, this paper describes specialized Soviet transportation system components which have been matched to their environment and tied together into a comprehensive national transportation system, effectively unlocking the Siberian maritime icebox. Soviet success in this endeavor has geo-strategic ramifications which are noted in the Conclusions of the paper. Recommendations are offered to U.S. and Canadian readers.

TRIUMPH OF TECHNOLOGY OVER GEOGRAPHY – UNLOCKING THE SIBERIAN MARITIME ICEBOX ©

BY: LCDR DENNIS M. EGAN, USCG, PE

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US NAVAL WAR COLLEGE

NEWPORT, RHODE ISLAND

Approved By: ________________ 5-22-87
Cdr. Michael Caruso, USN

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The tremendous size of the Siberian land mass, its system of northward leading waterways, and its frozen Arctic coast have historically posed insurmountable geographic barriers to unlocking the region's vast natural economic wealth. Recognizing the necessity of transportation systems as a prerequisite for the achievement of development as well as for communication and defence, this paper describes specialized Soviet transportation system components which have been matched to their environment and tied together into a comprehensive national transportation system, effectively unlocking the Siberian maritime icebox. Soviet success in this endeavor has geo-strategic ramifications which are noted in the Conclusions of the paper. Recommendations are offered to U.S. and Canadian readers.

PREFACE

The following paper represents my personal opinions and findings and does not necessarily represent the official position of the US Navy, the US Coast Guard or the US government.

After a career in the Coast Guard spanning four tours on Coast Guard icebreakers deployed in the ice strewn waters north of Alaska, on both sides of Greenland, north of Spitzbergen in the winter, and three voyages to Antarctica, I gained an appreciation for the possibilities and dangers of polar operations. My four years in charge of naval engineering support for a fleet of eighteen Coast Guard towboats on the Mississippi River emphasized in my mind the vital role rivers must play in a nation's transportation system. My academic studies* at Massachusetts Institute of Technology and the Naval War College helped me to focus upon shallow water craft design and the constraints of maritime Arctic warfare, respectively.

I have focussed my attention upon the Soviet Union's national transportation systems during my year's study at the Naval War College. I was particularly concerned about the Soviet's significant accomplishments in Arctic Ocean maneuverability over the last ten years, when compared to what I perceived to be diminishing appreciation and commitment to this region of operations by the US government.

I thank my many friends and instructors at the US Naval War College for helping me to develop an understanding of Soviet strategy and objectives. In the framework of my experience I was able to develop this document which examines how the Soviets have tapped the natural wealth of Siberia, have transformed their Arctic maritime frontier into a functional coastline, and have concurrently developed a logistics infrastructure of such geo-political significance that it ultimately may threaten the security of both Canada and the United States.

Last of all I dedicate this paper to my wife, Margaret, who gave me infinite patience and understanding while I jousted with windmills.

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* The author has received the Master of Science degree in Mechanical Engineering (MIT), the Degree of Ocean Engineer (MIT), and the Master of Arts in International Relations (Salve Regina College). He is currently a professional engineer, registered in the state Missouri.

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TRIUMPH OF TECHNOLOGY OVER GEOGRAPHY
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I. INTRODUCTION

This paper will examine the systematic development of the Soviet national transportation systems and their role in unlocking the natural wealth of Siberia. Transportation components and system capabilities will be discussed. Geo-strategic economic and defensive issues will be raised as the expected result of relatively successive efforts the Soviets have had in developing technology, which is transforming their frozen Arctic coastline into a functional maritime area.

Transportation systems are essential means of binding nations into a nation-state. A nation-state must have transportation systems for three reasons:

* COMMUNICATION
* DEFENSE
* DEVELOPMENT

Communications require the movement of people and information; defense requires mobility of military resources; and development requires engineering systems to tap natural resources and move them to the world's markets. In the Soviet Union, transportation systems have been created to jointly serve all three interests.

The strategic perspective and character of a government is directly affected by the ability of its transportation systems to overcome physical geographic barriers to bind itself together as a nation state. Because the Soviet Union has had to contend with great distances, swamps, shallow rivers, forests, mountains, frozen steppes, and ice-bound coastlines, technology has not, until recently, allowed for the practical exploitation of its vast natural resources, particularly in areas east of the Ural mountains such as Siberia and the Soviet Far East. Siberia has more miles of great navigable rivers than most other area of the world; * yet these rivers flow northward to the frozen Arctic rather than east and west to the population centers and markets of the world. Consequently, they have historically served as barriers rather than facilitators of communication.

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* "During peacetime, in a river rich, road poor land (inland river) vessels are absolutely indespensible in the functioning of the Russian economy. Of 70 rivers in Europe and Asia that have a length of more than 1,000 km, 50 are in the Soviet Union." (1)

Despite having a larger coastline than any other nation-state in the world, most of that coastline has been useless for maritime communication with world markets. Lack of unrestricted access to the open oceans and the great difficulties in the transport of people and material across a predominantly ice-bound Arctic coastline, historically have frustrated Russian attempts to become a maritime power and have led some to the perception of the Soviet Union as a continental power. * However, it is just as likely that rather than just dictating continental goals and ambitions, Soviet geographic barriers have actually driven their ambitions to become a maritime power. This started with thorough exploitation and development of their domestic, internal waterways communication system. In regions west of the Ural Mountains a network of interconnecting canals were constructed by slave labor to allow for the shuttling of 10,000 ton ships from the Black Sea to the Baltic to the White Sea, all within Soviet internal waters.** Because this inland waterway network is completely within internal waters, the Soviets have achieved a maritime trade monopoly on river cargos from the Baltic to the Black and Caspian Seas. However, quests for usable warm water seaports have driven Soviet expansionary ambitions and foreign policy towards their west, southwest and southeast flanks.*** Concurrent Soviet aspirations for control of international trade routes, access and to world markets, and global ideological leadership have significantly modified what might have been less ambitious continental tendencies and have provided the initiative to achieve their economic development by overcoming geographical barriers with technology. In particular, the ability of the Soviets' technology to systematically provide mobility across the vastness of Siberia, has been the key to unlocking immense reserves of natural resources and has had significant global economic impact. To the Soviets, according to their last two five-year plans, this development was necessary to satisfy both future domestic consumption requirements as well as to raise hard currencies from international trade. Successful development of Siberian resources and the means to get them to international markets has not been without risk to Soviet trade competitors and trade partners.****

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* Saul B. Cohen in his Geography and Politics in a World Divided (1973), referred to all of the Soviet Union, Eastern Europe, and Eastern and Inner Asia as "the Eurasian Continental Power" but failed to take into account the fact that the Soviet Union has become a leading maritime power, with naval, merchant, fishing, and oceanographic fleets ranking among the world's largest.[2]

** "From the Russian viewpoint, Europe has become an island, so far as small ships are concerned. Little ships can come in from the ocean and tie up at a dock in Moscow itself."[3]

*** Eastern Baltic, Iran, Turkey, Afghanistan, and Kurile Islands

**** A sudden influx of commodities potentially can have extremely disruptive effects upon capitalistic markets. For example, due to extremely efficient towboat-barge timber carriers built in a joint USSR-Japan enterprise,[4] recent massive exports of Siberian timber have collapsed the Far East timber market prices and stolen the U.S. timber market share in Japan. Conversely, if capitalistic states become dependent upon Soviet supplies, such as Siberian natural gas, these natural resources can take on a strategic nature with global political consequences. Such may be the case with the recently completed Siberian gas pipeline to Western Europe.[5]

The capabilities of Soviet transportation technology to develop Siberian natural resources also has had defence ramifications. The Soviet's strategic economic strength is becoming increasingly dependent upon Siberian resources, whose availability requires coordinated mobility in the air, on the surface and beneath the surface. Because joint military compatibility is required of all Soviet transportation systems, economic momentum is concurrently driving the development of Soviet military capability to project and sustain power anywhere within the Arctic basin.

Similar economic momentum is not shared by Canada or the United States because of environmental concerns and virtually insurmountable political barriers to development.* Unfortunately, transportation barriers in northern Alaska and Canada are very similar to Siberia. Transformation of Siberia and the Soviet Arctic coastline into a functional maritime coastline has concurrently resulted in a massive buildup of vessels and specialized Arctic craft giving the Soviets the capability to project strategic logistics over the icecap and achieve mobility of large, heavy military payloads across Canadian tundra, rivers, and swamps. This makes the North American Arctic "Shield" also vulnerable to military penetration. Opportunities may present themselves for sharing technology with the Soviets in this area for joint benefit, but the technology, itself, is not the issue. In the Soviet Union the government stands firmly behind development of Arctic mobility. The Soviet Union is developing a national transportation system in Siberia and the Arctic based upon strategic economic rationale. Because free market forces and political environmental issues drive the developmental policies of the Western governments, the U.S. and Canada apparently have given Arctic mobility a lower national priority. The ramifications of this strategic imbalance of priorities may ultimately prove to be significant to our national security.

II. DISCUSSION

A. NATURAL RESOURCES AND INCREASING SIBERIAN IMPORTANCE:

The Soviet Union has been blessed with an abundance of natural resources. These include rivers with hydroelectric potential, natural gas, oil, timber, and strategic minerals. The bulk of these resources are located east of the Ural mountains in Siberia and the Soviet Far East (see figure 1). Siberia has become increasingly important to the economic development of the Soviet

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** As an example, the Canadian Mackenzie River Valley gas pipeline project was blocked after millions of dollars of investment because of the disruption such development would have on the environment and native peoples in the Canadian Northwest Territories. Similarly, Canada has been extremely cautious and reluctant to develop the Northwest passage for tanker traffic because of the potential environmental consequences. (I conclude that U.S. and Canadian defense mobility capabilities will therefore lag well behind the Soviets in the ability to project power in the Arctic.)(7)

Union.* As energy resources in the Western European sectors of the Soviet Union declined, nuclear power plants were aggressively constructed as a substitute for conventional Siberian energy resources. However, nuclear power, though extensively developed in the Soviet Union, does not appear to be a significant substitute power source, now or anytime within the near future.** Industrial centers in the Soviet Union will still predominantly rely upon conventional coal, petrol, or hydroelectric power plants for electrical power generation and the primary source of this energy is Siberia. This does not cause an immediate problem because the Soviet Union is presently a net exporter of energy. Meanwhile, the Soviet Union's oil and gas surplus from Siberian fields has allowed them to increase their political and economic leverage with Europe while concurrently providing an important source of Western currency.***

However, while still benefitting from an overabundance of natural gas, future trends suggest problems in maintaining high rates of oil production without the assistance of Western "high tech" secondary extraction techniques and equipment. The Soviets now appear to be increasingly turning towards the northern Siberian Arctic offshore oil deposits to maintain an acceptably high rate of oil production.* Increasing emphasis on the development of Siberian resources may be evidenced by an increasing national apportionment of capital investment in the region. Though figures are only available through 1975, and only suggest an initial surge in capital investment (which probably is much more dramatic over the last ten year period) Soviet capital investment in Western Siberia and the Soviet Far East steadily increased from 12% of total capital investment during the period 1960-1965 to over 16% during the period 1970-1975.(13)

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* For instance in 1974, West Siberia and the Soviet Far East contributed only 10% to the total Soviet production of natural gas. By 1984 this had risen to over 50% of the total Soviet natural gas production. In 1973, oil production from West Siberia accounted for only 21% of total Soviet production. However, by 1983 this had increased to over 60% of total Soviet production. (8)

** In 1984, nuclear power contributed to only 9% of Soviet electrical power production. Over 35 nuclear power plants were operational, and almost all of these plants were located west of the Ural mountains. (Unfortunately, over 50% were based upon the design of the Chernobyl reactor.)(9)

*** In 1983 the Soviet Union delivered 953 billion cubic feet of natural gas to Europe supplying 100% of Finland's requirements, 67% of Austria's requirements, and 14% of France's requirements. (10) Between 1972 and 1982, Soviet oil production allowed for a surplus for export rising from 1.95 million barrels per day to 3.15 million barrels per day. However, the trend of oil production has leveled out. Domestic consumption is continuing to increase while production is on the wane. A problem seems to be a lack of Western enhanced recovery techniques.(11), (12)

* It was reported that three icebreaking oil drilling vessels built in Finland for the Soviets were operational. In the same issue a detailed map of Soviet Arctic oil and gas deposits was provided.(14) As a major element of domestic refined oil consumption, automobile production for domestic use increased from 123,000 vehicles in 1970 to 1.4 million vehicles in 1982. It may be significant that the Soviet Union is now emphasizing the conversion of domestic vehicles from gasoline to methane, natural gas. This perhaps reflects projections by some that the Soviet Union will become a net importer of oil by the 1990s, but will continue to have an inordinate abundance of Siberian natural gas.(15)

The population of the Siberian cities has also mirrored the improved communications and increasingly important economic significance of the area.

TABLE 1

GROWTH OF POPULATION OF SIBERIAN CITIES

City	1970	1975	1983
	Population in thousands		
Tiumen City	269	323	397
Norilsk	135	161	183
Nizhnevartovsk	16	52	166
Surgut	34	60	175
Khanty-Mansiisk	25	50	50
Tiumen Oblast (region)	1407	1580	2293

Source: Shearer, "USSR facts and figures manual", Vol.9, 1985, p. 201

Besides oil and gas, abundant strategic minerals increase the relative importance of Siberia and the Soviet Far East to the economic strength of the Soviet Union. As of 1981, the Soviet Union ranked first or second in the world in the production of eighteen strategic minerals including aluminum, cadmium, chromite, copper, diamonds, gold, iron ore, lead, manganese, mercury, nickel, platinum, silver, titanium sponge, tungsten, vanadium and zinc. The bulk of these minerals were extracted from Siberia and the Soviet Far East.(16)

B. SIBERIAN TRANSPORTATION SYSTEMS AND THEIR COMPONENTS:

Soviet transportation systems are comprised of land (undeveloped terrain and surface roads), rivers, railways, coastal and ocean going (ice capable and conventional maritime), integrated ports, and air components. (see figure 2)

Unlike the U.S., surface road transportation is still a relatively minor component of the Soviet transportation system. Nonetheless, Soviet surface road transportation has substantially increased over the last 20 years. From 1964 to 1982 the mileage of paved roads in the Soviet Union doubled. By 1982 this included over 761,000 km of paved roads with approximately 20,000 additional km of paved roads being developed each year. The number of automobiles produced for domestic use increased dramatically from 64,000 in 1965 to 1.4 million in 1982. Nonetheless, road travel is the least important of all transportation systems in Siberia and the Far East.(18)

The most significant roads in Siberia and the Soviet Far East are those maintenance and military roads paralleling the Trans-Siberian Railroad and the road network linking Yakutsk on the Lena River to Magadan on the Pacific coast and to the railhead of the BAM Railway and Trans-Siberian Railroad at Berkakit and Skovorodino, respectively. A military road network links the Arctic seaports of Pevek and Ambarchik with military facilities at Anadyr (on the Bering Sea) and on the Kamchatka Peninsula (via the Sea of Okhotsk) Other significant road networks are on Sakhalin Island linking Sakhalinskiy to Yuzhno Sakhalinsk, and along the corridor between the Siberian industrial centers of Sverdlovsk and Chita.[17]

All-terrain vehicles are playing increasingly important roles in Siberia moving large payloads over swamps, lakes, rivers and ice to roads, railheads, river crossings, and airfields. These substantially rely upon the principle of air cushion lift. Large platforms have been constructed with rubberized fabric, metal reinforced skirts and have been air pressurized with diesel powered fans to achieve the capability of lifting and moving large loads. This technique uses only a relatively low footprint pressure, minimizing damage to the terrain and allowing for all-weather movement of large loads across all terrain. Some vehicles propel themselves with high power fans or water jets. Others are simply air cushioned barges or trailers that are linked together into all-terrain trains and are propelled by multi-tracked "Weasel" amphibian air cushion assisted vehicles. The tracked vehicles are partially supported by air cushions as well to increase their mobility, decrease their footprint, and reduce environmental damage. (See figures 3, 4, and 5.)

Typically a tracked vehicle will be placed at the head of such a train and another tracked vehicle will be placed at the end to allow for controlled braking while going down slopes or around critically restricted curves. Frozen rivers become "interstate highways" for such hover platform trains during the winters. In some applications, helicopters are also used as tow vehicles.* Some of the heavier lift air cushion platforms have been modularized for helicopter transport to remote locations. For instance one such transportable hoverplatform was delivered to a remote Siberian oil drilling site in six helicopter payloads of less than six metric tons (tonnes) each. This platform bolted together and was connected to a 400 tonne payload, creating a lift system 36 meters long, 26 meters wide and an overall track width of 50 meters. The platform lifted the 400 tonne payload for an over the road clearance of approximately 23 cm. It

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* Typical standardized platforms are designated PVP-40, an 18 ton platform that carries a 40 tonne payload and the PVP-60, a 24 tonne platform that carries a 60 tonne payload. By 1980 over 550 PVP-40 or PVP-60 platforms were in active service in Siberia. During the period 1980-1985, 500 such vehicles were scheduled to be built each year.[20]

was then moved overland, towed with two tracked amphibian vehicles at an average speed of 10 km/hr for a distance of 220 km from Surgut to Lentorskoye in the Ob River Basin.[19] Road and off-road vehicles provide the basic means of getting cargo to the railheads and riverports where cargos are transfered to more efficient mediums of bulk cargo transport - the railroads and the river - marine shipping systems.

The vital east-west transportation backbone is the Trans-Siberian Railroad. Construction on the Trans-Siberian Railroad was started in 1891 predominantly with Western (French) venture capital, but was supported by a Czarist Russia which recognized its strategic military potential to move forces to the Pacific and to defend Russia from Japanese imperialistic ambitions. The railroad was laid out in a fertile strip bounded on the north by tundra and on the south by desert. Massive engineering problems were encountered from Lake Baykal, east. Costs were cut in several areas including initiating a cross lake rail ferry service at Lake Baykal and diverting the tracks south through Manchuria to sidestep the mountains and ravines north of the Amur River. Agreements with the Chinese and Czar Nicholas II in 1895 resulted in the formation of the Chinese Eastern Railway - a joint Sino-Russian company. By 1903 the Chinese-Eastern railway was complete and a line was completed around Lake Baykal in 1904. A southern extension of the Trans-Siberian railroad was built from Haerbin to Talien (Luda) and Port Arthur, the latter two ice free port cities.

Unfortunately, the limited capacity and poor quality of the single tracked, light weight rails, (max. 13 tonne axle load) and short cut economies taken by the Czarist railroad administration in laying down the railbeds resulted in an inability to sufficiently move war material into the theatre of conflict during the Russo-Japanese War of 1905. Two-thirds of the southward extensions of the Trans-Siberian Railroad and the warm water ports of Talien and Port Authur were ceded to Japan. A northern railroad leg to circumvent Manchuria and the Eastern Chinese Railroad was completed by 1916.

The railroad's national strategic importance became apparent during the Russian Revolution as White Russians used the Trans-Siberian Railroad as their sole means to get supplies from Western powers to fight the Bolsheviks (albeit unsuccessfully). The Trans-Siberian Railroad was improved between 1920-1935, but in 1935 the Soviets sold their rights to the Manchurian Branch of the Trans-Siberian Railroad to the Japanese. Portions of the Trans-Siberian railroad were used to resupply the Soviets during WWII, prior to the Japanese attack on Pearl Harbor.[21]

Since WWII the Trans-Siberian Railroad has been substantially upgraded and has served as the principal transportation system of Siberian development. The line has been doubled and has been electrified from Moscow to Irkutsk on Lake Baykal. The rail capacity has been upgraded to handle the weight of the Soviet main battle tank.(22) Railheads have been established at the major river crossings of the Tura River at Tyumen, the Irtysh River at Omsk, the Ob River at Novosibirsk, the Yenisey River near Krasnoyarsk, the Angara River at Bratsk and Irkutsk, Lake Baykal, the Zeya River near Belogorsk, and the Amur River at Khabarovsk. The Trans-Siberian Railroad terminates at the Pacific ports of Okha, Sovetskaya-Gavan, Vladivostok and Nahodka. An intermodal rail ferry has been developed between Sovetskaya Gavan and the Sakhalin Island city of Yuzhno Sakhalinsk. An intermodal container traffic system has been set up over the last ten years that dramatically increased the railroad's ability to move large volumes of cargo. (see figures 6, 7, and 8.)

TABLE 2

TRENDS IN INTERMODAL CONTAINER TRAFFIC ON SIBERIAN RAILROADS (in million tonnes)

1975	1980	1985
26	40	72

Source: Jane's Railroads of the World 1986. (p. 727)

A new landbridge service was initiated recently between Helsinki and the Pacific port of Nachodka with an average transit for containerized cargo at 13 - 16 days. Tracks have been upgraded to handle a design axleload of 23 tonnes. In 1985, Soviet rails moved an average of 10 million passengers (Passenger traffic was 89% local and 11% long distance) and 10 million tonnes of freight daily. Over 80% of the total freight was coke, coal, oil, non-ferrous metals, fertilizers, timber and grain. The 1981-1985 Five Year Plan put high priority on improving the rail connections and railhead intermodal facilities for connections between the Far East, Siberia, the north, the Urals and the country's eastern industrial population centers and river crossings. The Plan called for 390,000 new containerized freight cars and 15,000 new passenger cars. Over 50% of the railroad capital investment funds were designated specifically for rail lines carrying very heavy loads in the Urals, West Siberia and the Far East. By 1985, over 7025 km of the Trans-Siberian Railroad was electrified from Orsha (west of Moscow) to Karymskaya in the east. The entire Trans-Siberian Railroad is scheduled to be electrified by 1990.(23)

Concerned by border skirmishes with the Chinese along the Amur River Valley in the early 1970s, the Soviets initiated construction of a parallel branch of the Trans-Siberian Railroad, located in a strategically more defensible area north of Lake Baykal. This parallel branch of the Trans-Siberian was designated the Baikal-Amur-Magistral (BAM) and linked the important river ports of Ust Kut (Lena River), Ust Nyukzha (Olekma River) and Ust Muya (Yitim River) to the Trans-Siberian Railroad System. Track laying on the main 3145km stretch of the BAM was completed in 1984. A further 4800 km branch extension from the Central Soviet Union to the BAM is planned to commence in 1987. A northern extension of the BAM is under construction to link the Lena River port of Yakutsk with the BAM and tap the significant timber and mineral resources of the Yakutsk Region around the Lena River Basin. This extension is planned for completion before 1995. It is anticipated that the BAM will initiate full service in 1987 with approximately 35 million tonnes of bulk freight moving annually from east to west in unit trains averaging 9000 tonnes weight each. A major (Approx 240 km) northern rail extension was completed into the gas fields of the Ob River Basin, linking Surgut on the Ob River to the gas fields around Urengoy and the Pur River. Other northern rail extensions have been constructed to directly link various river ports along the Ob River (oil and gas fields have been extensively developed in this area) including Salekhard, Sergino, Surgut and Tomsk.(24)

The Inland Waterways of the Soviet Union comprise the north-south arteries of the national transportation system. Even though the emphasis of this paper is on Siberian transport systems, the extensive use of inland waterways west of the Ural mountains can first be used to illustrate the Soviet commitment to river systems as integral elements in the state's transportation systems. Prior to WWII, initial developments in the western Soviet Union were prompted from both military and commercial incentives. Because of restricted access to the ocean, the Soviets found it necessary to maintain a naval fleet in the Black Sea, a fleet in the Baltic and a fleet in the Northern White Sea. (not to mention the Soviet Pacific fleet) The Volga-Baltic-White Sea canal system was developed to allow for the shuttling of Soviet naval vessels among theatres and to allow for major shipbuilding to occur on the inland rivers where it could be better defended.

This system is now comprised of 25 earthen dams, 5 spillways, 74 km of navigable canals, 7 locks and 3 hydro-electric plants. It connects Moscow and Leningrad to all the ports along the Volga River, the Danube River, the Dnepr River, the Don River and the Ural River, as well as the three naval fleet areas. Significant shipyards on this system are the Krasnoye Sormovo shipyard in Gor'kiy (Volga River) which builds Kilo and Sierra Class nuclear attack submarines, the Leninskaya shipyard in Kiev (Dnepr River) which builds naval auxiliaries, and the Zelenodol'sk shipyard near Kazan (Vetluga River) which builds naval hydrofoils and Koni Class frigates. (SOURCE: POLMAR, GUIDE TO THE SOVIET NAVY, 4th ed., pp476-477.)

By 1983 the Volga Baltic Canal System could handle vessels up to approximately 5000 tons and a capacity of 10,000 ships per year.[25] Total transit time from Leningrad to the Volga River was three days. Soviets had reportedly[26] widened and deepened the 135 mile long White Sea Canal to allow for the shuttling of surface combatants and submarines between the Baltic and Barents Sea completely within Soviet internal waters. Other sources indicated that this canal system could shuttle vessels up to 10,000 tons after 1970.[27] The Soviets used this inland waterways system to gain a virtual monopoly on river transportation of cargo shipped from the Baltic Sea to the Caspian Sea because it was legally an internal waterway not available to international shipping.*

The great rivers of Siberia have likewise been extensively used as integral components of the state's transportation system.** From the railheads on the Irtysh, Ob, Yenisey, Angara, Lena, and Amur Rivers, depending on the time of year, people and supplies move northward on conventional steamboats pushing barges, high speed shallow water hydro-foils, air cushion surface skimmers, air cushion amphibian craft, wing in ground (WIG) effect surface skimmers, (see figure 9) and, as previously mentioned, air cushion barge trains propelled by all terrain vehicles. While most of these river craft are extensively described in Jane's Surface Skimmers 1985, for those unfamiliar with transportation modes of this type I offer the following generic descriptions and will then follow with a summary of overall dimensional and performance characteristics of the various types of platforms used on the Soviet river systems.

Soviet conventional steamboats pushing barges are similar to small towboats and their barges on the Mackenzie River, the Hudson River, and the Tenn-Tom River Systems of the North American Continent. Most Soviet towboats are diesel propulsion of about 1,000 horsepower, with drafts of 4-8 ft. Usually they can be used only with icebreaker assistance when the rivers freeze over.*** Top speed is usually about 8-12 mph through the open water.

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* "Especially since the petroleum-producing countries have become important buyers of Western industrial goods, the Soviet Volga boatmen have become shipping entrepreneurs, transporting more and more cargo from Western Europe, via the Baltic and Soviet inland waterway system to northern Iran and Tehran. West European shipping companies are barred from using the Soviet river and canal system." [28]

** By 1965 cargo transported by the river fleets amounted to 133 billion-ton kilometers rising steadily to over 140 billion-ton kilometers by 1969. Prices for general cargo transported on the river system are 1/3 to 1/2 as much as equivalent transportation by the Soviet railroad system.[29]

*** An extensive inland fleet of ice strengthened barges and river icebreaking vessels operate on all large Siberian rivers. Some river icebreakers, the Tamyr class, will be nuclear powered by 1990. [30]

Hydrofoils are watercraft which, when moving, rise out of the water and are supported on foil structures. These foils not only lift the vessel, allowing for operation in very shallow waters while foil borne, but also substantially reduce drag and consequent powering requirements. Within relatively light payload constraints, shallow water hydrofoils allow for rapid and efficient transportation of people and high value/ low weight packages. (see figures 10 and 11) Hydrofoils operate on all major Soviet rivers, are 60 to 112 feet long, 15 to 31 feet wide, and carry 40 to 120 passengers for ranges 230 - 300 miles at speeds between 35 to 45 miles per hour.

Air cushion, rigid sidewall craft are similar to what is known in the U.S. as the Surface Effect Ship (SES). Fans blow air into a captured air bubble trapped between fore and aft rubberized fabric skirts and structurally rigid sidewalls. Required lift fan power is not as great as that required by a fully skirted amphibious craft (ACV). The rigid sidewalls often are fitted with skis to allow the craft to operate in swamps, ice, and snow as well as in open water. These craft are more flexible, year around, for moving people and cargos on the Soviet river systems. The bow and stern skirts are susceptible to debris damage but are designed for rapid and simple repair in the field. Typical models found on Siberian rivers include the Orion 01, the Zarnitsa and the Zarya. These vessels are 72 ft to 85 ft long, 13 ft to 21 ft wide, and when water borne, require minimum operating depths on water of 18 to 22 inches and carry 48 to 87 passengers and cargos from 1 tonne to 14 tonnes at speeds 22-37 miles per hour and ranges 100 - 250 miles.

Fully amphibious air cushion vehicles (ACV), are configured with a rubberized fabric, all around skirt, and have the capability of operating over land, ice, mud or water. Though cargo carrying configurations of ACV hoverbarges have been previously mentioned in conjunction with all- terrain heavy lift vehicles, most self propelled ACV in Siberia are used for rapid all weather surface transportation of people and light, oftentimes emergency, cargo. If there was a Siberian equivalent to the American automobile or the light truck, this would be it. These vehicles are at their best when the weather socks in and doesn't permit helicopter or small aircraft transportation. Vehicle lengths are typically 20 ft to 32 ft, widths are 7 ft to 15 ft, passenger capacities vary between 2 to 18, depending upon configuration, and cargo carrying capacity varies between 200 lbs to 2 tonnes. Transit speeds up to 40 mph are routinely attainable over water and 74 mph over flat land. Ranges are typically 150 to 200 miles.

These craft will operate on rivers with minimum water depths between 3 and 8 feet deep, depending upon the model and time of year. Extensive operational experience gained over the last twenty five years, operating these vessels in debris strewn Siberian river waters, has vouched for their inherent simplicity, rugged design and durability.* Propulsion is generally achieved with engine driven propulsion fans, similar to swamp boats (airboats) in the Florida Everglades. A variation of this is the air cushion tracked vehicle. This is the amphibious tracked vehicle mentioned previously in the heavy lift air cushion barge train discussion. It offers the advantages of all terrain tracked propulsion while requiring a relatively light footprint thanks to its partial support by a trapped cushion of air. This allows it to operate within most Siberian river basin areas without getting bogged down. A summary of the characteristics of representative special Siberian River Surface Transport Craft follows:

TABLE 3

SPECIAL SIBERIAN RIVER SURFACE TRANSPORT CRAFT CHARACTERISTICS

NAME	LENGTH(ft)	WIDTH (ft)	PAYLOAD	RANGE(mi)	SPEED (mph)
ORION (SES) (Rigid Sides /Max Draft is 1.5')	84.7'	21.3'	80 passengers and 14 tonnes	250 mi.	37 mph
** ZARNITSA (SES) (Rigid Sides/ Max Draft is 1.5')	72.2'	12.7'	48 passengers and 6 tonnes	250 mi.	22 mph
** ZARYA (SES) (Rigid Sides/Max Draft is 1.8')	78.5'	13.6'	87 passengers and 1 tonne	100 mi	28mph
SAVR-1 (ACV) (Complete Air Cushion)	25'	12.5'	2 passengers and 1.3 tonnes	Variable	30 mph
SAVR-2 (ACV) (Complete Air Cushion)	32.4'	15'	18 passengers or 2 tonnes plus 2 passengers	Variable	30 mph
AKVPR-1(ACV) (Complete Air Cushion)	24.5'	13'	4 passengers plus moderate luggage	Variable	31 mph
BAPRS-1(ACV) (Complete Air Cushion)	24.5'	8.6'	7 passengers or 1400 lb. cargo	150 mi.	50 mph

* By the end of 1964 about 126 hydrofoils were operational on 67 routes. Since that time the numbers have increased dramatically.[31]

** NOTE: Over 250 SES river craft of the ZARNITSA and ZARYA type are operating on Soviet rivers as of 1985. (SOURCE: JANE'S SURFACE SKIMMERS- 1985)[32]

SPECIAL SIBERIAN RIVER SURFACE TRANSPORT CRAFT CHARACTERISTICS (Cont.)

NAME	LENGTH	WIDTH	PAYLOAD CAPACITY	RANGE	SPEED
TUPOLEV A-3 (Complete Air Cushion)	20'	7'	1400 lb winter or 600 lb summer	190 mi.	40-74mph
TAIFUN (Air Cushion Tracked Vehicle) (Also used to tow air cushion barges)	25' (est.)	13'(est)	20 passengers or 3 tonnes cargo	UNKNOWN (Negotiates 35 deg Slopes and 3.2' high obstacles)	UNK
* VOSKHOD 2 Hydrofoil (Requires 6.8' water depth min.)	90.6'	20.3'	71 passengers	300 mi.	45 mph
* BYELORUS Shallow Water Hydrofoil (Requires 2.9' water depth min.)	60.5'	15.2'	40 passengers	VARIABLE	37 mph
* KOMETA Hydrofoil (Requires 8 ft water depth min.)	112'	31'	105 passengers	230 mi.	38mph
* METEOR Hydrofoil (Requires 8 ft water depth min.)	112'	31'	120 passengers	373 mi.	39 mph
* RAKETA Hydrofoil (Requires 6 ft water depth min.)	88.5'	16.4'	64-100 passengers	VARIABLE	35 mph

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* The hydrofoils are common on all rivers permitting their navigation constraints of 2.9' to 8' water depth. Over 300 RAKETAs were in service in 1985 with large numbers of the other hydrofoils (Exact population of these rivercraft is not available from readily accessible sources.) Most of the data used in summarizing the table of Special Siberian Rivercraft was analyzed and derived from information presented in Jane's Surface Skimmers-1985. (33)

Bridging the gap between surface rivercraft and aircraft are a fleet of hybrid Wing in Ground Effect (WIG) or Bartini "T WING" machines. Experiments with these craft have been conducted on Siberian rivers by the Ministry of the River Fleet since 1972. The basic design carries 80 passengers, a payload of 20 tonnes, and has approximate dimensions 100 ft long with a 50' wingspan. Six gas turbines propel the craft within several meters of the river's surface at speeds between 150 - 350 miles per hour. This type of craft has twin hulls integrated into cargo carrying wings, and uses a ground effect air cushion which builds up between the craft and the river's surface to achieve lift to weight ratios as great as 500. Figure (9) is taken from Jane's Surface Skimmers - 1985, and shows an artist's conception of this hybrid rivercraft. Several opertional prototypes are undergoing evaluation on Soviet Rivers.(34) A military version of this conceptual type of craft has been developed for the Soviet Navy and was reported to carry 400 passengers or several armored vehicles. Its length was 200 ft and wingspan 100 ft. Its maximum altitude was reported to be approximately 100 feet and, with its twin gas turbines and tail propeller, was believed to be able to achieve speeds in excess of 300 kt. Scheduled for full production in 1987, this craft is to be fitted with two or more Soviet SSN22 antiship cruise missiles similar to the Exocet missiles used by the Argentines during the Faulklands War. (35) (See figure 12)

For those areas inaccessible to developed river and rail transport systems and, as a vital element of communications, people-moving, and supply-moving, air lift is a familiar and essential means of transportation in Siberia. Frequently, airstrips are constructed well before riverports, roads, or rails can functionally serve remote areas. Numerous cities across Siberia and the Soviet Far East must totally rely upon air transport as their vital link to the river systems, the railheads and the port facilities.

The Soviet logistics aircraft fleet is made up of over 8000 small fixed wing and rotary aircraft as well as numerous military helicopters and transports. Dual military defense and economic development objectives have created the domestic logistics organization of Aeroflot which has more than 30,000 pilots qualified and ready to fly commercial or military missions (36) The work horses of this fleet throughout the Siberian Arctic are the approximately 320 (1983 est) AN-12 CUB aircraft. These extremely versatile aircraft have performance capabilities similar to the U.S. C-130 aircraft. They use 4 turboprops to carry max cargo loads of 44,000 lbs at 320 knots for a 2000 nautical mile range. They typically require 2500 ft of runway or frozen river or lake bed to take off but they only need approximately 1600 ft to land. They are configured to carry 90 passengers or up to 60 paratroops. (37) Other fixed wing assets in the Soviet Air Logistics Fleet serve dual defense and economic roles in Siberia. Capabilities of two of the more common aircraft follow:

The IL-76 / CANDID has lift capabilities similar to one U.S. C-141- B or two U.S. C-130 aircraft. Using four jet engines it cruises at 430 knots, carrying a payload of 88,000 lbs for a maximum range of 2700 nmi. It requires up to 3300 ft for unassisted takeoff and approximately 1600 feet to land. It can be configured to carry either 140 passengers or 140 paratroops.

The AN-22 / COCK has lift capabilities similar to two U.S. C-141-B aircraft. Using four turbo-props it cruises at 350 knots, carrying a payload of 176,200 lbs for a maximum range of 2200 nmi.. This aircraft requires up to 4260 ft for unassisted takeoff and 2620 feet for landing. It can be configured for 175 passengers.*

Cargo carrying helicopters also are extensively used to provide both civil and military airlift and towing services. Three of the more common helos are drawn from the approximately 700 Hoplite, 1405 Hip, and 445 Halo rotary aircraft reported to be in the Soviet air inventory in 1983.

Characteristics of these helicopters are presented in the following Table:

TABLE 4

Helicopters of the Soviet Air Logistics Fleet (38)

Designation/Name	No. of Turboshafts	Cruise Speed	Payload	Range	Passengers
MI-2 / HOPLITE	2	120 Knots	1800 lb	300nmi	8 pass
MI-8 / HIP	2	120 Knots	9000 lb	270nmi	28 pass.
MI-26 / HALO	2	140 Knots	44000 lb	430nmi	20 pass.

*The latest strategic logistics aircraft to enter the Soviet's inventory has the NATO designation "CONDOR". It's addition will significantly increase their airfleet's total lift capacity. (SOURCE: Jane's All the World's Aircraft Supplement, Air Force Magazine, Feb. 1986, pp 82-85)

As one surveys the components of the Soviet transportation system, one is struck by their long term commitment to ensure that all the pieces fit and function together into a national transport service.* Integral to this system are the ports of the Pacific Coast. Primary Soviet port facilities in Siberia and the Soviet Far East are Vladivostok, Nahodka, Sovetskaya Gavan, Korsakov, Magadan, and Petropavlovsk (primarily naval). Important containerized cargo rail transfer points are located in Vladivostok, Nahodka, Sovetskaya Gavan and Korsakov. Nahodka is one of the best developed, ** and it serves as an eastern terminal of the Trans-Siberian railway landbridge link with Japan (see figure 13). In 1980, more than 38,500 containers moved through this port. Services are provided in a joint Soviet-Japanese venture offering twice weekly transfer services to and from Japan. (Soviet Far Eastern Shipping Company and the Yamashita Shinnihon Lines)

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* The Institute for Complex Transport Problems is drawing up scientifically corroborated recommendations for the development of individual branches of transport services as component parts of an integrated national transport system.[39] The State Research and Project Development Institute of Merchant Marine (Soyuzmorniiproekt) was established in 1939 and has played a significant part in the development of economic and productive activities of the Soviet merchant marine. "Research and projects performed by the Institute have paved the way for accelerated growth in Arctic shipping, for the introduction of specialized berthing structures to be operated in harsh climactic conditions and new, highly efficient technologies of cargo discharge onto non-equipped shores, on the shore ice belt included. Much has been done to implement year-round navigation in the Western Arctic sector."[40]

**This port has navigation year around, but during ice formation assistance of ice breaker tugs is advisable. The port was constructed after 1945 and consists of a long L-shaped quay with 17 berths including 5 for timber and oil. Maximum depth alongside is about 37 feet. Electrical portal cranes are available for up to 41 tons lifting capacity. Facilities also include a containerized lift-on terminal with a length of about 150 meters equipped with two 30.5 ton Mitsubishi container gantry cranes, sized to handle international 40 ft. containers. Three LancerBoss sideloaders (one 54 ton and two 38.7 ton) are used to rapidly move containerized cargo from one transport mode to another. Two 30.5 tonne rail mounted container transfer cranes are located over rail sidings and two coal handling quays have been integrated with the container handling facility (SOURCE: JANE's FREIGHT CONTAINERS 1985)

V/O Sojuztransit (SOTRA) was set up in February 1980 as the sole operator of cargo transits via the USSR both for conventional cargo and containers. Several services are available. Those that relate to Siberia and the Soviet Far East are TRANSRAIL, TRANSEA, TRACONS and TRANSAIR. TRANSRAIL provides for the carriage of container transit cargos from Japanese ports, Hong Kong, and Australia via the port of Nakhodka and then by rail to border Soviet stations. Rail transit time between Nahodka and Soviet/Europe border stations takes approximately 15 days. With border station and intermodal transfer delays the total transit time for TRANSRAIL service (Japan to European border) is 25-30 days. This compares very competitively to TRANSEA which arranges the dispatch of containers from Japanese ports, Hong Kong, and Australia to European ports via the Soviet Baltic and the inland Volga-Baltic Canal transportation system. Transit time is 35-40 days. TRACONS provides for the carriage of transit cargoes from Japanese ports, Hong Kong and Australia to the container terminal at Vysoko-Litovsk and then to the receiver's warehouse at final European destinations. Transit time is 40-45 days. TRANSAIR provides air freight shipment of containers from Vladivostock to Luxembourg. The 20 ft and 40 ft steel dry cargo unit containers with heights of 8 and 8.5 feet are accepted with a maximum gross weight of 20 and 30 tonnes respectively. Magadan is a transfer point for break bulk and truck transportable cargo with destinations to military facilities in the Soviet Far East and road transport to Yakutsk on the Lena River.[41]

Other important Siberian ports form vital logistics transfer points in the Soviet Transportation System among riverways, air trans-shipment points and the Northern Sea Route.* These are Ust Kamchatsk, Korf, Anadyr, Provideniya, Lavrentiya, along the Bearing Sea Coast; Pevek near the important mining regions in the Chukotskoye Nagor'ye mountains, Cherskiy and Ambarchik at the mouth of the Kolyma River Basin; Tiksi at the mouth of the Lena River Basin; Nordvik, Kosistyy, and Khatanga along the Kheta River Basin; Dickson at the mouth of the Yenisey River Basin; and Salekhard at the mouth of the Ob River (and railhead and air transhipment point for the Western Siberian oil and gas fields) (Source: NATIONAL GEOGRAPHIC MAP, FEB 1976)

* The Northern Seas Route is of both military and economic importance. Ordinary merchantmen on this route are structurally reinforced in the hull. In the summer of 1967 the route from Hamburg to Japan via the Northern Sea Route took 28 days.[42]

During the period 1976 to 1984 the Soviet merchant marine fleet experienced unprecedented peace time growth. Soviet merchant fleet dead weight tonnage increased from 14.6 million tonnes in 1976 to 20.5 million tonnes in 1984. Closer inspection of the figures revealed a shift in the character of the Soviet fleet with general cargo vessels and passenger vessels actually being significantly reduced in capacity and number of vessels. The most significant increases were ice strengthened Container Vessels (500% capacity increase), ice strengthened Roll On Roll Off Vessels (900% Capacity Increase), ice strengthened Barge Carriers (LASH vessels were not in the Soviet Fleet in 1976 but by 1984 this category of vessel had expanded to 110,000 dead weight tonnes capacity), and a 70% increase in ice strengthened timber carrier capacity.*

To provide integrated container and roll on-roll off shipping across the Northern Sea Route,** fourteen icebreaking (Norilsk SR-15 Class) container ships were built and now can operate independently in ice up to 1 meter thick. In 1970 the convoy season along the Northern Sea Route lasted only about three months and icebreaker escorted ships averaged 3-4 knots transit speed. Additions to the Soviet icebreaker fleet and the construction of ice strengthened cargo ships has extended the shipping season to virtually all year from all points west up to the mouth of the Yenisey River, and for over ten months in the remaining areas. Additional plans to add two new Artika Class nuclear powered icebreakers were initiated in 1984. These will be added to the existing three large nuclear powered icebreakers in the Soviet fleet. Two new conventionally powered shallow draft icebreakers were also purchased from Finland in 1984 to improve the ice operations of tug and barge trains inland from the coast on the Yensey River, and the Soviets initiated the construction of two new nuclear powered shallow draft icebreakers in 1985 to extend the navigation season in the northern reaches of the Ob and Lena Rivers inclusive of the regions along the continental shelf of the Laptev, East Siberian and Chukchi Seas. (43)

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* These conclusions were developed from the author's analysis of Soviet Merchant Marine Statistics. (44) and (45)

** The Northern Sea Route can be defined as the system of marine routes from the Barents and Kara Seas to the Bering Strait in the East. Major icebreaking operations occur in the Kara Sea where ice-strengthened freighters make port calls along the Yamal Peninsula, and in the Ob and Yenisey estuaries. During the past seven years (since 1978) year around traffic to the city of Dudinka on the Yenisey River has been accomplished except for periods of breakup when river ice is flushed out during the late spring.(46)

Construction of the first of a class of nuclear powered icebreaking barge carriers (LASH) was started in 1986; these vessels similar to a fleet of recently acquired conventionally powered ice-strengthened LASH and RO/RO vessels, will have the ability to independently operate in 3 ft thick ice, unload themselves onto the water or ice in undeveloped Siberian Arctic ports, and link up with air cushion lighter or conventional tug-barge/lighter transportation service at the mouths of the Siberian river systems.

Strategically, the Soviet Union is developing the economic momentum, transportation mobility, and physical vessel inventory to establish unparalled sea control in the Arctic Ocean.* In 1977 the 14 day round trip voyage of the nuclear icebreaker Arktika, from Murmansk to the North Pole and back, averaging 11.5 knots, was just a brief glimpse of things to come. In 1978 the nuclear icebreaker Sibir conducted the SA-15 class freighter Kapitan Myshevskiy across an Arctic Basin route north of Seyernaya Zemlya and Novosibirskiye Ostrova, penetrating above 80 degrees North Latitude two months before the opening of the normal icebreaking season. The two vessels continued across the entire Northern Sea Route, capably demonstrating the feasibility of Soviet escorted convoy operations both in multi-year polar pack ice as well as the marginal ice zone areas, regardless of season. The Soviets have a logistics supply fleet of over 584 significant, ice strengthened vessels (over 10,000 horsepower each, comprising over 15.5 million deadweight tons)(48) and should be able to extend the duration of the navigation season to all year across the Northern Sea Route and in all of the great Siberian river basins by 1990. A nuclear ship convoy of the 1990s should be able to transit the Northern Sea Route at an average speed of 9-12 knots.(49)

Before the year 2000, I project that Soviet military application of nuclear powered icebreakers, nuclear powered icebreaking LASH ships, ice strengthened containerized cargo ships, and ice strengthened ROLL ON ROLL OFF ships will logistically give the Soviets an unprecedented capability to project strategic sea lift across Arctic waters under defensive cover of land based aircraft, vertical take-off carrier aircraft or ice island based aircraft.

Recently in the U.S. Naval Institute Proceedings, Cdr. Brigham added that,

> "This nuclear capability will place the Soviet Union in a dominant position in surface navigation throughout the Arctic Basin. The nuclear fleet will provide the Soviets with the necessary range and endurance for routine, unrestricted Arctic operations."(50)

Provisions for mounting military weapons on Soviet nuclear icebreakers are reported in Jane's Fighting Ships 1986-1987. (51)

A summary of major icebreakers in the Soviet fleet follows:

TABLE 5

TABLE OF MAJOR* SOVIET ICEBREAKING SHIPS**

CLASS	No	YR OP	SHP	Length	Beam	Draft	Disp	IB Capab.
LENIN	1	1959	44000	439'	91'	32'	19200 Tonne	7 ft
ARKTIKA	4	'75-'90	75000	446'	92'	36'	23500 "	8 ft
TAMYR	2	'90-'91	52000	490'	88'	26'	22000 "	6 ft
SEYMORPUT***	1 (?)	'88	40000	850'	105'	35'	61000 "	3 ft

Note: All of the above ships are nuclear powered, those below are conventional.

YERMAK	3	'74-'76	36000	400'	80'	34'	20000 "	5 ft
MOSKVA	5	'59-'69	22000	370'	76'	32'	15400 "	3 ft
KAPITAN	4	'77-'81	22000	400'	82'	27'	14900 "	3 ft

* Defined as those icebreakers with over 20,000 SHP installed.

** Hundreds of merchant, fishing and research vessels of the Soviet Arctic fleet are shown in Lloyd's Register as ice strengthened or ice capable. The Soviets have approximately 50 smaller icebreakers for use in sub-polar coastal areas and rivers and over 584 significant ice strengthened cargo ships and tankers.

*** The SEVMORPUT, launched in early 1986, is the first of a class of nuclear powered LASH barge carrier icebreakers, which is being added to a rapidly growing, conventionally powered fleet of heavily ice strengthened RO-RO, RO-LO, and barge carrying ships, specially configured to convert the Soviet Arctic coast into a functional maritime coast, and to link intermodularly into the northern Siberian River portions of the Soviet transportation system. It is designed to carry 74 conventional or air cushioned lighters, or more than 1300 standard containers.[52] The ship is self unloading and is uniquely suited for the marginally developed Siberian Arctic river ports facilities. The ultimate number of vessels to be built in this class is not readily accessible but Soviet sources confirm that is is just "the lead in a series of atomic cargo vessels." Follow on vessels are reported to be rated at about 39% greater SHP than Sevmorput.[53]

III. CONCLUSIONS:

The SOVIET UNION has systematically developed a national transportation system throughout Siberia and the Soviet Far East which promises to overcome historical geographic obstacles to communications, development and defense. With the ultimate success of this endeavor, the world may come to the startling realization that the Soviet Union has the very definite nation-state character of a maritime power. As a maritime power, their ability to exploit and control the sea and project power across the sea will take on global strategic implications, particularly by virtue of their extensive development of mobility in the Arctic Ocean Basin. I contend that because of the relationship in the Soviet system between economic development and defense, the systematic achievement of Soviet transportation technology to develop Siberian natural resources has concurrent defense ramifications. The Soviet's strategic economic perspective is drawn steadily northward with the requirements for becoming mobile, in the air, on the surface and beneath the surface. Because joint military compatibility is required of all Soviet transportation systems, economic momentum is concurrently aiding the development of Soviet military capability to project and sustain power anywhere within the Arctic basin. Unfortunately, transportation barriers in northern Alaska and Canada are very similar to Siberia. Transformation of Siberia and the Soviet Arctic coastline into a functional maritime coastline by the use of Soviet transportation technology makes the North American Arctic "Shield" also vulnerable to military penetration. The Soviet Union is developing a transportation system in Siberia and the Arctic based upon strategic economic and defense rationale. The U.S. and Canada, because economics and environmental politics ultimately determine the nature and pace of their Arctic development, apparently have higher priorities elsewhere. The ramifications of this strategic imbalance of priorities may ultimately prove to be significant to U.S. and Canadian national security. Time will tell.

IV. RECOMMENDATIONS:

My recommendations to U.S. and Canadian readers follow:

1. The Soviet Union's emerging role as a robust, global maritime power must be reckoned with. Competition with non-profit Soviet fleets in free world markets will require us to pursue both aggressive and protective national maritime strategies and increased use of bilateral trade agreements with enhanced opportunities for use of U.S. flagged ships in the trade. Because of the dual suitability of Soviet ships to serve either economic or military mission requirements, we must be particularly cautious of any Soviet initiatives to initiate trade routes or "Freedom of the Seas" demonstrative passages through the so called "Northwest Passage" of North America. Our defence risks caused by increased use of Warsaw Pact ice-strengthened ships in other Arctic trade routes should be carefully scrutinized. I recommend that a mutually beneficial pact be achieved as soon as possible between Canada and the United States to protect our continent's northern strategic axis of approach. Such an agreement must satisfy the economic, environmental and defence interests of both nations.

2. The increasing practicality, economy and mutual national defense benefits of developing the Northwest Passage for exclusive use of US and Canadian ships should be recognized, jointly developed, promoted and maintained by the United States and Canada. Intermodal cargo transfer concepts such as those used by the Soviets to move air cushioned barges from large nuclear powered LASH vessels up the frozen estuaries of the northern rivers should have direct application to our Arctic maritime areas as well. (Particularly those of the Alaskan North Slope and the Mackenzie River Valley)

3. The U.S. and Canadian federal governments should mutually provide incentives for Arctic Maritime Zone regional economic development such as initial insurance indemnities and low interest capital development loans. Development within the fragile Arctic ecosystem requires joint, long term national regulatory programs which are realistic, consistent and carefully managed.

4. Joint development programs and scientific projects of the Soviets, Japan and Northern Europe should be carefully monitored and perhaps joined for mutual benefits and technology transfer. (I suggest that the US will reap the greatest benefits from such interactions.)

4. Domestic Arctic Ocean trade routes should be opened up with full protection and assistance to users by the Canadian and US Coast Guards. This is necessary not only to ensure that our economic momentum is maintained in the Arctic region, but also to increase political awareness and support for defense of our Arctic coasts. Whether we take the initiative or not, the Soviet Union will have a year-round nuclear powered cargo transport and strategic lift capability by the early 1990s. To counterbalance this strategic presence, substantial U.S. and Canadian government investment will undoubtedly be necessary. Such a long term commitment is justified by both national security arguments as well as future, long term economic development rationale. The US and Canada need to cooperate on sovereignty issues and make a mutual commitment for developing maritime forces to enforce our northern maritime frontiers. To fail in such a commitment means to cede the strategic momentum of Arctic Sea Control to the Soviet Union and this ultimately may prove to be disasterous to our vital interests.

LIST OF FIGURES

LIST OF FIGURES. (cont.)

OUTLINE OF CONTIGUOUS UNITED STATES SUPERIMPOSED ON SIBE

SIBERIA

FIGURE 1

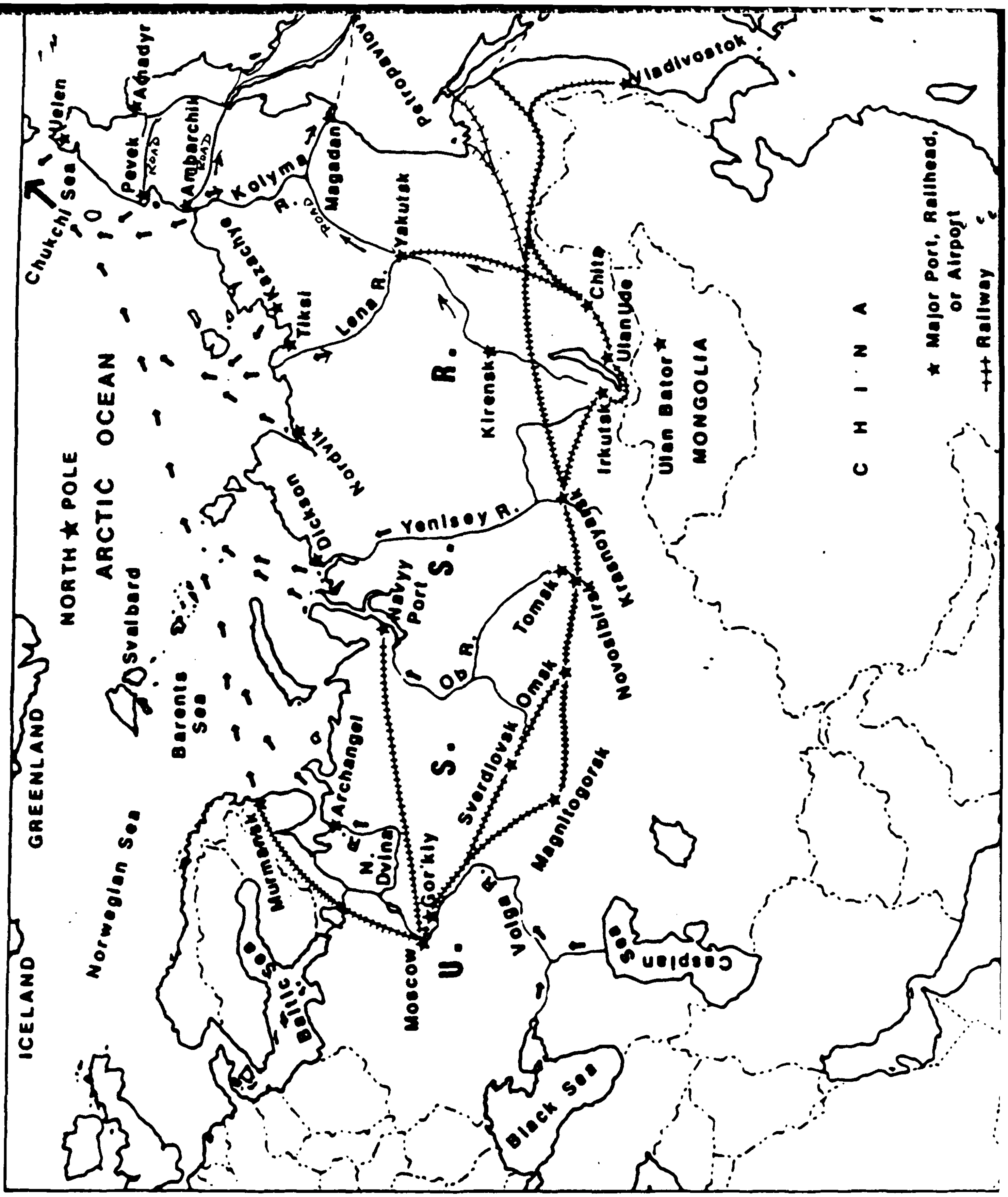
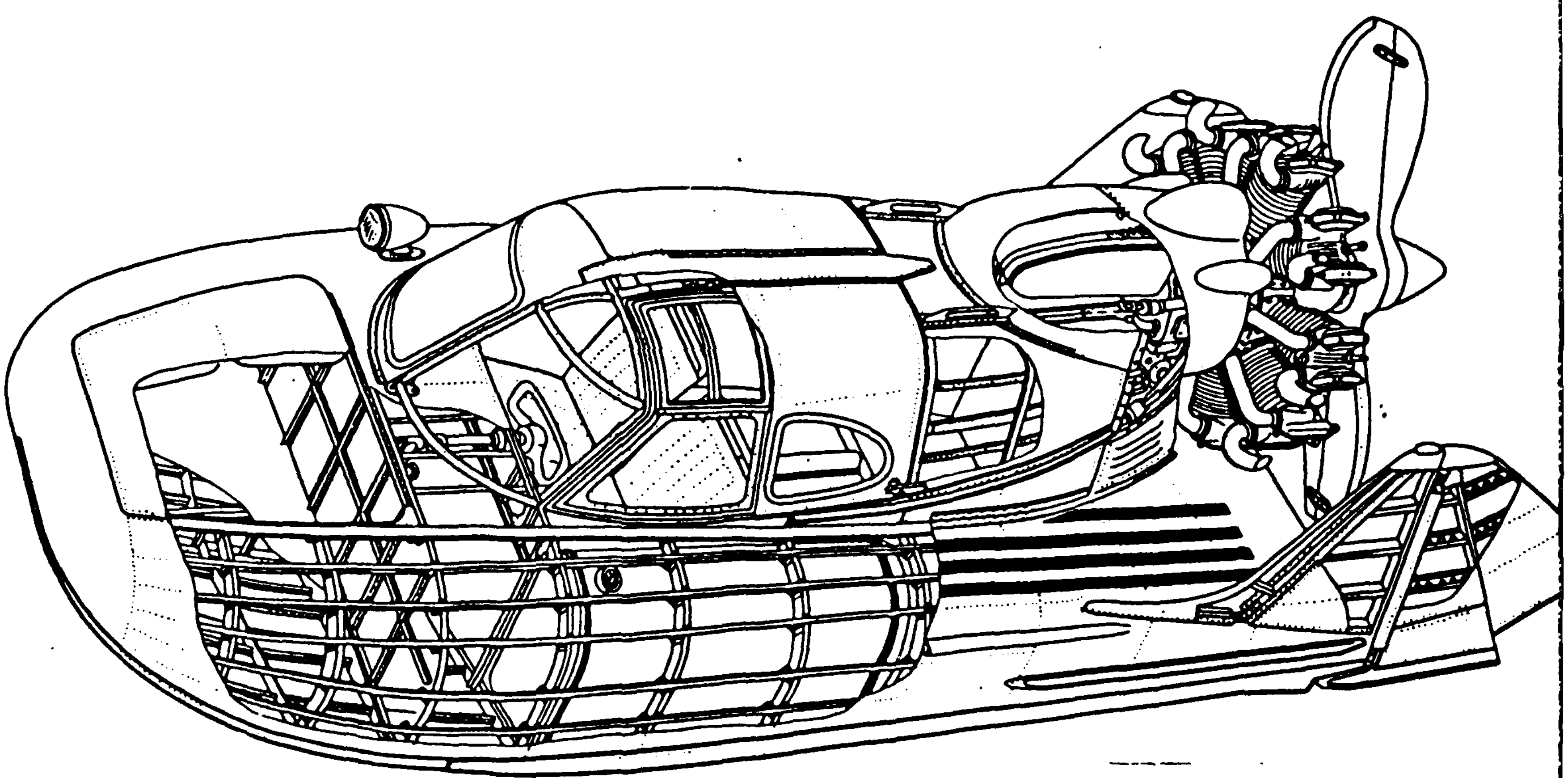


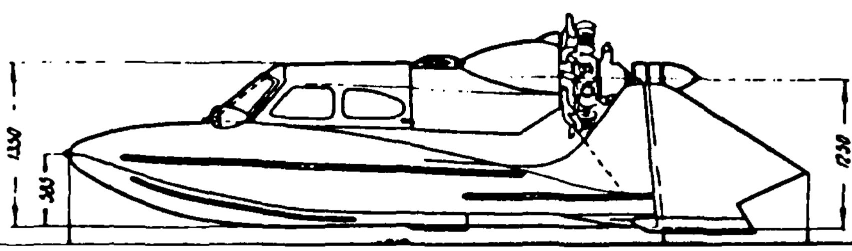
FIGURE 2
U.S.S.R. ARCTIC LAND AND SEA/RIVER TRANSPORTATION SYSTEMS

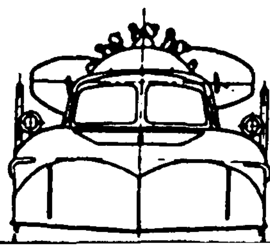
TYPICAL PASSENGER AIR CUSHION VEHICLE

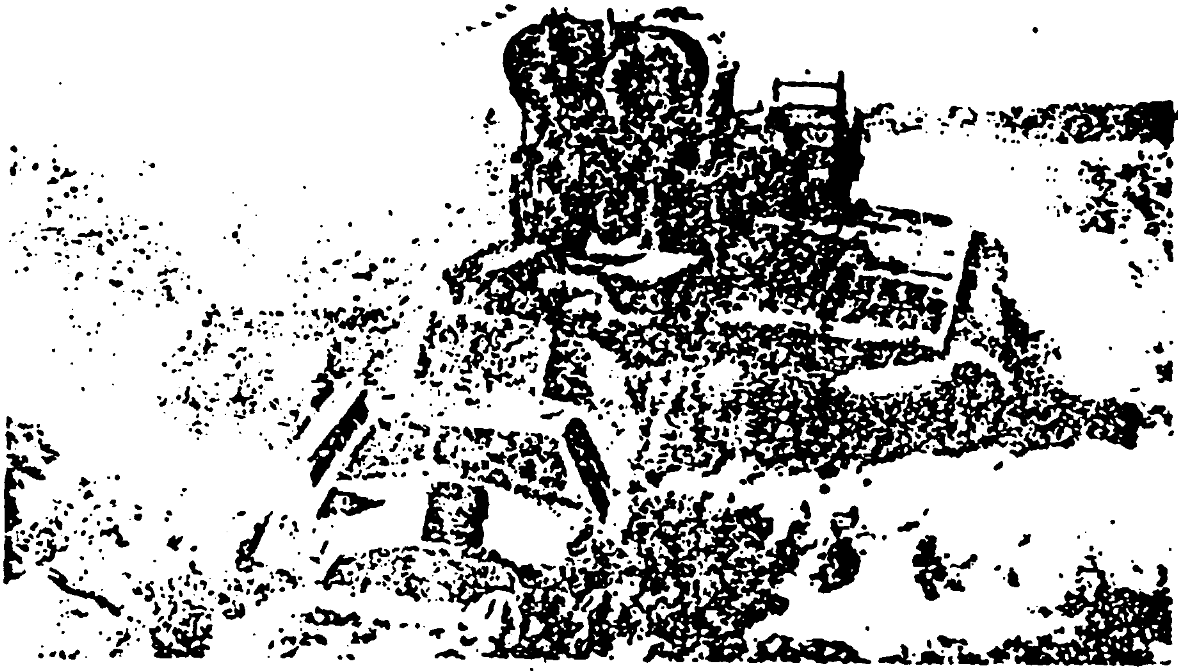
FIGURE 3



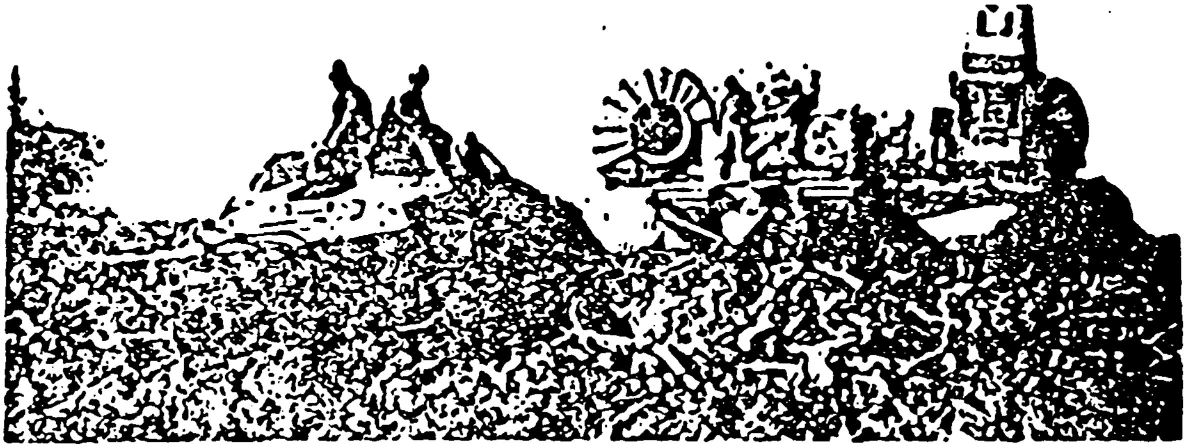
Cutaway showing basic structural components of Tupolev A-3







PVP-40 under tow across Siberian swamp



PVP-60 under tow

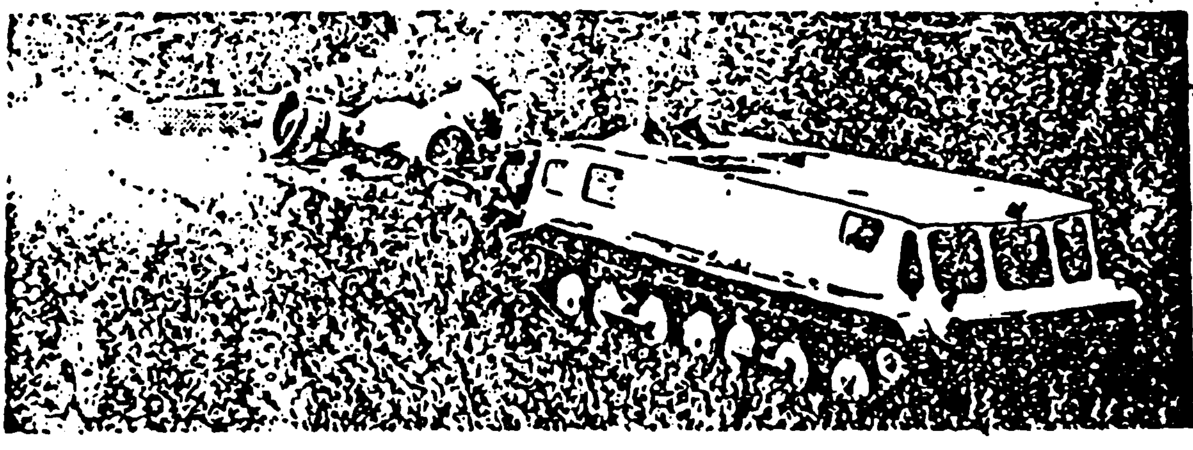
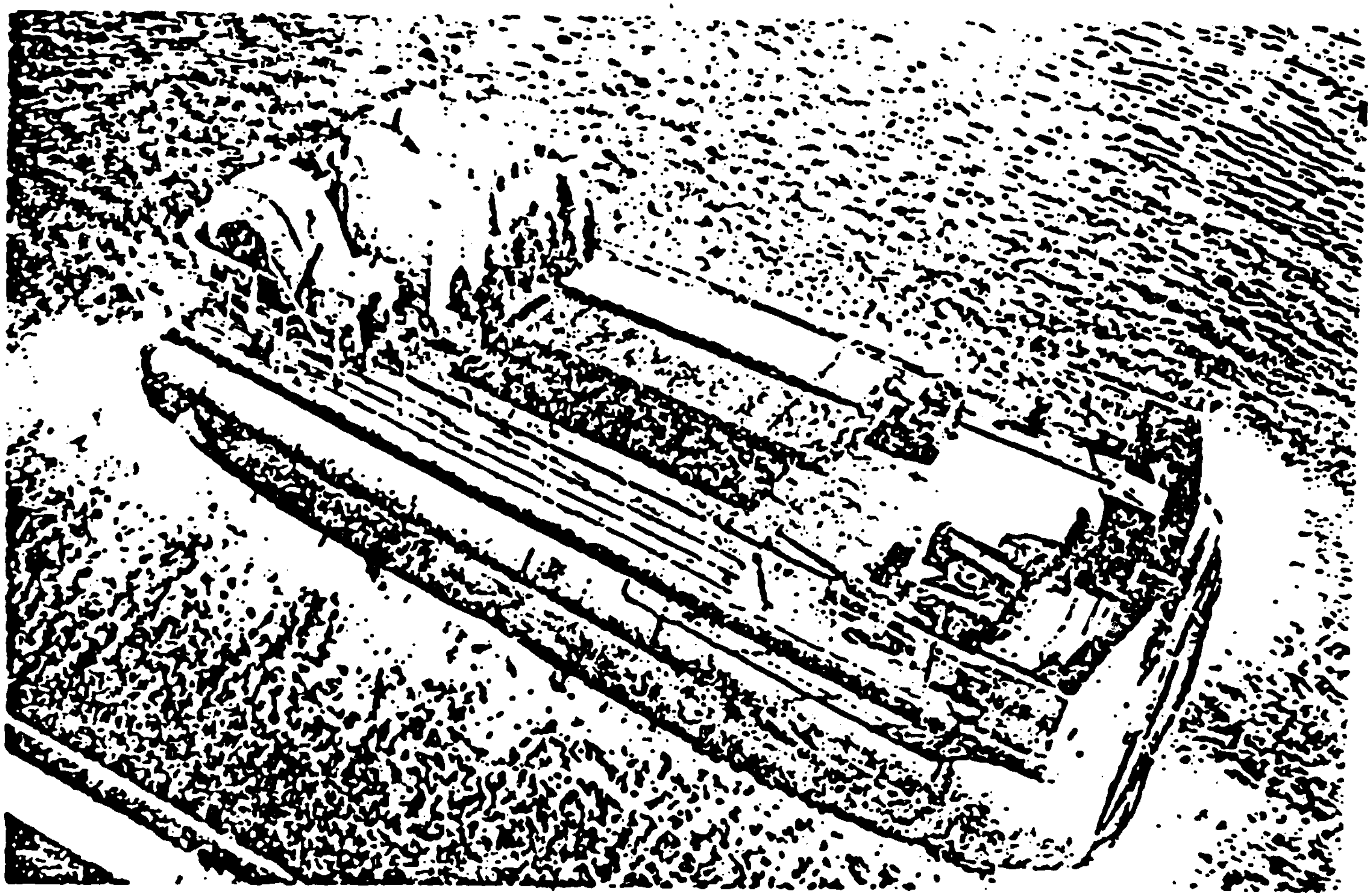


FIGURE 5 U.S.S.R. HEAVY LIFT SYSTEMS

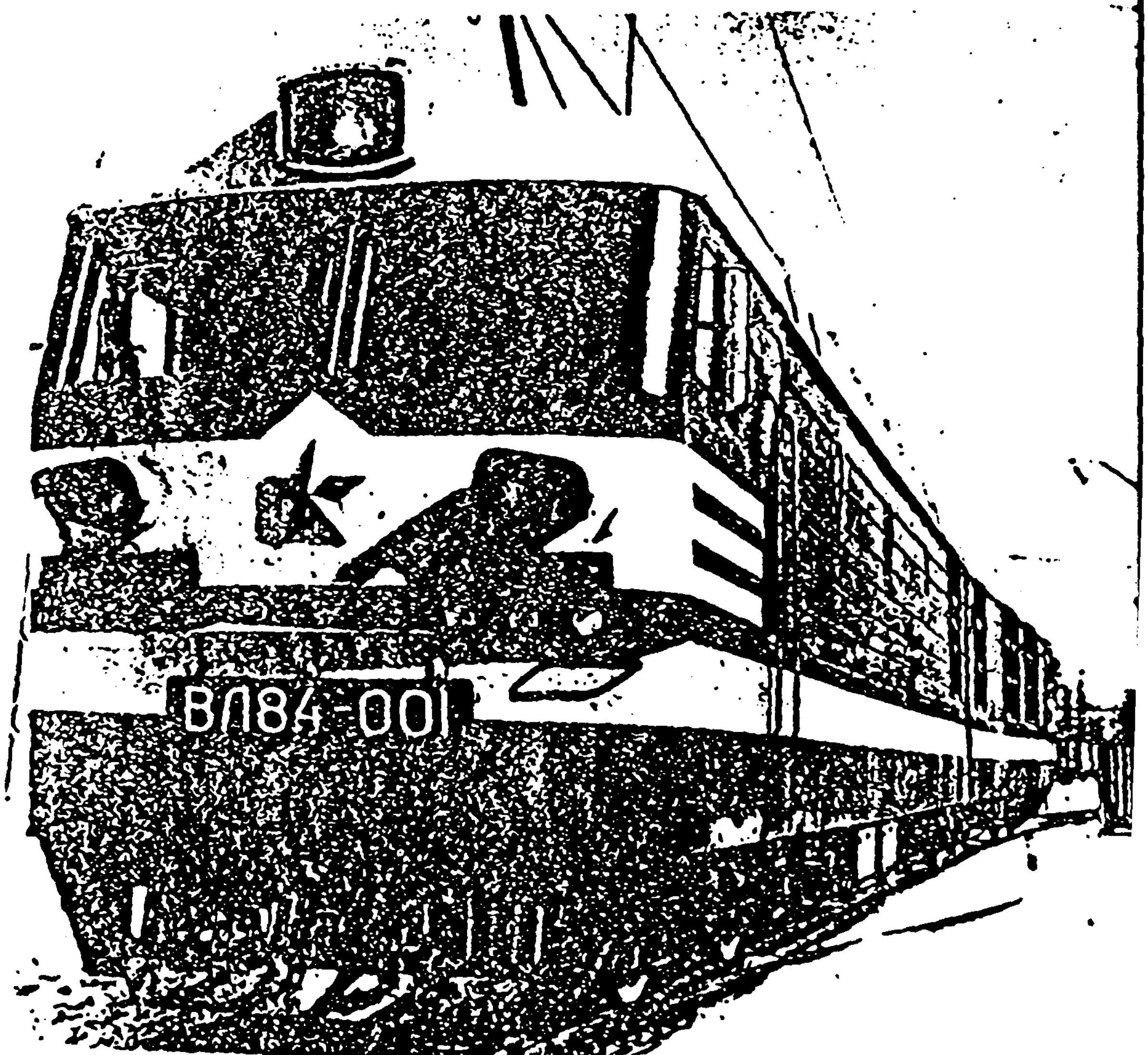


MPVP-40

FIGURE 6

ELECTRIC LOCOMOTIVE USED ON THE TRANS-SIBERIAN RAILROAD

USSR / RAILWAY SYSTEMS

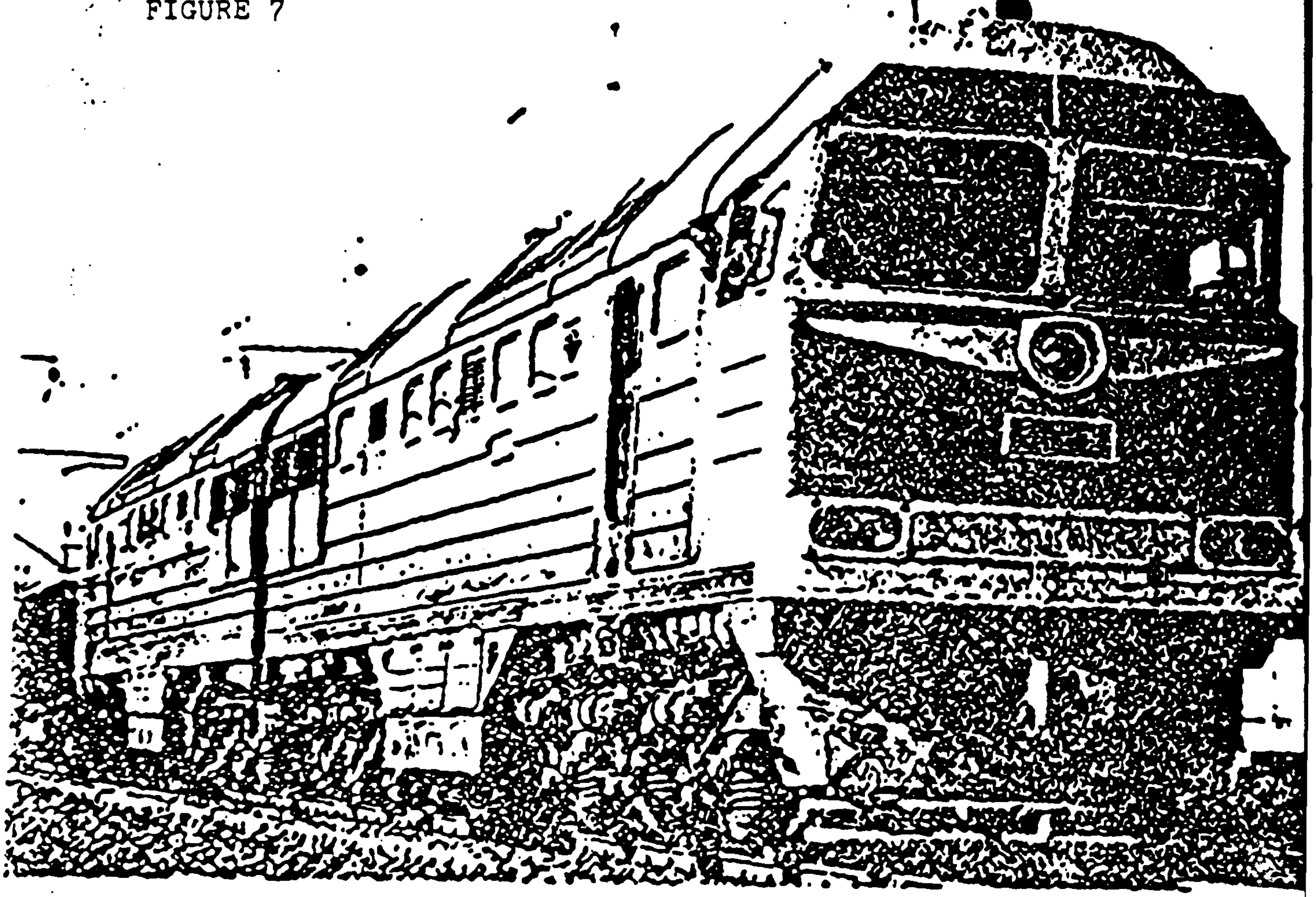


Electric locomotive

Source: Janes: World Railways - 198

FIGURE 7

DIESEL LOCOMOTIVE USED ON THE TRANS-SIBERIAN RAILROAD

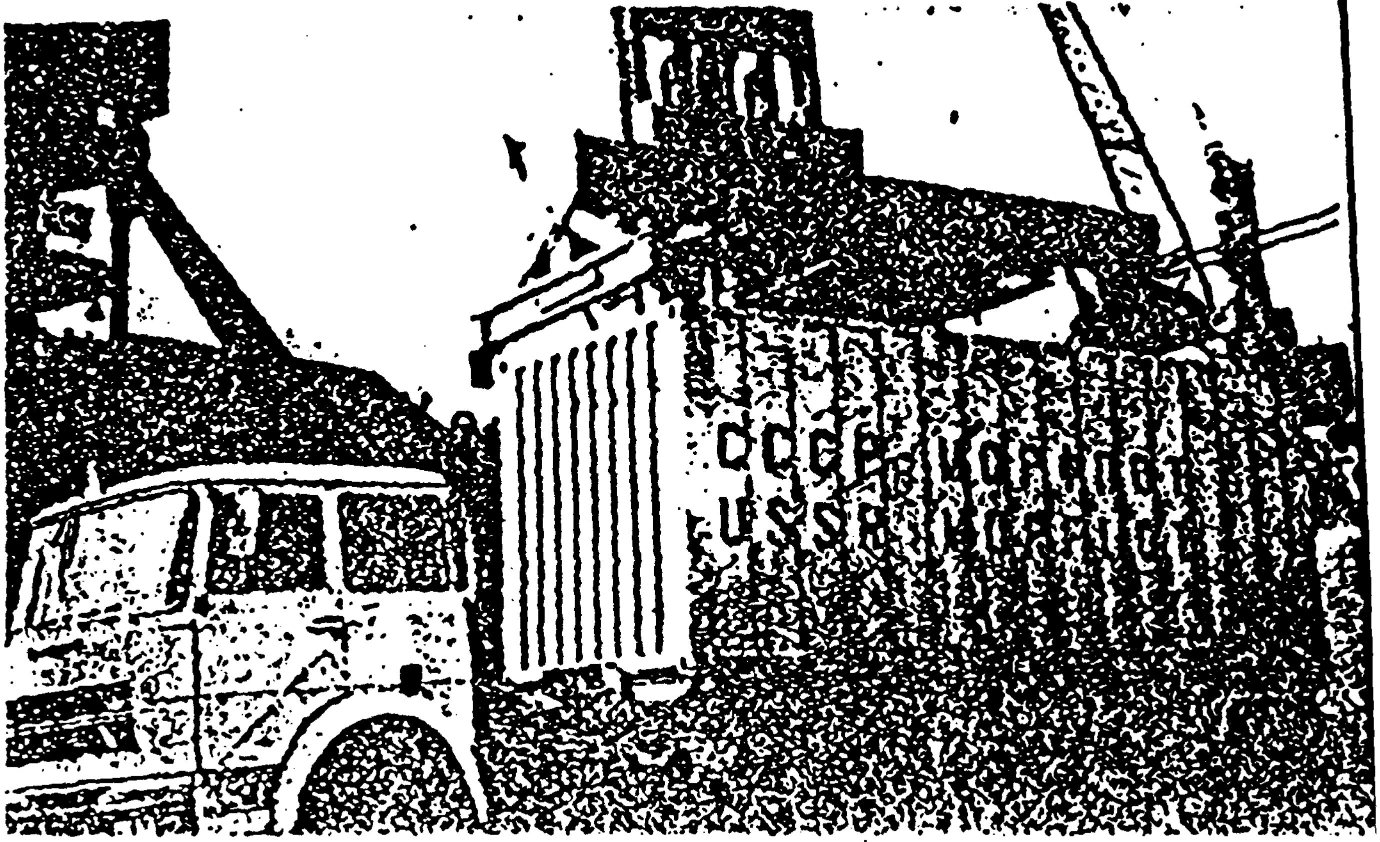


TE116 6000 hp main-line diesel locomotive

Source: Jane's World Railways 1985-1986

USSR / PORTS

FIGURE 8

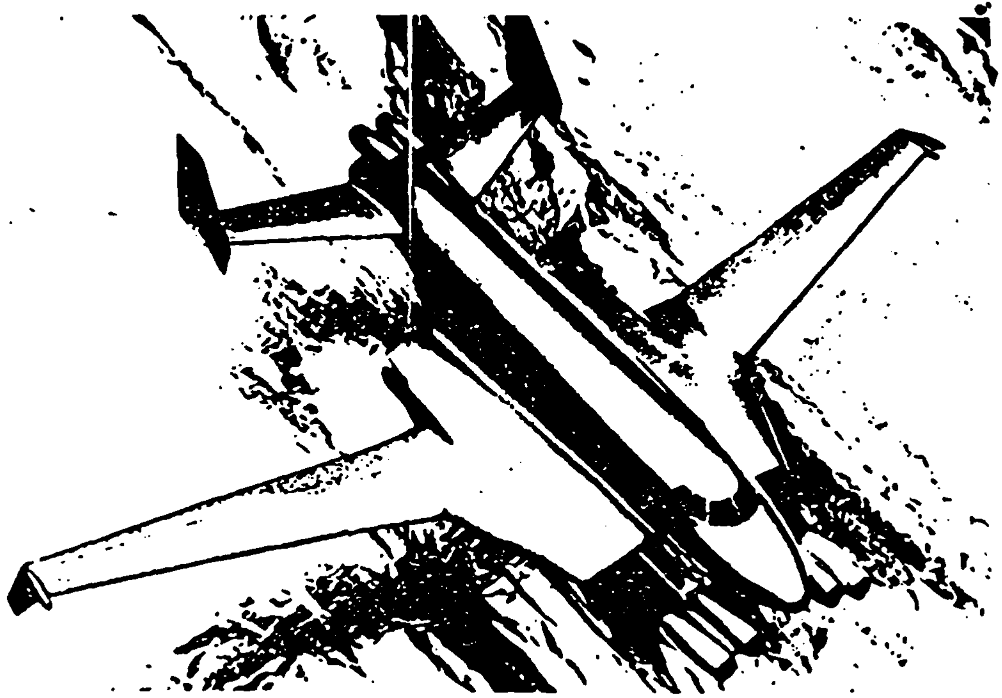


Source: Jane's Freight Containers 1985

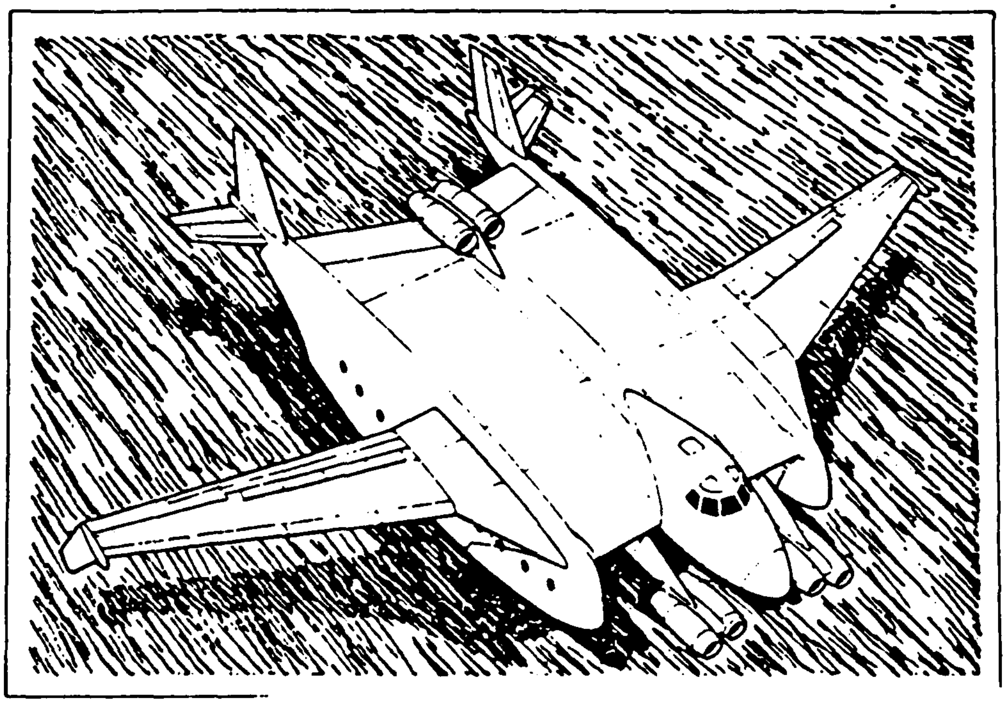
BARTINI T-WING IN GROUND (WIG) EFFECT AIRCRAFT

USSR / AIR CUSHION VEHICLES

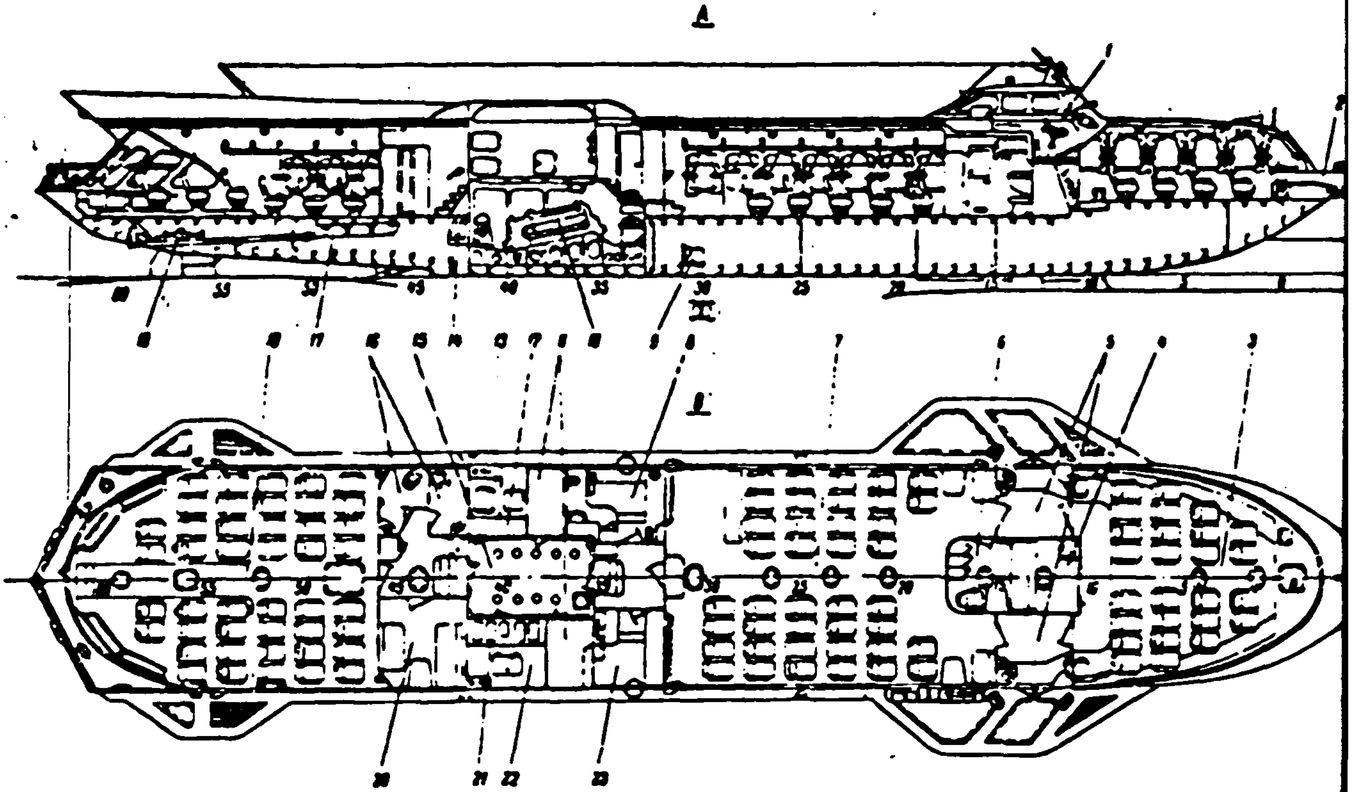
FIGURE 9



Model of Bartini PAR design



HYDROFOILS / USSR



Meteor:
(A) inboard profile (B) main deck plan (I) waterline hullborne (II) hull base line (III) waterline foilborne (IV) longitudinal centreline (1) wheelhouse (2) anchor compartment (3) forward passenger saloon, 26 seats (4) luggage rack (5) embarkation companionway (6) crew duty room (7) midship passenger saloon, 42 seats (8) bar (9) refrigeration unit (10) engine room (11 (12) boatswain's store (13) calorifier (14) fire fighting equipment (15) pro deck (16) wcs (17) tank (18) aft passenger saloon, 44 seats (19) l (20) four-seat passenger cabin (21) storage batteries (22) hydrau (23) main switchboard

DIMENSIONS

Length overall: 34·5m (112ft 2·25in)
Beam overall: 9·5m (31ft 2in)
Height foilborne above water surface: 6·8m (22ft 3·75in)
Draught hullborne: 2·4m (7ft 10·5in)

FIGURE 11

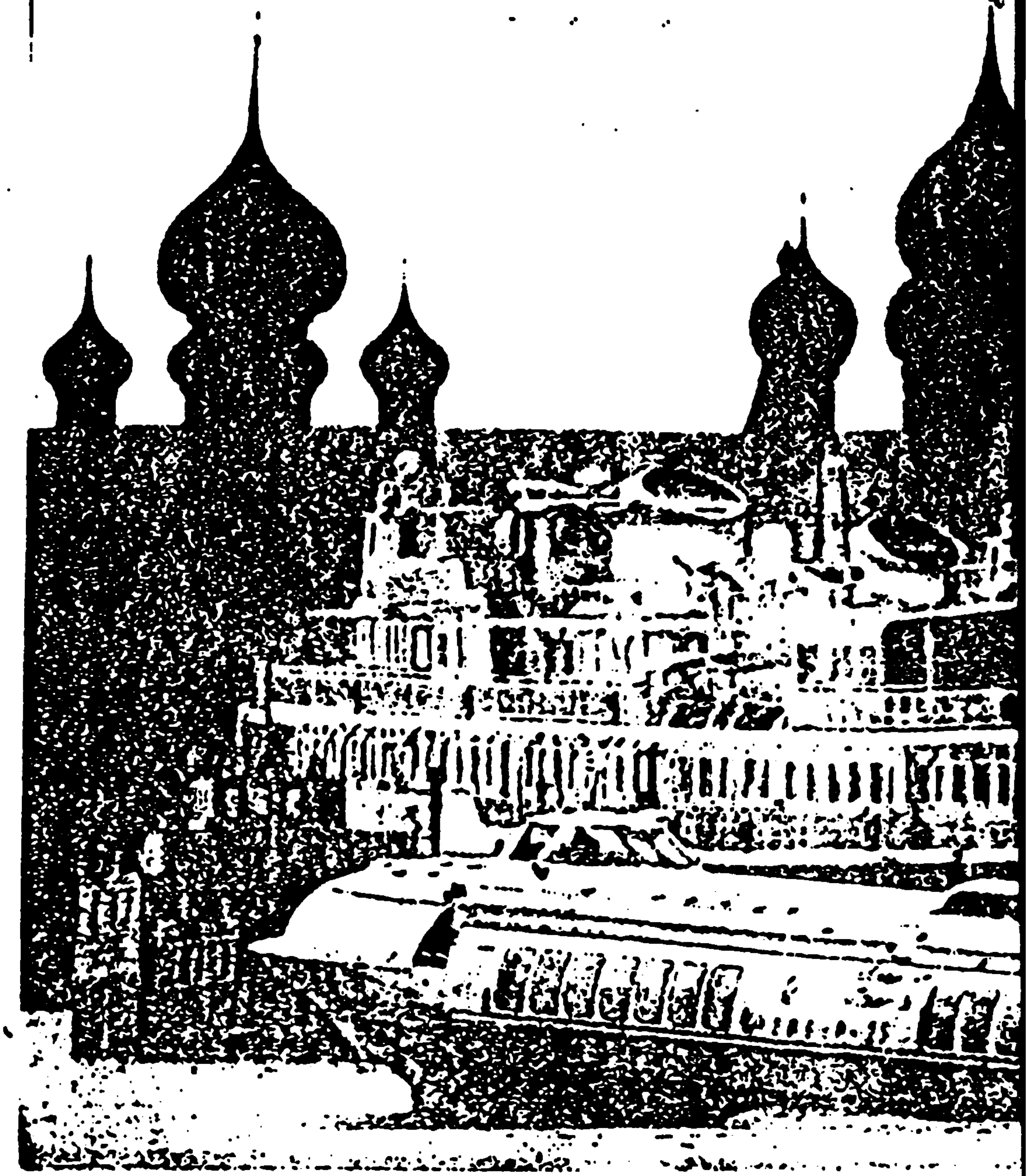
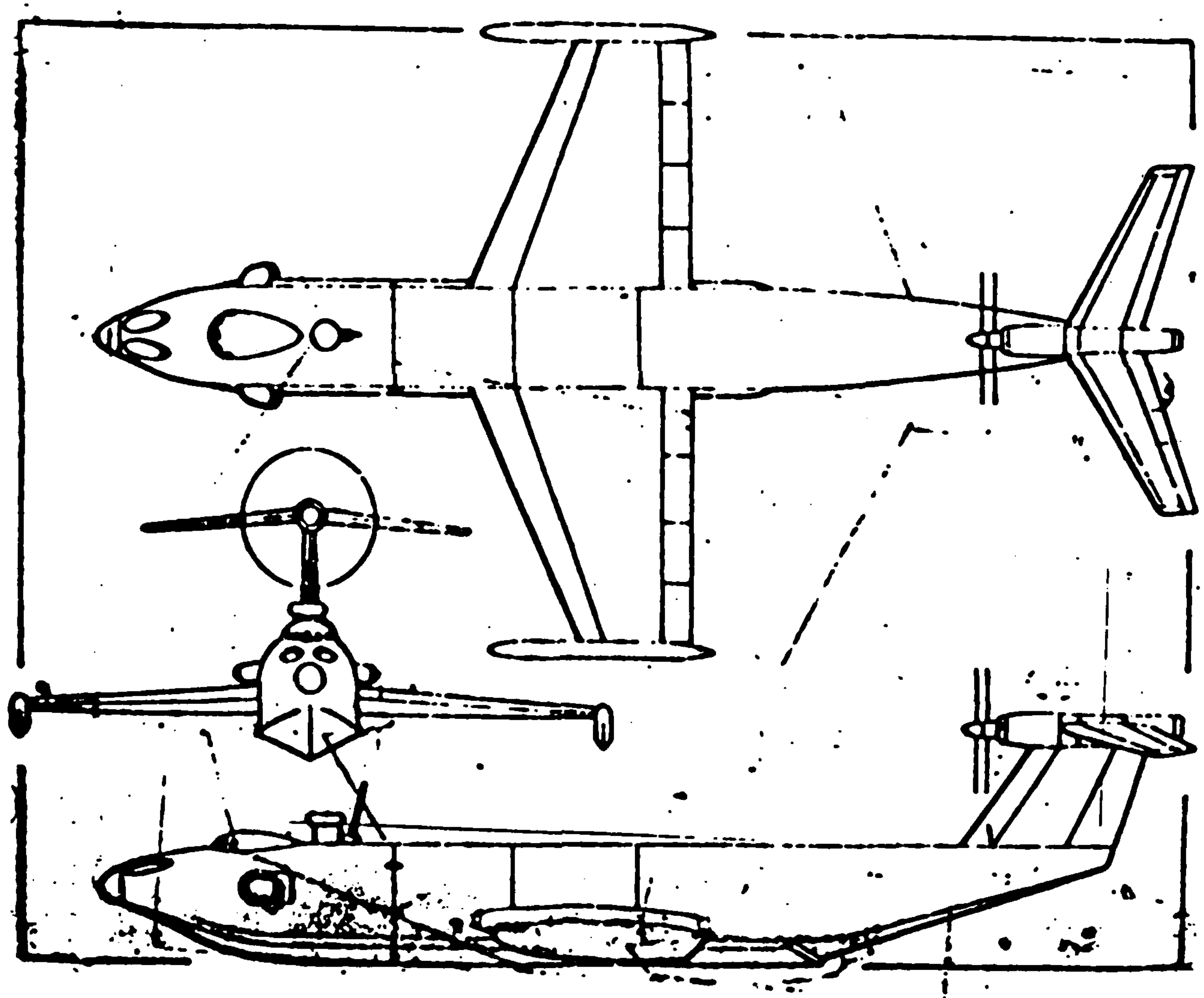


FIGURE 12 CASP-A AND CASP-B MILITARY WIG

Length overall, approx: 68·9m (200ft)
Span: 30·4m (100ft)
Aspect ratio: 3·0



Source: Jane's Freight Containers 1985

THE PORT OF NAHODKA - PORTS/USSR

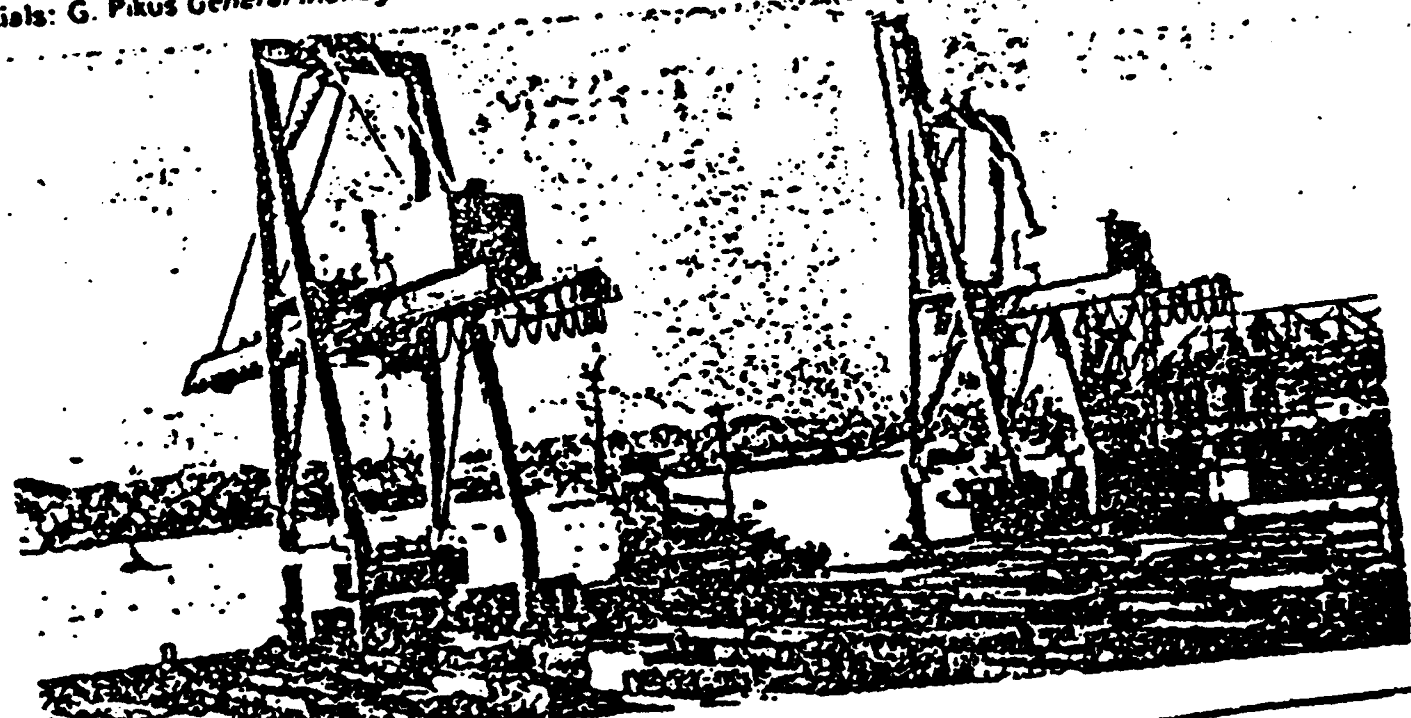
FIGURE 13

NAKHODKA

Nakhodka
Il. Portuvaya 22, Nakhodka 4, Primorsky Krai, USSR
Tel: 6798. Telex: 213112

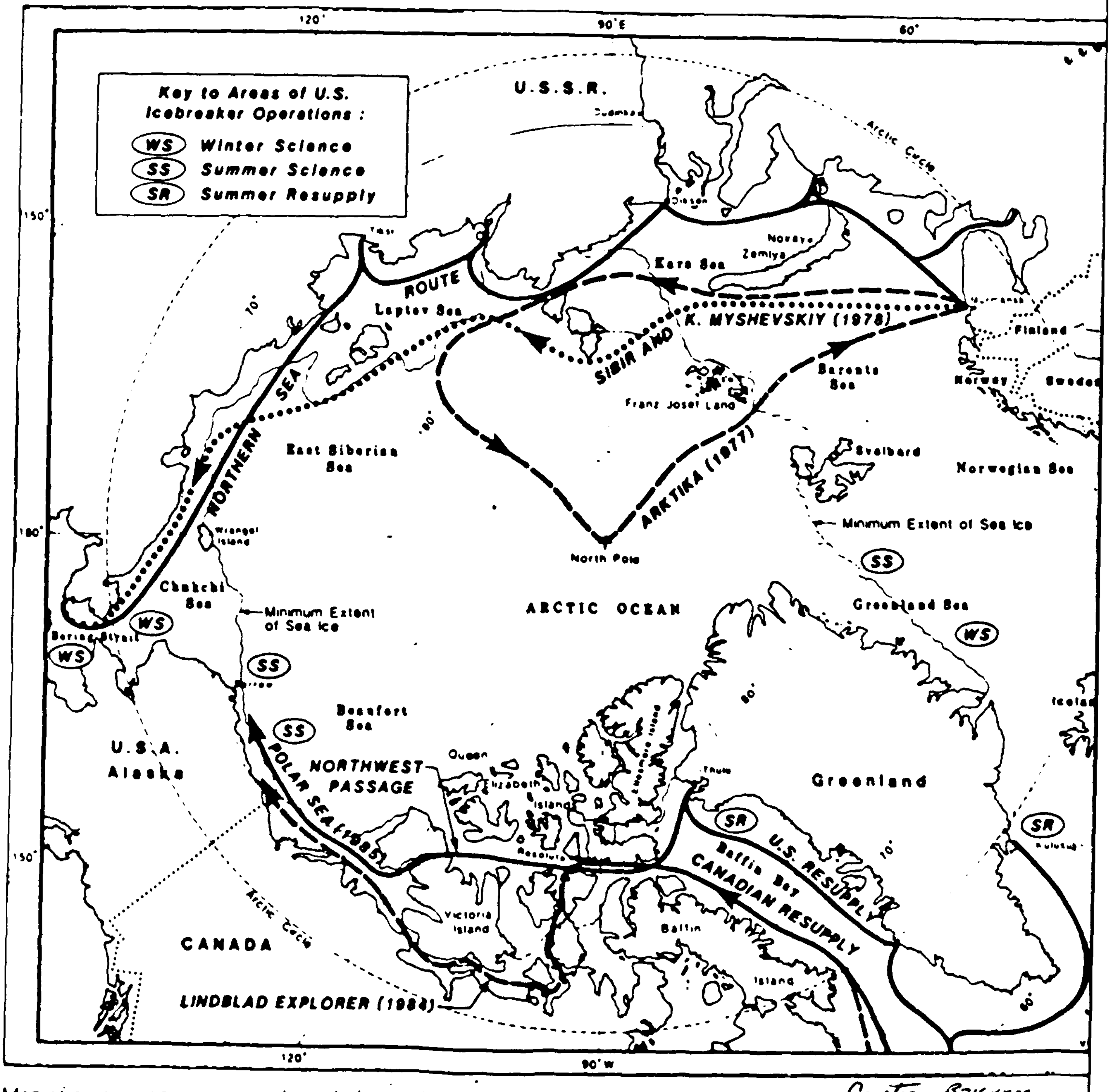
Officials: G. Pikus *General Manager*

The port of Nakhodka is situated between the Astafiev and Shefreis Capes in the north-west Japan Sea. Navigation is year round but during ice formation assistance of ice breaker tugs is required. Nakhodka is the eastern land terminal of the Trans-Siberian railway landbridge link with Japan.



Nakhodka

FIGURE 14 TRAVEL ROUTES OF THE ARCTIC page



Map of pioneering voyages and regularly traveled routes in the Arctic.

Courtesy Brigham

Table 1. Soviet Arctic Marine Transportation System: Accomplishments

FIGURE 15

- World's First Experimental Ice Tank For Ship Research (1955)
- First Nuclear Powered Icebreaker (1959)
- Development of the World's Most Powerful Icebreakers
- First Transit to the North Pole by a Surface Vessel (1977)
- First Icebreaker Escort of a Freighter Across the Arctic Basin (1978)
- Routine Operations of Icebreaking Cargo Vessels (SA-15 Class)
- Employment of Specialized Icebreakers (Shallow-draft Polar & River Icebreakers)
- Substantial Ice Piloting Expertise Due to Extensive, Long-term Efforts
- Achievement of a Nearly Year-round Navigation Season on the Northern Sea Route
- Successful Application of New Technology (spoon-shaped bows, ice breaking-ice removing devices, cp propellers, bubblers, quadruple-screw propulsion systems)

Courtesy: BRIGHAM

FIGURE 16 THE NUCLEAR ICEBREAKER ARTIKA

Soviet Icebreakers

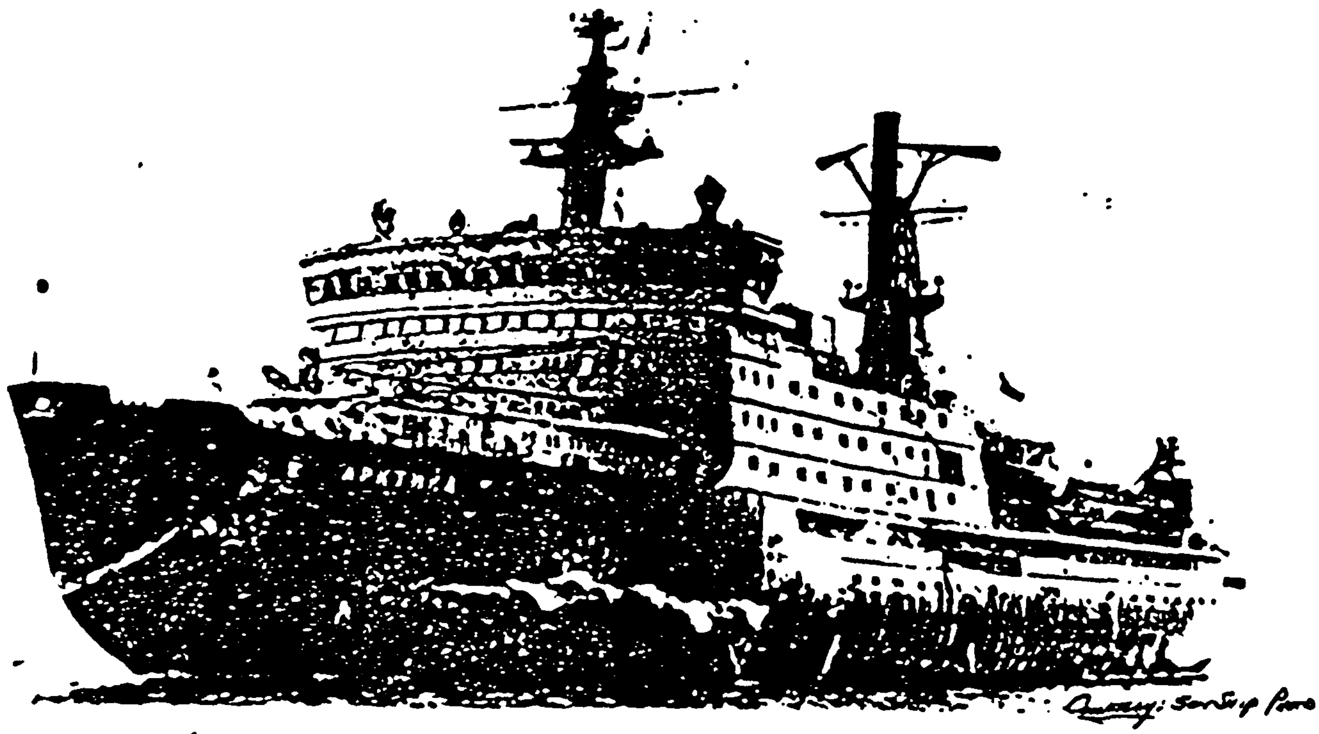
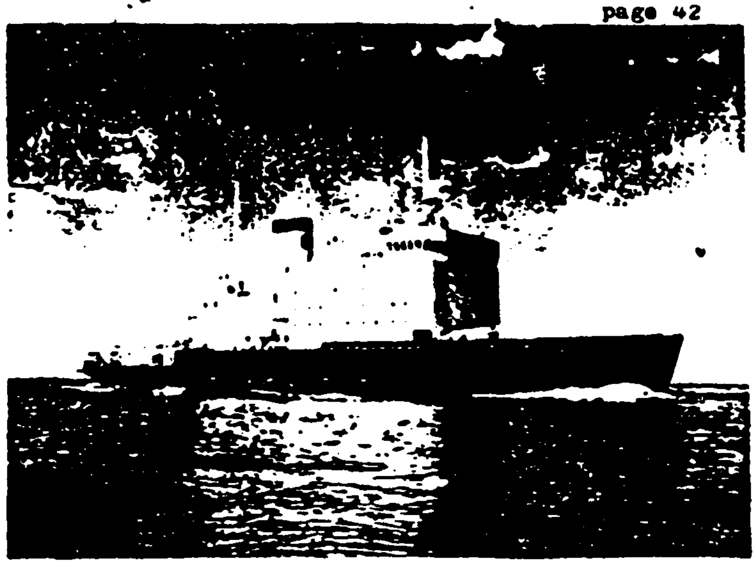
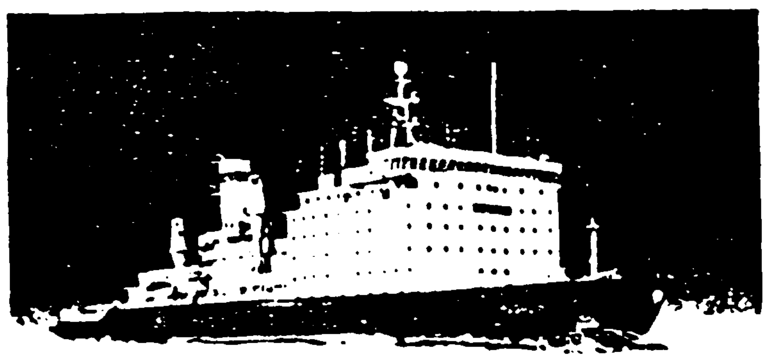


FIGURE 17

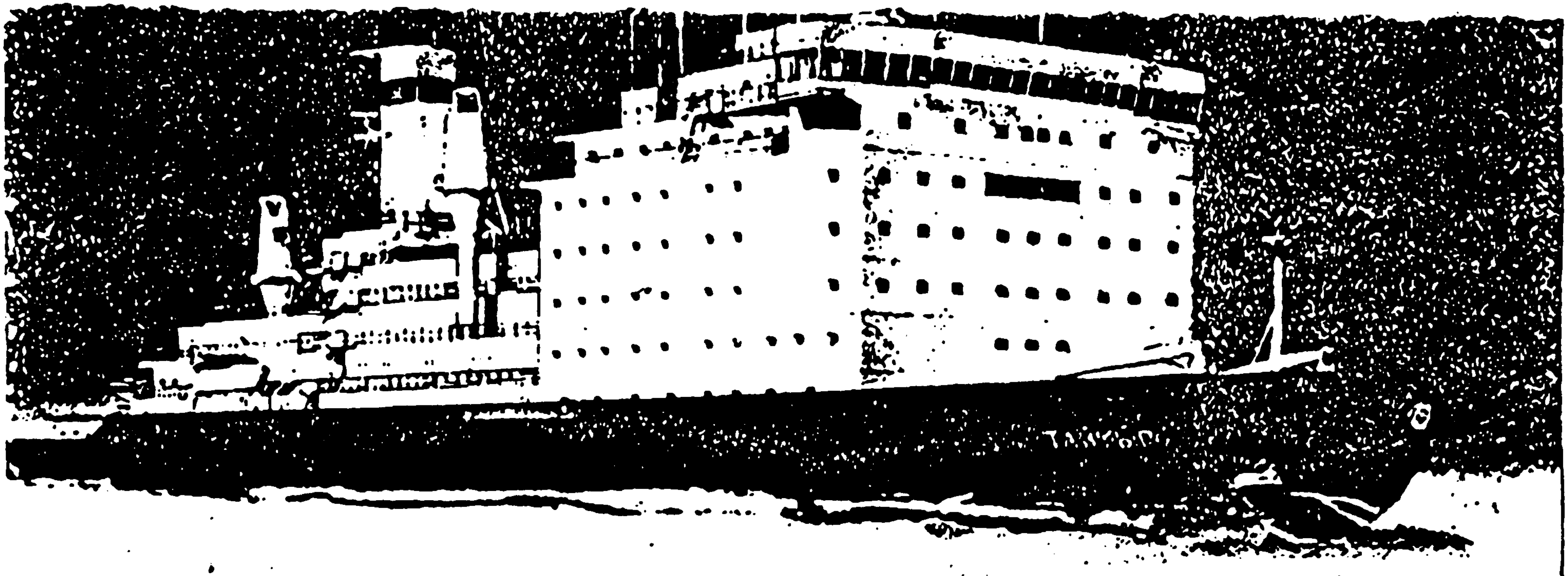
SHALLOW DRAFT
ICEBREAKERS OF
THE SOVIET FLEET



Above, an icebreaker of the Kapitan Sorokin *class. These shallow draft ships are designed for shallow areas along the continental shelf, where deep-draft icebreakers cannot operate. Below, an artist's rendering of a new nuclear-powered, shallow draft icebreaker being built for the Soviet Union by the Finnish shipbuilder Wartsila. It will be among the world's most capable icebreakers. (Photo and painting courtesy of Wartsila)*



Note: see next page



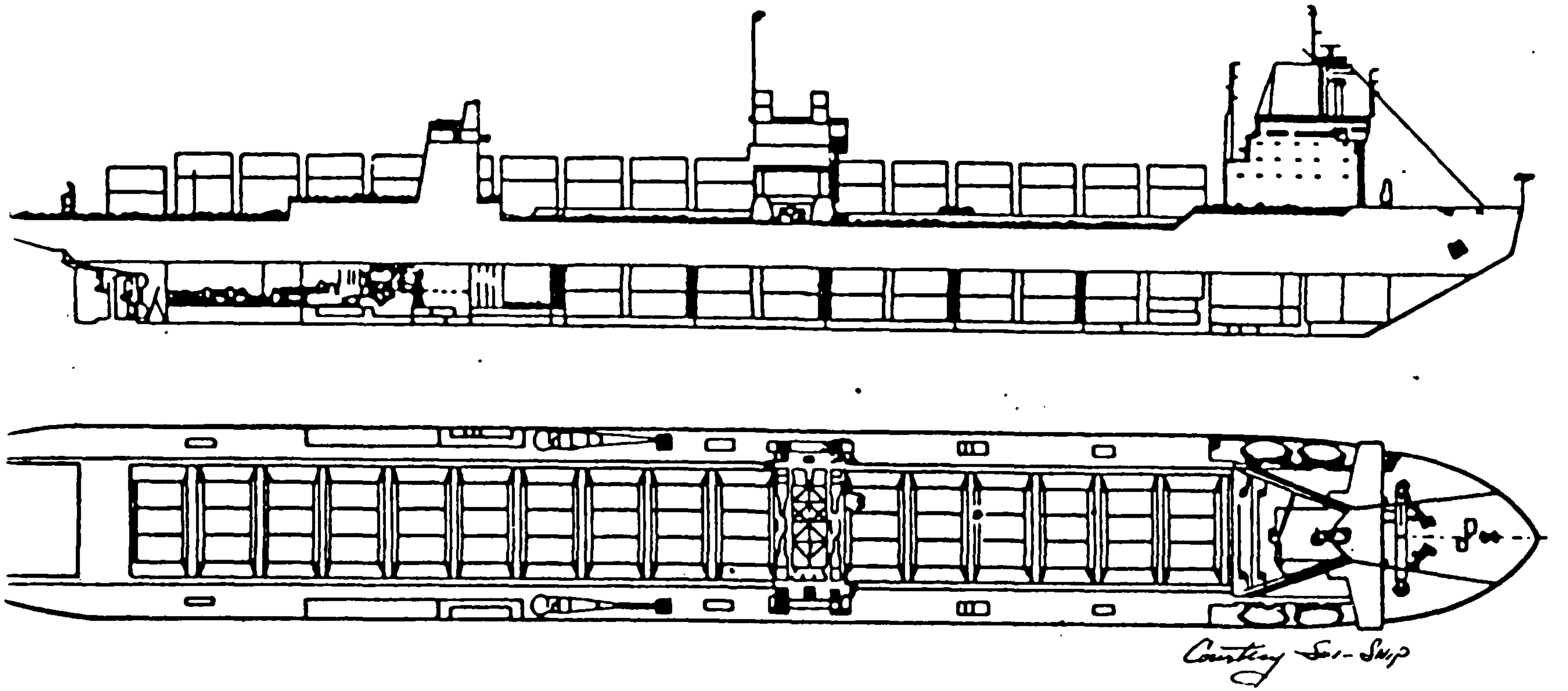
NUCLEAR POWERED SHALLOW DRAFT ICEBREAKERS - TAYMYR CLASS

FIGURE 18

Courtesy Wärtsilä

Indicative of the recent thaw in Soviet-Finnish relations, the construction of two "Taymyr"-class shallow-draft nuclear polar icebreakers,

FIGURE 19 SOVIET NUCLEAR POWERED LASH



(Length Overall: 260m: Beam: 32m; Draft: 10.6 to 11.8 m; Displacement: 61,000 Tons; Speed: 20 Kts)

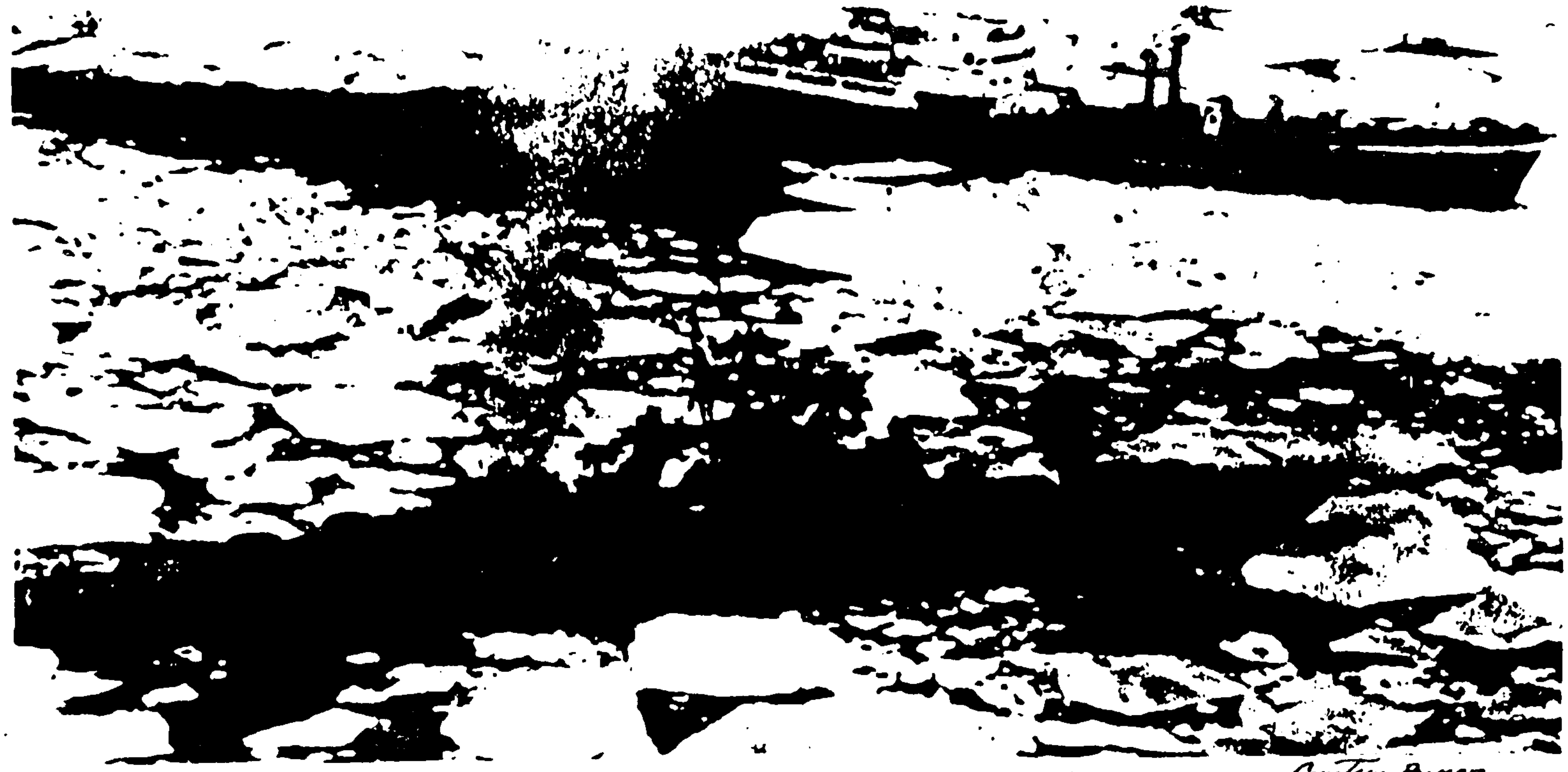
FIGURE 20

PROJECTIONS OF SOVIET ARCTIC MARINE TRANSPORTATION CAPABILITY - YEAR 2000

	Mode of Marine Transport		
	Submarine	Icebreaker Escort	Independent Cargo Ship Ops
Barents	Yes	Yes[1]	Yes
Kara	No[2]	Yes	Probable
Laptev/ East Siberian	No[3]	Yes	No[4]

Notes: 1 Not as economical as independent cargo ship ops.
2 Shallow waters and the requirement for offshore terminals.
3 Shallow waters and undeveloped by 2000.
4 Ice conditions difficult and undeveloped by 2000.

Courtesy Brigham

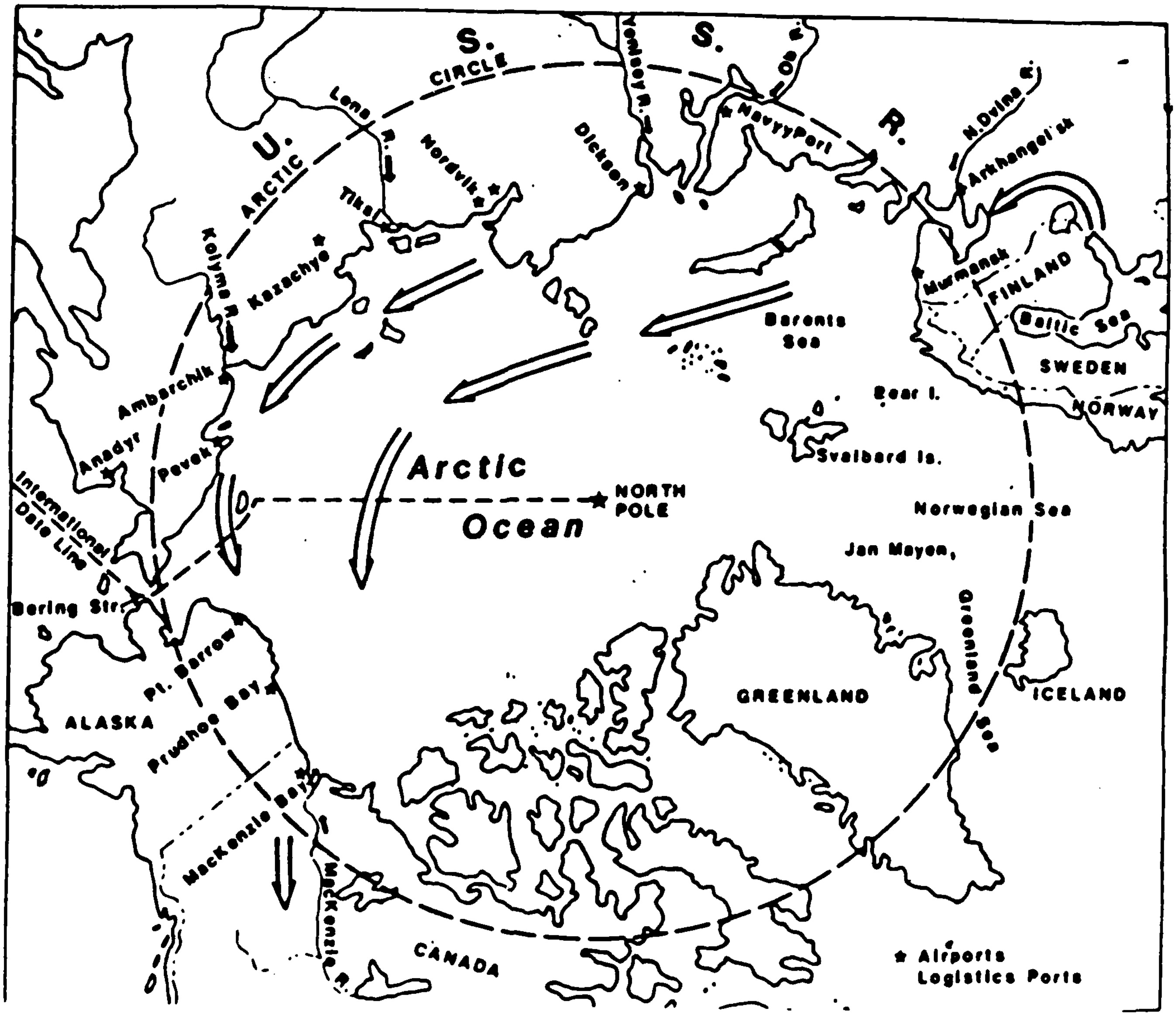


Courtesy Russe

ICE-STRENGTHENED SHIPS ARE REQUIRED BY THE SOVIET ENVIRONMENT. A SOVIET KRIVAK II FRIGATE, ONE OF THE MOST HEAVILY ARMED FRIGATES AFLOAT, ESCORTS A SOVIET MANYCH CLASS MERCHANT SHIP THROUGH 6-8 FT THICK ICE FLOES IN THE SEA OF OKHOTSK.

(THE KRIVAK II IS ARMED WITH TWO 100 MM GUN TURRENTS, 20 SA-N-4 ANTI-AIR MISSILES, 8EA 533MM TORPEDO TUBES, 2 EA RBU 6000 CHAFF ROCKET LAUNCHERS, RAILS FOR 20 MINES AND 4EA SS-N-14 ASW MISSILES. THE SOVIET NAVY OPERATES 32 SHIPS OF THE KRIVAK I AND II CLASS WHICH DIFFER ONLY IN THEIR ARMAMENT SUITES. A SIMILAR VERSION, THE KRIVAK III IS CURRENTLY BEING BUILT FOR THE KGB TO JOIN THEIR FLEET OF ARMED (IVAN SUSANIN CLASS) ICEBREAKERS. THIS VERSION OF THE KRIVAK HAS ONE LESS 100MM GUN BUT IS FITTED FOR A HELICOPTER DECK AND OPERATES WITH THE KA 27 HELIX HELICOPTER AND POSSIBLY THE KA 25 HORMONE HELICOPTER. THE KRIVAK FRIGATE IS FITTED WITH A HULL MOUNTED AND VARIABLE DEPTH SONAR. (SOURCE: POLMAR , pp 218-220)).

FIGURE 21



NORTH AMERICAN DEFENCE RAMIFICATIONS - A POLAR AXIS OF ADVANCE

FIGURE 22

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p 52 INTENTIONALLY

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(Map is enclosed
with original
only on p52)

APPENDIX B

SHIPS OF THE ARCTIC FLEET

Type/Class of Vessel	Number of Ships 1986	1995
A. Naval War Ships*		
1. Suspected Ice Strengthened		
a. Aircraft Carrier (CVN)	0	+2
b. Kiev (CV)	4	4
c. Kirov (CG)	3	3
d. Kara (CG)	7	7
e. Kresta II (CG)	10	10
f. Sverdlov (CA)	14	14
g. Polnocny A (LSM)	43	43
h. Ivan Rogov (LPD)	2	3
i. Ropucha (LST)	21	21
j. Sovremenny (DDG)	5	9
k. Udaloy (DDG)	7	9
l. Kashin & Kashin Mod. (DDG)	19	19
m. Kanin (DDG)	8	8
n. Riga (FF)	45	45
B. Air Cushion/ Surface Effect Vehicles		
1. Non-rigid Skirt		
a. LCPA (Gus) (24-troops)	31	31
b. LCUA (AIST) (80-ton)	19	+19
c. LCMA (LEBED) (40-ton)	18	+18
d. Pomornik (350-ton)	1	+1
e. Tsaplya (not availible	1	+1
f. Utenok	2	+2
2. Wing in Ground Effect (WIG)		
a. Ekranoplan (Casp-B) (900-troops)	2	+2
b. Bartini T-wings (80-passengers)	?	?

* There is currently little information availible with which to confirm or deny the authors' suspicions that these warships are ice strengthened. As a result, we selected these particular vessels on the basis of hull characteristics, the unique appearance of the bow wave which the ship made when moving through the water, and on abnormally large horsepower ratings which are typical of ships that have been designed to negotiate heavy ice conditions. In certain instances, such as the Ivan Rogov class amphibious assault ship, we were able to confirm that the ship had been assigned to the Northern Fleet.

APPENDIX C

SOVIET MERCHANT SHIPS WITH GREATER THAN 10,000 SHAFT HORSEPOWER RATINGS

Type of Ship	Total Number of Ships	Total Net Cargo		Total Bulk Cargo		Total Liquid Capacity*		Total 20 ft Container TEU	Total Passenger Capacity
		M	Tons	M	Tons	M	Gal.		
Bulk	108	N/A	N/A	5,057,702	3,795,198	1,782	470,713	3,536	N/A
Container	22	318,220	280,925	N/A	N/A	N/A	N/A	14,644	N/A
Drilling	3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GC	162	3,211,462	2,835,078	N/A	N/A	N/A	N/A	8,898	N/A
Hospital	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Icebreaker	40	12,688	11,201	N/A	N/A	N/A	N/A	5,770	N/A
LPG Tanker	2	N/A	N/A	N/A	N/A	[151,512]	[40,021,701]	N/A	N/A
Ore	10	139,974	123,569	N/A	N/A	N/A	N/A	N/A	N/A
Pass/Ferry	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1,966
Pass/GC	9	5,736	5,064	N/A	N/A	N/A	N/A	N/A	6,002
Ref GC	78	974,249	860,067	N/A	N/A	10,590	2,797,335	11,036	28
RoLo/GC	12	224,004	197,751	N/A	N/A	N/A	N/A	5,352	N/A
RoRo/Ferry	20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11,574
RoRo/GC	31	1,208,270	1,066,660	N/A	N/A	N/A	N/A	24,138	138
Tanker	160	480,132	423,861	N/A	N/A	7,336,291	1,937,871,877	N/A	N/A
Whaling	2	16,980	14,990	N/A	N/A	53,222	14,058,523	N/A	N/A
TOTALS:	662	6,591,715	5,819,166	5,057,702	3,795,198	7,401,885	1,955,198,448	73,374	19,708

* Capacity of LPG Tankers are not included in the totals

Calculations of Lift and Fuel Requirements

Step #1: Compute lift capability in terms of net cargo:

One US Armored Division	= 243,573 Tons[1]
One US Mechanized Infantry Division	= 240,308 Tons
One US Infantry Division	= 188,537 Tons
One US Air Assault Division	= 181,963 Tons
One US Airborne Division	= 120,986 Tons

1 Ton = 40 ft^3; 1 M^3 = 35.314 ft^3;

35.314 ft^3/M^3 ÷ 40 ft^3/Ton = 0.8828 Ton/M^3

Net cargo = 6,591,715 M^3 X 0.8828 Tons/M^3 = 5,819,166 Ton

5,819,166 Tons ÷ 243,573 Tons = <u>23.9 US Armored Divisions</u>

Step #2: Compute lift capability in terms of bulk cargo:

Bulk cargo must be reduced by 85 percent to = net cargo

5,057,702 M^3 X 0.8828 Ton/M^3 X 0.85 = 3,795,198 Tons

3,795,198 Tons ÷ 243,573 Tons/Div. = <u>15.6 Armored Divisions</u>

Step #3: Compute fuel requirements:

One US Armored Division consumes 460,000 gal/day of fuel[2]

7.48 gal/ft^3 X 35.314 ft^3/M^3 X 7,401,885 M^3 =
=1,955,198,448 gallons

1,955,198,448 gal ÷ 460,000 gal/day = <u>4,250 Arm. Div. Days</u>

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[1] <u>Logistics Handbook for Strategic Mobility Planning</u>, Military Traffic Management Command, PAM 700-1, Jan 1986, pp. 5 - 8.

The authors used the lift requirement for an armored division as that unit had the largest tonnage to be moved. Our rational was that if we could move a calculated number of these units, then we could easily move units with less of a requirement.

[2] Charles D. Odorizzi, "Can Army Support Keep Those Caissons Rolling Along", "Armed Forces Journal", Oct 1986, p. 83. Note: We used a slightly higher figure than the 450,000 gallons per day quoted by Odorizzi.

type	shp	ship class	spd	dwt	total	net cargo	teu	notes
Bulk	17400	Beius	16	54615	18	75516		
Bulk	15000	Universytet Jagiellonski	16	52000	01	61070		Net cargo is grain storage capacity
Bulk	14600	Universytet Warszawski	16	52020	02	60954		Net cargo is grain storage capacity
Bulk	14400	Sovfracht	16	44470	03	48020		Net cargo is grain storage capacity
Bulk	14000	Belchatow	15	71277	02	81248		Net cargo is grain storage capacity
Bulk	13700	Zoya Kosmodemyanskaya	14	49999	08	62900		Net cargo is grain storage capacity
Bulk	12000	Feliks Dzerzhinskiy	16	33490	05	43581		Net cargo is grain storage capacity
Bulk	12000	General Swierczewski	17	37844	09	46533		Net cargo is grain (ore) storage capacity
Bulk	12000	Georgiy Leonidze	17	31923	05	40758		Net cargo is grain (ore) storage capacity
Bulk	12000	Gorlitz	16	38250	04	47130		Net cargo is grain storage capacity
Bulk	12000	Khudozhnik Fedor.	14	24354	14	29214		Net cargo is grain storage capacity
Bulk	12000	Professor Kostiukov	14	44750	02	54100		Net cargo is grain storage capacity
Bulk	12000	Rogen	15	24500	01	32478		Net cargo is grain storage capacity
Bulk	12000	Stepan Artemenko	17	26200	03	32493		Net cargo is grain storage capacity
Bulk	12000	Syn Pulku	17	31910	06	43893		Net cargo is grain storage capacity
Bulk	11550	Donuzlav	15	34291	01	40492		Net cargo is grain storage capacity
Bulk	11200	Filipp Makharadle	15	32404	07	35971		Net cargo is grain storage capacity
Bulk	11200	Viktor Tkachyov	15	19240	08	22245	442	Net cargo is grain storage capacity
Bulk	11200	Ziemia Gdanska	15	24208	03	34342		L 594; Net cargo is grain storage capacity
Bulk	11200	Ziemia Kielecka	16	20500	02	34342		Net cargo is grain storage capacity
Bulk	10350	Yasenyevo	15	25929	02	29320		Net cargo is grain storage capacity
Bulk	10350	Yasnoye	15	25450	01	29320		Net cargo is grain storage capacity
Bulk	10200	Dagonys	14	32010	01	36238		Net cargo is grain storage capacity
..Subtotals.. 23 records, type = Bulk								
Container	36000	Yulius Fuchik	20	37850	02	47000	1552	Also refered to as a barge carrier, carries 26 ligh
Container	17400	Khudozhnik Saryan	20	unl	10	unl	712	
Container	11200	Dmitriy Donskoy	15	19590	10	22422	442	
..Subtotals.. 3 records, type = Container								
Drilling	17500	Viktor Muravlenko	12	7245	03	N/A		
..Subtotals.. 1 records, type = Drilling								
GC	9600	Kasimov	17	12490	09	16810		
GC	17400	Franciszek Zubrzycki	21	11684	07	19298	218	
GC	13000	Metallurg Anosov	19	16251	21	19925		
GC	12600	Beloretsk	17	14900	06	20409		
GC	12600	Kosmonaut	17	14900	43	20410		
GC	12000	Kapitan Alekseyev	18	16617	17	20800		
GC	12000	Ola	17	15015	05	19640		
GC	12000	Omsk	17	14857	03	19917		
GC	12000	Otradnoye	17	14995	05	21072		
GC	12000	Pula	18	14868	26	19368		
GC	10800	Predeal	18	14830	01	20728		
GC	10600	Ivan Zagubanski	18	13480	19	19730	388	
..Subtotals.. 12 records, type = GC								
Hospital	unk	Robert Koch	14	unk	1	unknown		GRT 1093
..Subtotals.. 1 records, type = Hospital								
Icebreaker	unl	Ivan Kruzenshtern	unl	1092	02	244		

merships

02-08-1987 Pag

type	shp	ship class	spd	dwt	total	net cargo	teu	notes
Icebreaker	unl	Kapitan Yevdokimov	13	unl	08	unl		
Icebreaker	unl	Khariton Laptev	unl	1092	02	244		AGI ships
Icebreaker	75000	Leonid I. Brezhnev	unk	4096	04	1092		Nuclear power
Icebreaker	52000	Taмyr	21	unl	01	unl	N/A	Nuclear, w/helo; poss. large pass. cap.; (+1) 1st
Icebreaker	44000	Lenin	18	3073	01	1971		Nuclear power
Icebreaker	41400	Yermak	19	7560	03	unl		
Icebreaker	39500	Sevmorput	20	32000	01	unl	1330	N. pwr; 74 LASH 370 T bgs; 500 T Gtry Crane; (+1)
Icebreaker	33580	Aleksey Kosygin	18	40881	03	unl	1480	Carries 82 LASH 370 T barges, 500 T Gantry Crane
Icebreaker	26000	Moskva	19	6147	05	945		
Icebreaker	24840	Kapitan Sorokin	19	4225	04	unl		
Icebreaker	12400	Mudyug	16	1909	03	N/A	N/A	Used for tug and salvage purposes
Icebreaker	10500	Kapitan Belousov	15	1450	03	216		
..Subtotals.. 13 records, type = Icebreaker								
LPG Tanker	21600	Lensovet	16	55728	02	unl		LPG 75,756
..Subtotals.. 1 records, type = LPG Tanker								
Ore	11500	Bucegi	16	25606	08	13017		
Ore	11000	Eisenhuttenstadt	14	38242	02	17919		
..Subtotals.. 2 records, type = Ore								
Pass/Ferry	16800	Pomerania	21	1856	02	unlisted		460 bth P., 523 dk P.
..Subtotals.. 1 records, type = Pass/Ferry								
Pass/GC	unl	Baltika	15	2463	01	1362		437 bth P.
Pass/GC	21000	Alexsandr Pushkin	21	5180	05	unl		763 bth P.
Pass/GC	12000	Admiral Nakhimov	16	8942	01	2238		870 bth P.
Pass/GC	12000	Volkerfreundschaft	18	2020	01	2136		568 bth P.
Pass/GC	10400	Ayvazovskiy	19	710	01	unl		312 bth P.
..Subtotals.. 5 records, type = Pass/GC								
Ref GC	33000	Jozef Conrad Korzen.	25	17245	03	26935	615	L 610; 4 bth P
Ref GC	33000	Jozef Conrad Korzen.	25	17245	01	26935	615	4 bth P.
Ref GC	23200	Jacek Malczewski	21	17057	04	21777	304	
Ref GC	20000	Hel	21	14170	05	19535		
Ref GC	13200	Dzieci Polskie	22	5657	06	7440		
Ref GC	13200	Ilya Mechnikov	22	5880	06	7430		2 bth P.
Ref GC	13200	Nikolay Kopernik	21	5880	17	7430		
Ref GC	11200	Altenburg	19	10080	16	7841		
Ref GC	11200	Warnemunde	19	12347	20	17037	368	L 438
..Subtotals.. 9 records, type = Ref GC								
RoLo/GC	10336	Astrakhan	17	18020	12	18667	446	Stern door/ramp
..Subtotals.. 1 records, type = RoLo/GC								
RoRo/Ferry	unk	Sakhalin - 1	16	2427	07	unl		72 P.; Stern door; carries rail vehicles
RoRo/Ferry	18000	Byelorussiya	21	2147	05	unl		650 bth P., 110 dk P.; Bow, Stern and Side Doors
RoRo/Ferry	18000	Ilyich	22	2100	01	unl		Bow & stern doors; 377 bth P., [illegible] dk P.
RoRo/Ferry	17500	Rostock	18	3132	01	unl		Rail cars; Stern plus 2 side doors; 36 bth P., 34
RoRo/Ferry	17400	Georg Ots	unl	1363	05	unl		216 bth P., 764 dk P.

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type	shp	ship class	spd	dwt	total	net cargo	teu	notes
RoRo/Ferry	16000	Eddz	21	1250	01	unl		Bow & stern doors; 440 bth P., 560 dk P.
..Subtotals.. 6 records, type = RoRo/Ferry								
RoRo/GC	47020	Kapitan Smirnov	25	20075	04	54513	1246	Stern door, Qtr ramp
RoRo/GC	27000	Magnitogorsk	22	21002	04	64500	1346	12 bth P.; Stern door w/ Qtr ramp
RoRo/GC	21000	Norilsk	17	19943	14	31186	576	Icebreaker; over 42 ships by 1995; side door/ramp
RoRo/GC	20800	Skulptor Kunenkov	21	18462	09	32846	634	10 bth P.; Net cargo is grain storage capacity
..Subtotals.. 4 records, type = RoRo/GC								
Tanker	unl	Klyazma	11	1122	11	unl		Oil 1,398
Tanker	29000	Zavrat	15	144892	03	unl		Oil 173,721
Tanker	23200	Marshal Budyonnyy	15	101877	04	103590		Oil 123,500
Tanker	21000	Boris Butoma	15	109640	05	unlisted		L 114,340
Tanker	20300	Banat	16	86094	04	unl		L 102,190
Tanker	19000	Dzhordano Bruno	16	50720	03	917		Oil 58,591
Tanker	19000	Dzhuzeppi Verdi	16	50840	03	917		L 58,591
Tanker	19000	Praga	17	32030	07	830		Oil 39,813
Tanker	19000	Sofiya	17	50770	23	unl		Oil 56,882
Tanker	18000	Leninabad	16	37010	02	1450		Oil 47,588
Tanker	18000	Lisichansk	16	36653	03	1450		Oil 47,556
Tanker	18000	Livny	16	36653	08	1450		Oil 47,556
Tanker	18000	Lugansk	16	36684	08	711		Oil 47,029
Tanker	18000	Lutsk	16	36968	02	1450		Oil 47,588
Tanker	17400	Mate Zalka	17	40030	11	unl		Oil 45,562
Tanker	12000	Daugaypils	17	22630	26	587		L 29,665
Tanker	12000	Maykop	15	32039	05	unl		Oil 38,375
Tanker	12000	Tatry	15	31016	02	unl		Oil 39,596
Tanker	11000	Samotlor	16	17200	14	840		Oil 17940
Tanker	10600	Aleksandr Tsulukiaze	15	27360	01	unl		L 31,398
Tanker	10600	Kcmandarm Fedko	15	27480	15	unl		Oil 31,398
..Subtotals.. 21 records, type = Tanker								
Whaling	15000	Sovietskaya	16	25720	01	8750		L 31,570
Whaling	15000	Sovietskaya Rossiya	16	26050	01	8230		L 21,652
..Subtotals.. 2 records, type = Whaling								

TOTAL

Printed 105 of the 345 records.

APPENDIX D

SOVIET MERCHANT SHIPS WITH LESS THAN 10,000 SHAFT HORSEPOWER RATINGS

Type of Ship	Total Number of Ships	Total Net Cargo		Total Bulk Cargo		Total Liquid Capacity*		Total 20 ft. Container	Total Passenger Capacity
		M	Tons	M	Tons	M	Gal.	TEU	
Bulk									
>9,000shp	47	N/A	N/A	1,036,417	777,707	N/A	N/A	N/A	N/A
>8,000shp	11	N/A	N/A	214,310	160,814	N/A	N/A	N/A	N/A
>7,000shp	38	N/A	N/A	579,561	434,891	N/A	N/A	N/A	54
<7,000shp	33	N/A	N/A	unl	unl	N/A	N/A	N/A	unl
Cablelayer	11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Container									
>9,000shp	6	N/A	N/A	N/A	N/A	N/A	N/A	2,400	N/A
<7,000shp	11	101,060	89,216	N/A	N/A	N/A	N/A	2,828	N/A
Dredge	3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GC									
>9,000shp	146	2,560,881	2,260,746	N/A	N/A	N/A	N/A	N/A	N/A
>8,000shp	22	349,889	308,882	N/A	N/A	1,650	435,845	N/A	24
>7,000shp	41	552,364	487,627	N/A	N/A	1,836	484,977	N/A	76
<7,000shp	1,112	unl	unl	N/A	N/A	unl	unl	unl	N/A
Icebreaker	38	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LPG Tanker									
>9,000shp	6	N/A	N/A	N/A	N/A	[72,000]	[19,018,708]	N/A	N/A
<7,000shp	2	N/A	N/A	N/A	N/A	[4,192]	[1,107,311]	N/A	N/A
Ore									
>9,000shp	12	N/A	N/A	129,600	97,249	N/A	N/A	N/A	N/A
<7,000shp	4	30,712	27,113	N/A	N/A	N/A	N/A	N/A	N/A
Pass/Ferry	4	3,000	2,648	N/A	N/A	N/A	N/A	N/A	824
Pass/GC									
>7,000shp	1	2,257	1,992	N/A	N/A	N/A	N/A	N/A	779
<7,000shp	39	14,606	12,894	N/A	N/A	N/A	N/A	N/A	9,926
Ref GC									
>9,000shp	5	67,413	59,512	N/A	N/A	N/A	N/A	N/A	N/A
>8,000shp	25	245,015	216,299	N/A	N/A	N/A	N/A	N/A	132
>7,000shp	40	496,979	438,733	N/A	N/A	3,141	829,691	N/A	72
<7,000shp	128	unl	unl	N/A	N/A	14,997	3,961,438	9,284	unl
Research	1	8,757	7,731	N/A	N/A	N/A	N/A	N/A	N/A

* Capacity of LPG Tankers are not included in the total on Page D2

SOVIET MERCHANT SHIPS WITH LESS THAN 10,000 SHAFT HORSEPOWER RATINGS

Type of Ship	Total Number of Ships	Total Net Cargo M	Total Net Cargo Tons	Total Bulk Cargo M	Total Bulk Cargo Tons	Total Liquid Capacity* M	Total Liquid Capacity* Gal.	Total 20 ft. Container TEU	Total Passenger Capacity
RoRo/Ferry									
>9,000shp	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1,659
RoRo/GC									
>9,000shp	8	61,200	54,027	N/A	N/A	N/A	N/A	2,176	12
>8,000shp	9	138,870	122,594	N/A	N/A	N/A	N/A	N/A	N/A
>7,000shp	2	unl	unl	N/A	N/A	N/A	N/A	N/A	82
<7,000shp	32	unl	unl	N/A	N/A	N/A	N/A	N/A	12
Tanker									
>9,000shp	31	6,496	5,735	N/A	N/A	444,850	117,506,558	N/A	N/A
>7,000shp	1	11,091	9,791	N/A	N/A	22,081	5,832,668	N/A	N/A
<7,000shp	252	unl	unl	N/A	N/A	unl	unl	N/A	N/A
[1] Total:	262	2,695,990	2,380,020	1,166,017	874,956	444,850	117,506,558	4,576	1,671
[2] Total:	2,123	4,650,590	4,105,540	1,959,888	1,470,661	488,555	129,051,177	16,688	13,785

[1] This total is for all ships with a shaft horsepower rating greater than 9,000 shp. We used these figures for the calculations on page D3.

[2] This total is for all ships listed in the above tables for Appendix D. However, only the total number of ships is complete. A lack of complete information especially in the general cargo (GC) type of ship resulted in a partial listing of the remaining data. The important point to remember is that these figures should be considerably higher as the difference in number of ships between the two totals would suggest. The lack of information is not detrimental to this report as it is highly unlikely that ships with less than 9,000 shp would be employed in the Arctic Ocean except during a few weeks in late summer when the ice pack has retreated from the shoreline.

N/A - means that the category is not applicable to this ship class.

Unl - means that the information was not provided in Lloyd's Registry or that the authors purposely left the information out.

* Capacity of LPG Tankers are not included in the above totals.

APPENDIX D

Calculations of Lift and Fuel Requirements Only for Those Vessels Between 9,000 & 10,000 shp

Step #1: Compute lift capability in terms of net cargo:

One US Armored Division	= 243,573 Tons[1]
One US Mechanized Infantry Division	= 240,308 Tons
One US Infantry Division	= 188,537 Tons
One US Air Assault Division	= 181,963 Tons
One US Airborne Division	= 120,986 Tons

1 Ton = 40 ft^3; 1 M^3 = 35.314 ft^3;

35.314 ft^3/M^3 ÷ 40 ft^3/ton = 0.8828 Ton/M^3

Net cargo = 2,695,990 M^3 X 0.8828 Tons/M^3 = 2,380,020 Ton

2,380,020 Tons ÷ 243,573 Tons/Div. = <u>9.8 US Armor Div'n</u>

Step #2: Compute lift capability in terms of bulk cargo:

Bulk cargo must be reduced by 85 percent to = net cargo

1,166,017 M^3 X 0.8828 Ton/M^3 X 0.85 = 874,956 Tons

874,956 Tons ÷ 243,573 Tons/Div. = <u>3.6 US Armor Div'n</u>

Step #3: Compute fuel requirements:

One US Armored Division consumes 460,000 gal/day of fuel[2]

7.48 gal/ft^3 X 35.314 ft^3/M^3 X 444,850 M^3 =
= 117,506,558 gallons

117,506,558 gal ÷ 460,000 gal/day = <u>255 Arm. Div. Days</u>

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[1] <u>Logistics Handbook for Strategic Mobility Planning</u>, Military Traffic Management Command, PAM 700-1, Jan 1986, pp. 5 - 8.

The authors used the lift requirement for an armored division as that unit had the largest tonnage to be moved. Our rational was that if we could move a calculated number of these units, then we could easily move units with less of a requirement.

[2] Charles D. Odorizzi, "Can Army Support Keep Those Caissons Rolling Along", "Armed Forces Journal", Oct 1986, p.83. Note: We used a slightly higher figure than the 450,000 gallon per day quoted by Odorizzi.

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..Subtotals.. records, type =

type	shp	ship class	spd	dwt	total	net cargo	teu	notes
Bulk	09600	Nikolay Novikov	16	13955	25	16441		Net cargo is grain storage capacity
Bulk	09600	Zarechensk	16	22884	10	29725		Net cargo is grain storage capacity
Bulk	09600	Ziemia Bydgoska	16	25051	02	31021		Ore carrier; Net cargo is grain storage capacity
Bulk	09600	Zvenigorod	15	22896	10	26610		
Bulk	08100	Kopalinia Gottwald	15	16733	03	21312		Net cargo is grain storage capacity
Bulk	08100	Kopalnia Jastrzebie	15	16653	04	21312		Net cargo is grain storage capacity
Bulk	08000	Kopalnia Grzybow	16	14036	02	16217		Net cargo is grain storage capacity
Bulk	08000	Kopalnia Piaseczno	15	13665	02	16346		Net cargo is grain storage capacity
Bulk	07400	Huta Zgoda	15	14176	07	18400		Net cargo is grain storage capacity
Bulk	07200	Buzludja	14	13904	04	15960		Net cargo is grain storage capacity
Bulk	07200	Kopalnia Mosz.	15	11780	07	15695		2 bth P
Bulk	07200	Musala	13	14030	03	15960		Net cargo is grain storage capacity
Bulk	07200	Thale	15	22565	01	28656		4 P.; Net cargo is grain storage capacity
Bulk	07200	Uricani	13	12500	10	7773		Net cargo is grain storage capacity
Bulk	07200	Zaglebie Dabrowskie	16	15688	06	20465		6 P.; Net cargo is grain storage capacity
Bulk	06700	Kapitan Panfilov	14	14631	10	16930		Net cargo is grain storage capacity
Bulk	05850	Lubberau	14	11830	06	13874		Net cargo is grain storage capacity
Bulk	05400	Ugleuralsk	15	7185	08	9313		Ore carrier; Net cargo is grain storage capacity
Bulk	05000	Yasnogorsk	15	16145	02	17242		Net cargo is grain storage capacity
Bulk	02000	Vladimir Lenorskiy	11	4300	07	3630		Ore carrier; Net cargo is grain storage capacity

..Subtotals.. 20 records, type = Bulk

type	shp	ship class	spd	dwt	total	net cargo	teu	notes
Cablelayer	01620	Emba	11	755	11	N/A		

..Subtotals.. 1 records, type = Cablelayer

type	shp	ship class	spd	dwt	total	net cargo	teu	notes
Container	09048	Simon Bolivar	18	9141	06	unl	400	
Container	06700	Aleksandr Fadeyev	16	6458	05	10012	304	
Container	05500	Pidner Nakhodki	15	6270	06	8500	218	

..Subtotals.. 3 records, type = Container

type	shp	ship class	spd	dwt	total	net cargo	teu	notes
Dredge	[illegible]	Severodvinskiy	[illegible]	N/A	03	N/A		Suction/bottom doors

type	shp	ship class	spd	dwt	total	net cargo	teu	notes
..Subtotals.. 1 records, type = Dredge								
GC	09600	Harry Pollitt	19	13150	13	17611		
GC	09600	Ignatiy Sergeyev	19	12640	26	17964		
GC	09600	Irkutsk	18	12530	11	17168		
GC	09600	Minsk	17	12611	29	17680		
GC	09600	Novgorod	18	13650	15	17642		
GC	09600	Vladimir Ilych	17	13150	06	17611		
GC	09000	Klin	17	12844	15	16866		
GC	09000	Sosnogorsk	17	13738	18	17420		
GC	09000	Svetlogorsk	17	13738	13	17420		
GC	08800	Prignitz	17	7500	03	9591		In 280, L 550
GC	08150	Velikiye Luki	17	12295	04	16622		
GC	08150	Volchansk	16	12400	01	17269		
GC	08150	Vybork	17	12295	04	16621		
GC	08000	Leninogorsk	17	11050	07	16897		
GC	08000	Stefan Czarniecki	16	12045	03	17532		8 bth P.
GC	07800	Divnogorsk	17	10568	02	15979		L 918
GC	07800	Kochanowski	15	10749	02	14693		
GC	07800	Simferopol	15	12457	06	17747		
GC	07600	Kraszewski	16	14403	01	19786		4 bth P.
GC	07200	Amquema	15	8842	13	9306		Some have helicopter decks
GC	07200	Francesco Nullo	15	11600	09	16464		
GC	07200	Major Sucharski	18	12120	02	16803		
GC	07200	Zakopane	17	7081	06	10332		12 bth P.
GC	06700	Nikolay Zhukov	16	7700	12	10650		L 300
GC	06600	Chemik	14	13933	02	19395		
GC	06600	Transportowiec	14	14072	02	19395		
GC	06550	Petko R. Slavgjnov	15	13270	02	18128		L 640
GC	06100	Pioner Moskvy	16	6780	22	8250		
GC	06100	Radauti	16	8750	34	11150		
GC	05800	Georgi Benkovski	14	14600	01	17720		
GC	05600	Bucuresti	14	12961	02	17482		
GC	05500	Antoni Garnuszewski	16	5510	04	5491		Used as a training ship
GC	05400	Rostok	16	5657	18	6904		
GC	05325	Hettstedt	15	7923	05	10608		
GC	05200	Borovichi	15	1834	04	1450		Used as a missile tracker
GC	05200	Chulymes	14	6459	20	7300		
GC	05200	Perm	16	6575	20	7490		
GC	05200	Pyatidyes Kom.	17	8260	01	10120		
GC	04900	Kcasomolets Armenii	16	8290	38	10120		
GC	04450	Leonid Teliga	12	7490	04	10341		
GC	04200	Verila	14	9542	04	12884		Net cargo is grain storage capacity
GC	04000	Bolgrad	15	6453	02	8122		
GC	03850	Pirin	unl	9383	04	10274		
GC	03500	Abram Arkhipov	14	4471	12	5892		
GC	03250	Lyonya Golikov	14	4638	01	6060		
GC	03250	Pyarnu	14	4415	03	5767		
GC	03250	Shura Kober	14	4687	30	6510		
GC	03250	Sinegorsk	13	4150	34	5767		

type	shp	ship class	spd	dwt	total	net cargo	teu	notes
GC	03250	Sofia	14	6310	03	8222		
GC	03060	Pliska	13	6549	02	8495		
GC	03060	Plovdiv	14	6545	01	8807		
GC	03000	Boleslaviec	12	4385	11	5655		
GC	03000	Brad	14	4800	31	5898		
GC	03000	Mielec	15	4456	04	5655		
GC	03000	Vasiliy Shurshin	13	5550	07	5800	165	Operates on rivers or oceans
GC	02900	Aleksandr Dovzhenko	14	3517	05	4641		
GC	02900	Bereznik	14	3930	45	5171		
GC	02900	Blagoveshchensk	14	3930	30	5171		
GC	02900	Chazhma	12	3930	03	5171		Missile tracker, includes helicopter and platform
GC	02900	Indiga	14	3446	14	4785		
GC	02900	Izhmales	14	3596	12	4751		
GC	02900	Kirovskles	13	3779	10	4769		
GC	02900	Lakhta	13	3797	04	4829		Naval Auxiliary
GC	02900	Lenales	13	4009	01	4769		
GC	02900	Unzha	14	3794	41	5031		
GC	02500	Andizhan	12	4296	45	5635		Large radar mast
GC	02500	Baia Mare	12	4400	03	5800		
GC	02500	Galati	12	4400	05	5800		
GC	02500	Jaroslaw	14	2988	01	3441		
GC	02500	Niewiadow	14	2973	02	3441		
GC	02500	Novyy Bug	12	4220	05	5418		
GC	02500	Oradea	12	4400	10	5800		
GC	02500	Sovietskiy Voin	13	2485	20	2870		
GC	02500	Yermak	12	5129	14	5999		
GC	02450	Arazamas	12	4410	01	5325		
GC	02450	Kotlas	13	4410	05	4948		Being converted to naval auxiliary
GC	02400	Botevgrad	14	4013	01	6768		
GC	02400	Faleshty	13	3080	06	4824		
GC	02400	Fastov	13	3137	05	4824		
GC	02400	Ivan Babushkin	14	3330	05	4919		
GC	02320	Sliven	unl	3032	02	unlisted		
GC	02300	Adam Mitskevich	11	4935	23	5609		
GC	02300	Oelsa	15	3640	05	4411		
GC	02250	Bega	13	1979	04	3149		
GC	02250	Suwalki	13	3617	07	4146		
GC	02250	Warna	13	3496	09	4146		
GC	02080	Anton Gubaryev	13	2180	23	3240	57	
GC	02000	Kishinev	12	4150	10	5400		
GC	02000	Malaya Vishera	13	3600	03	5130		
GC	02000	Sovietskaya Yakutiya	12	4000	32	5800		Configured for containers; operate on rivers/ocean
GC	01740	Baltiyskiy 101	13	2554	10	3475	83	
GC	01740	Ladoga 1-19	12	1578	19	2623		
GC	01650	Chapayevsk	11	3165	11	4169		
GC	01600	Baku	12	4316	19	5485		
GC	01560	Cherepovets	12	1857	15	2450		
GC	01500	Spartak	13	1718	18	2289		
GC	01365	Bussard	12	2733	05	3077		
GC	01320	Baltiyskiy -73	11	2162	73	3467		Net cargo is grain storage capacity; Inland waterways

type	shp	ship class	spd	dwt	total	net cargo	teu	notes
GC	01320	Batak	unl	2255	11	3111		
GC	01320	Elena	unl	2239	01	1677		Net cargo is grain storage capacity
GC	01320	Sormovskiy	11	2925	98	4297		Used primarily on rivers
GC	01160	Boltenhagen	12	780	06	1400		
GC	01160	Fritsis Rozin	12	1120	07	1993		
GC	01160	Marlow	12	718	11	1400		
GC	01000	Ananyev	11	1288	22	1895		
GC	01000	Balkhash	11	1545	03	1830		
GC	00960	Skrzat	10	1115	04	1753	39	2 P.
GC	00900	Hajnowka	11	1075	02	1443		
GC	00900	Ruciane	12	1066	01	1420		
GC	00800	Takeli	10	1075	24	1515		
GC	00500	Bellatrix	10	819	01	1456		
..Subtotals.. 111 records, type = GC								
Icebreaker	05400	Dobrinya Nikitich	14	1118	22	unl		Armed, manned by naval crews
Icebreaker	01360	Kapitan Kosolapov	13	354	03	unl		Used for firefighting and salvage work
Icebreaker	01360	Kapitan M. Izmaylov	13	354	03	unl		Used for salvage work
Icebreaker	03000	Sibirskiy	15	1474	10	unl		Used for fire fighting, Salvage, Diving, Tug
..Subtotals.. 4 records, type = Icebreaker								
LPG Tanker	08940	Yurmala	16	9551	06	unl		Gas 12,000
LPG Tanker	02400	Kegums	14	2405	02	unl		Gas 2,096
..Subtotals.. 2 records, type = LPG Tanker								
Ore	05400	Debaltsevo	14	9997	12	10800		Net cargo is expressed in bulk
Ore	03400	Tarnow	14	5735	04	7678		Net cargo is grain storage capacity
..Subtotals.. 2 records, type = Ore								
Pass/Ferry	05280	Antonina Nedzhdanova	17	1414	04	750		206 bth P.
..Subtotals.. 1 records, type = Pass/Ferry								
Pass/GC	08500	Stefan Batory	17	7170	01	2257		779 bth P.
Pass/GC	08300	Bashkiriya	17	1355	03	585		333 bth P.
Pass/GC	08300	Estoniya	17	1332	07	505		333 bth P.
Pass/GC	08300	Priamurye	18	1332	02	505		333 bth P.
Pass/GC	05280	Mariya Yermolova	17	1465	05	750		206 bth P.
Pass/GC	04000	Kolhida	14	690	09	235		250 P.
Pass/GC	04000	Kolkhida	14	690	09	235		250 P.
Pass/GC	01200	Dimitar Blagoev	unl	unl	02	unl		
Pass/GC	01000	Georgi Dimitrov	12	168	02	163		200 P.
..Subtotals.. 9 records, type = Pass/GC								
Ref GC	09700	John Brinckman	20	6249	02	7810		
Ref GC	09600	Ursus	18	12312	01	17193		
Ref GC	09600	Wladyslaw Orkan	18	12181	02	17300		
Ref GC	08400	Yanis Raynis	19	4428	12	5357		
Ref GC	08000	Alba Iulia	18	11742	02	11663		
Ref GC	08000	Wladyslaw Jagiello	17	11570	09	13645		12 bth P.
Ref GC	08000	Wladyslaw Orkan	18	12181	02	17300		12 bth P.

type	shp	ship class	spd	dwt	total	net cargo	teu	notes
Ref GC	07800	Adam Asnyk	17	15100	01	16449		
Ref GC	07800	Andrzej Strug	16	10526	02	14165		
Ref GC	07800	Hanka Sawicka	15	10093	01	14826		
Ref GC	07800	Hanoi	16	9953	03	16720		L 1,047
Ref GC	07800	Romer	16	8553	02	13459		12 bth P.
Ref GC	07600	Kotovskiy	19	4572	05	unl		
Ref GC	07500	Poltava	17	13400	19	16440		
Ref GC	07250	Aragvi	18	4222	03	5100		
Ref GC	07000	Wismar	16	6950	04	8159		12 P.
Ref GC	06100	Leninskaya Gvardiya	16	7400	31	10746	112	L 417
Ref GC	06100	Radzionkow	16	6380	09	7623	50	
Ref GC	06100	Tarkhansk	16	5816	13	7143	50	
Ref GC	05850	Anton Saefkow	14	10400	10	12734		
Ref GC	05850	Anton Saefkow	15	10400	10	12734		
Ref GC	05850	Wilhelm Florin	14	10300	04	11944		
Ref GC	05320	Liebenwalde	18	7496	19	8582	248	
Ref GC	05000	Professor Shchyogolev	15	5505	09	4918		L 230
Ref GC	05000	Tauysk	15	3470	01	5165		
Ref GC	04900	Krakow	15	5993	07	8824		12 bth P.
Ref GC	04900	Lewant II	16	4600	01	7388		5 bth P.
Ref GC	04600	Grudziadz	15	4461	03	7375		4 P.
Ref GC	03300	Schwarza	15	4960	01	7079		
Ref GC	03000	Jaslo	15	3350	01	4771		8 bth P.
Ref GC	02750	Harmatton	16	1962	01	2285		
Ref GC	02500	Sopot	14	3645	04	4573		
Ref GC	02250	Naleczow	14	1924	04	2638		6 bth P.
..Subtotals.. 33 records, type = Ref GC								
Research	07200	Mikhail	16	8445	01	8757		Carries a helicopter
..Subtotals.. 1 records, type = Research								
RoRo/Ferry	09600	Sassnitz	18	1850	01	unl		27 bth P, 800 dk P; Rail vehicles; Stern & side do
RoRo/Ferry	09600	Warnemunde	18	1564	01	unl		Rail vehicles; bow door; 32 bth P., 800 dk P.
..Subtotals.. 2 records, type = RoRo/Ferry								
RoRo/GC	09560	Inowroclaw	18	7203	01	unl	354	12 bth P.; 2 stern doors w/ramps
RoRo/GC	09100	Akademik Artisimovich	17	4477	06	10200	235	
RoRo/GC	09048	Yuriy Levitan	18	9141	01	N/A	412	(+1) More ships of this class will be built
RoRo/GC	08000	Inzhener Machulskiy	17	6128	09	15430		Stern door, Qtr ramp
RoRo/GC	07360	Mikolaj Kopernik	15	2500	02	unl		41 bth P.; Rail vehicles; Stern & side doors, ramp
RoRo/GC	06420	Stakhanovets Kotov	14	5717	03	10020	268	Stern door/ramp
RoRo/GC	06100	Ivan Skuridin	17	4600	12	11610	242	Bow door
RoRo/GC	06100	Yuriy Avot	17	5500	09	11610	242	Bow door; similar to Ivan Skuridan class
RoRo/GC	05760	Izvestiya	16	12600	02	16040	380	Qtr stern door/ramp
RoRo/GC	03000	Inselsberg	13	4470	01	8504		12 P.; Stern door
RoRo/GC	02000	Kessulaid	13	1532	05	4543	115	
..Subtotals.. 11 records, type = RoRo/GC								
Tanker	09600	Internatsional	16	20000	10	unl		Oil 27,216
Tanker	09600	Plyavinyas	15	19350	07	928		Oil 24,670

type	shp	ship class	spd	dwt	total	net cargo	teu	notes
Tanker	09000	Velikiy Oktyabr	16	16540	14	unl		
Tanker	07300	Aue	15	23815	01	11091		L 22,081; Net cargo is grain storage capacity
Tanker	06000	Sergey Tyulenin	unl	4987	06	unl		Liquid capacity unlisted in Lloyd's, est. Oil 6,00
Tanker	05050	Maxhutte	13	12800	01	18995		Oil 11,810
Tanker	04670	Tarndbrzeg	14	9813	04	unl		L 5,543; Sulphur 5,607
Tanker	04000	Rava Russkaya	12	11695	01	1118		Oil 13,772
Tanker	04000	Yelsk	13	12081	07	1118		Oil 14,140
Tanker	03500	Kapitan Shvetsov	13	5780	11	unl		Oil 3,265
Tanker	03351	Kaliningradneft	14	5873	17	203		Oil 6,420; used as replenishment tankers
Tanker	03351	Ventspils	14	6297	05	unl		Liquids unlisted, est. 6,800; used as Icebreaker
Tanker	03000	Ivan Zemnukhov	unl	4987	06	unl		Liquid capacity unlisted in Lloyd's, est. Oil 6,00
Tanker	02900	Altay	14	4997	36	187		L 5,908
Tanker	02900	Argon	14	4399	31	174		Oil 5,328
Tanker	02850	Aliot	14	3319	03	unl		L 2,492; Chemicals
Tanker	02250	Buna	12	1760	02	unl		L 1,046; chemical
Tanker	02000	Kripton	13	1660	41	unl		Oil 2,024
Tanker	01600	Bolshevik Karayev	10	4717	27	unl		Oil 5,850
Tanker	01600	Mangyshlak	11	4719	06	unl		Oil 6,170
Tanker	01320	Nefterudovoz	11	2848	36	1821		Oil 3,556
Tanker	01250	Altair	12	1800	12	unl		L 2,024

..Subtotals.. 22 records, type = Tanker

TOTAL

Printed 240 of the 345 records.

APPENDIX E

THE SOVIET AUXILIARY FLEET

Lloyd's Registry Representative Ship in Class	Number in Class	Fishing	Tug Salvage	Research	<1000 shp Cargo	Oth
Kengarags	15	15				
Kustanay	5	5				
Kamchatskie Gory	3	3				
Vostock	1	1				
Kosmonaut Vladmir Kom	1			1		
Kosmonaut Yuriy Gag	1			1		
Professor Baranov	36	36				
Vilis Lacis	8	8				
Severouralsk	7	7				
Pionersk	14	14				
Primorye	6					6 A
Atlantik	175	175				
Akademik Korolyov	4			4		
Kerch	85	85				
Pushkin	6	6				
Pushkin - Modified	13	13				
Mayakovskiy	11	11				
Mayakovskiy - Modified	176	176				
Akademik Knipovich	11			11		
Odissey - (looks just like the Mayakovskiy class - submersible support hold)	2			2		
Zakarpatye	3			3		
Leskov	10	10				
Juniper	5	5				
Bertolt Brecht	4	4				
Walter Dehmel	6	6				
Super Atlantik - +3,000 Tn	178	178				
Vityaz	2			2		
Akademik Mstislaw Kel.	1			1		
Galali	2	2				
Ristna - (Space monitor)	1			1		
Petr Lebedev	2			2		
Indigirka	3	3				
Ernst Haeckel	1			1		
Zvyeroboy	26	26				
Bodo Uhse	2	2				
Martin Andersen Nexo	1	1				
Mikhail Lomonosov	1			1		
Havana	5	5				
Kuba	1	1				
Icha	1	1				
Tsiklov	2	2				
Nordsee	14	14				
Laskara	18	18				
Jana	7	7				
Zelenogorsk	5	5				

APPENDIX E

THE SOVIET AUXILIARY FLEET continued

Lloyd's Registry Representative Ship in Class	Number in Class	Fishing	Tug Salvage	Research	<1000 shp Cargo	O
Perkun	1		1			
Dovator (Shallow water hydrofoil)	30					
Admiral Golovko	19	19				
Alexsandrovsk	6		6			
Kirovsk	5	5				
Alushta - (Pass. Ferry)	7					
Ingul	2	2				
Baykal - (Tanker)	7				7	
Musson	9			9		
Stroptivyy	7	7				
Inguri - (Tanker)	1				1	
Akademik Shuleykin	6			6		
Nataliya Kov.	3	3				
Abkhaziya	4			4		
Akademik Kurchatov	3			3		
Kopet - Dag	31	31				
Balakhna	14	14				
Aguila	3	3				
Baskunchak	7			7		
Kometa	28	28				
Smolnyy	27	27				
Andromeda	4	4				
Columbia	3	3				
Vega	11	11				
Profesor Siedlecki	1			1		
Carina	1	1				
Retezatul	14	14				
Tarusa	65	65				
Wlocznik	2	2				
Akademick Ser.	1			1		
Mikolaj Kopernik	2	2				
Grumant	17	17				
Skryplev	8	8				
Sprut	1	1				
Buran	3	3				
Delta Dunar II	2	2				
Regulus	5	5				
Sejwal	9	9				
Malakhov Kurgan	3	3				
Druzhba	1	1				
Professor Bogorov	6			6		
Rodina	10	10				
Lamut	2	2				
Vsevolod Beryezkin	10			10		
Kaliningrad	7	7				
Yantarnyy	9	9				
Aktyubinsk	11	11				

THE SOVIET AUXILIARY FLEET continued

Lloyd's Registry Representative Ship in Class	Number in Class	Fishing	Tug Salvage	Research	<1000 shp Cargo	Oth
Konstitutsiya	6	6				
Pyatidyesy...	3	3				
Aytodor	1	1				
Karskoye More	2	2				
Bolon	9	9				
Zulawy	4	4				
Karl Liebknecht	21	21				
Rizhskiy Zaliv	10	10				
Priboy	6	6				
Andrey Zakharov	13	13				
Prut	2	2				
Ostruvrusskiy	12	12				
Leninskiy Loch	5	5				
Ivan Aivazovskiy	47	47				
Galata	1				1 GC	
Malchin	2				2 GC	
Tatarstan	3	3				
Zulawy	4	4				
Medveditsa	3	3				
Palekh	1			1		
Zvaygzne	14	14				
Ina	2				2 GC	
Ivan Aivazovskiy	1	1				
Yurilsk	14	14				
Kapitan Kanski	3				3 GC	
Kekhra	21				21 GC	
Krasnal	6				6 GC	
Ozernoye (Tanker)	3				3	
Pervomaysk	4	4				
Tsiklon	4	4				
Olyutorka	1	1				
Nikolai Zubov	9			9		
NB - 18	4		4			
Yaguar	4		4			
Kapitan Checkin	6		6			
Ingul	1	1				
Belona	11	11				
Rybak Morski	2	2				
Sever	1			1		
Otto Schmidt (Icebreaker)	1			1		
Rybak	23	23				
Andizhan	41	41				
Afala	30	30				
Luchegorsk	102	102				
MB - 29	8		8			
Pluton	9			9		
Aleksandr Ivan. Voeykov	2			2		
Kavkaz	2			2		

THE SOVIET AUXILIARY FLEET continued

Lloyd's Registry Representative Ship in Class	Number in Class	Fishing	Tug Salvage	Research	<1000 shp Cargo	Other
Junge Garde	2	2				
Rodina (w/helo deck)	10	10				
Severodvinsk	11	11				
Sovietskaya Arktika	1	1				
Bataysk	1	1				
Polyus	1			1		
Balkhash	2			2		
Longva	1			1		
Yeyskiy Liman	2	2				
Brestskaya Krepost	1	1				
Tarusa	59	59				
Ivan Bochkov	21	21				
Sprut	5	5				
Kaspiy	30	30				
Dmitry Ovtsyn	9			9		
Sergey Kravkov	1			1		
Belinskiy (River pass. ferry - hydrofoil)	16					16
TOTAL ALL SHIPS:	1,964	1,714	29	116	46	59

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