Trade with Socialist Countries

In the late 1980s, the Soviet Union traded with fourteen socialist countries. The political and economic relationships between the Soviet Union and these countries determine the four groups into which these countries can be divided: members of Comecon; Yugoslavia; China; and the developing communist countries of Cambodia, Laos, and the Democratic People's Republic of Korea (North Korea).

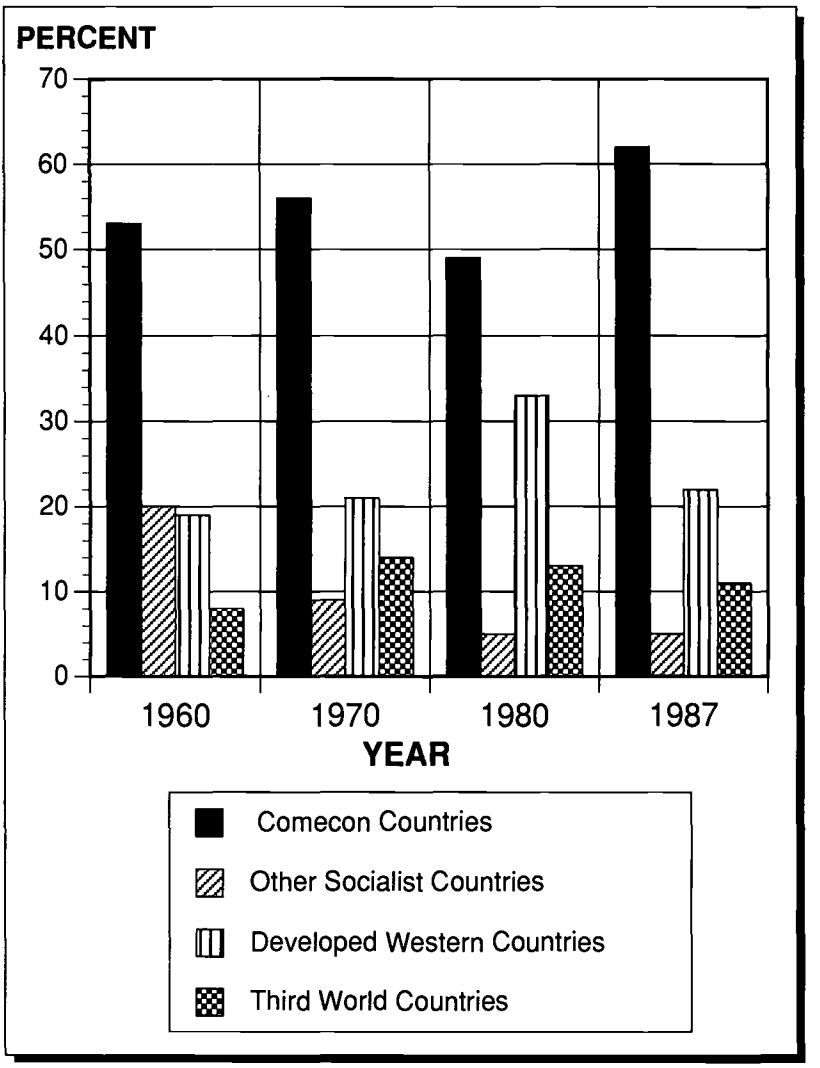
Business with socialist countries was conducted on a bilateral, country-by-country basis in which imports balanced exports. Soviet oil exports to these countries bought machinery and equipment and industrial consumer goods, as well as political support without the expenditure of freely convertible foreign currency. In addition, Soviet aid programs, which took the form of direct loans or trade subsidies, almost exclusively involved socialist countries.

The Council for Mutual Economic Assistance

The Soviet Union formed the Council for Mutual Economic Assistance (Comecon) in 1949, in part to discourage the countries of Eastern Europe from participating in the Marshall Plan (see Glossary) and to countereact trade boycotts imposed after World War II by the United States and by Britain and other West European countries. Ostensibly, Comecon was organized to coordinate economic and technical cooperation between the Soviet Union and the member countries. In reality, the Soviet Union's domination over Comecon activities reflected its economic, political, and military power. In 1989 Comecon comprised ten countries: the six original members—Bulgaria, Czechoslovakia, Hungary, Poland, Romania, and the Soviet Union—plus the German Democratic Republic (East Germany, which joined in 1950), Mongolia (1962), Cuba (1972), and Vietnam (1978). Albania, although it joined in February 1949, stopped participating in Comecon activities in 1961 and formally withdrew in 1987.

Since 1949 the Soviet Union has traded primarily with other Comecon members (see fig. 25). In 1960 the Soviet Union sent 56 percent of its exports to and received 58 percent of its imports from Comecon members. From that time, the volume of this trade has steadily increased, but the proportion of Soviet trade with Comecon members decreased as the Soviet Union sought to increase trade with Western industrialized countries. In contrast to 1960, trade with Comecon members accounted for only 42 percent of Soviet exports and 43 percent of Soviet imports in 1980.

The European members of Comecon have looked to the Soviet Union for oil; in turn, they have provided machinery, equipment,



Source: Based on information from Gosudarstvennyi komitet po statistike, *Narodnoe khoziaistvo SSSR v 1987 g.*, Moscow, 1988.

Figure 25. Composition of Foreign Trade, Selected Years, 1960–87

agricultural goods, industrial goods, and consumer goods to the Soviet Union. Because of the peculiarities of the Comecon pricing system, throughout the 1970s and early 1980s Comecon prices for Soviet oil were lower than world oil prices. Western specialists have debated the political motivation of this implicit price subsidy to Comecon members. The cohesiveness within Comecon members

seemed remarkable when in 1985 the fall in the world price left Comecon members paying above-market prices for Soviet oil.

The membership of Cuba, Mongolia, and Vietnam in Comecon has served Soviet foreign policy interests more than the economic welfare of Comecon members. In general, the more economically developed European members have supported the three less developed members by providing a large market for their exports, often at above-market prices. Most of Cuba's sugar and nickel and all of Mongolia's copper and molybdenum have been imported by the Soviet Union. In addition, the Soviet Union has established naval and air bases in Cuba and Vietnam.

Since 1985 Gorbachev has called for an increase in trade with Comecon members. At the Twenty-Seventh Party Congress in February–March 1986, both he and Prime Minister Nikolai I. Ryzhkov stressed the need to improve cooperation with the socialist countries on the basis of Comecon's *Comprehensive Program for Scientific and Technical Cooperation to the Year 2000.* This program stressed the self-sufficiency of Comecon countries in five key areas: electronics, automation of production, nuclear power, biotechnology, and development of new raw materials. It also called for improvement of plan coordination, joint planning, Comecon investment strategy, production specialization, and quality of machinery and equipment exported to the Soviet Union (see Appendix B).

Yugoslavia

In 1964 Yugoslavia negotiated a formal agreement of cooperation with Comecon. This relationship allowed Yugoslavia to maintain its nonaligned position while acquiring almost all the rights and privileges of a full Comecon member. In the 1980s, the Soviet Union's trade relationship with Yugoslavia resembled its relationship with full members of Comecon. The Soviet Union exported fuel, ferrous metals, plastics, and fertilizer to Yugoslavia. Yugoslavia's machine-tool, power-engineering, shipbuilding, and consumer goods industries supplied the Soviet Union with soft-currency goods (see Glossary).

In the late 1970s and early 1980s, Yugoslavia became more dependent on Soviet oil as hostilities in the Persian Gulf cut off its supply of Iraqi oil. In addition, from 1970 well into the 1980s actual trade with the Soviet Union exceeded planned trade volumes. Thus, in 1983 the Yugoslav government informed Soviet Prime Minister Nikolai A. Tikhonov of its desire to decrease trade with the Soviet Union in the mid- to late 1980s. Because of the huge foreign currency debt accumulated by Yugoslavia from 1981 to 1985, however, the Soviet Union remained its most important trade

partner in the late 1980s. In fact, for some Yugoslav products, such as shoes, the Soviet Union was the sole foreign buyer.

China

In the 1950s, the Soviet Union claimed half of China's foreign trade. The political rift that developed between the two countries in the late 1950s culminated in 1960 with the withdrawal of more than 1,000 Soviet specialists from China and an official break in trade relations in 1964. Although it had been only an observer, China stopped attending Comecon sessions in 1961. Economic relations between the Soviet Union and China resumed in 1982. Primarily as a result of Soviet political concessions and pressures on the Chinese to expand trade, trade volume between the two countries increased tenfold between 1982 and 1987.

In the 1980s, the Soviet Union proved to be an ideal trade partner for China. China's exports were not competitive on the world market, and its foreign currency reserves were severely depleted by record foreign trade deficits in 1984 and 1985. Likewise, the Soviet Union, producing dated technology that was difficult to market in more industrially advanced countries and acquiring a growing hard-currency debt, eagerly pursued the Chinese market. Each country would sell the other goods it could not market elsewhere, and each could conserve scarce hard currency by bartering. The Soviet Union possessed machinery, equipment, and technical know-how to help China develop its fuel and mineral resources and power, transportation, and metallurgical industries. China could offer a wealth of raw materials, textiles, and agricultural and industrial consumer goods.

Stepped-up economic relations reflected Soviet flexibility in overcoming various political and administrative stumbling blocks. By mid-1988 Gorbachev was speaking of reducing Soviet troops on the Chinese border, Vietnam had removed half of its troops from Cambodia, and Soviet troops had begun their withdrawal from Afghanistan (see Sino-Soviet Relations, ch. 10). Reforms of the Soviet foreign trade complex established free trade zones (see Glossary) in the Soviet Far East and Soviet Central Asia, simplifying border trade between the two countries. Soviet trade officials persuaded the Chinese to expand business ties beyond border trade into joint ventures, coproduction contracts, and the export of surplus Chinese labor to the Soviet Union. The Peking Restaurant in Moscow, specializing in Chinese cuisine, became the first joint venture between the Soviet Union and China. In April 1988, China's minister of foreign economic relations and trade, Zheng Toubin, stated that China would continue to expand trade with

the Soviet Union "at a rapid pace," thus rewarding Soviet persistence in expanding trade with China.

Cambodia, Laos, and North Korea

Soviet economic relations with non-Comecon communist states have taken the form of aid and trade. In 1987 approximately 85 percent of Soviet aid went to the communist Third World. By far the largest share of these funds was absorbed by Cuba, Mongolia, and Vietnam. The rest was left to Cambodia, Laos, and North Korea. Pledges of Soviet aid increased steadily from 1985 through 1988 and were divided evenly between direct aid and trade subsidies. Commodity exchange was characterized by the Soviet Union's providing machinery, fuel, and transportation equipment in return for Laotian ores and concentrated metals, North Korean rolled ferrous metals and labor, and Cambodian rubber.

Trade with Western Industrialized Countries

The Western industrialized countries include the countries of Western Europe, as well as Australia, Canada, Japan, New Zealand, South Africa, and the United States (see table 47, Appendix A). Soviet trade with industrialized countries, except Finland, consisted of simple purchases paid for on a cash or credit basis, direct exchange of one good for another (Pepsi-Cola for Stolichnaya vodka, for example), or industrial cooperation agreements in which foreign firms participated in the construction or operation of plants in the Soviet Union. In the latter instances, payments were rendered in the form of the output of new plants. By contrast, trade with Finland, which does not have a convertible currency, was conducted through bilateral clearing agreements, much like Soviet trade with its Comecon partners.

In the 1970s and 1980s, the Soviet Union relied heavily on various kinds of fuel exports to earn hard currency, and Western partners regarded the Soviet Union as an extremely reliable supplier of oil and natural gas. In the 1980s, the Soviet Union gave domestic priority to gas, coal, and nuclear power in order to free more oil reserves for export. This was necessary because of higher production costs and losses of convertible currency resulting from the drop in world oil prices. The development of natural gas for domestic and export use was also stimulated by these factors. Between 1970 and 1986, natural gas exports rose from 1 percent to 15 percent of total Soviet exports to the West.

Because of the inferior quality of Soviet goods, the Soviet Union was unsuccessful in increasing its exports of manufactured goods. In 1987 only 18 percent of Soviet manufactured goods met world

technical standards. As an illustration of these problems in quality, Canadian customers who had purchased Soviet Belarus tractors often found that the tractors had to be overhauled on arrival before they could be sold on the Canadian market. In 1986 less than 5 percent of Soviet exports to the West consisted of machinery. Other Soviet nonfuel exports in the 1990s included timber, exported primarily to Japan, and chemicals, the export of which grew substantially in 1984 and 1985.

In the 1980s, Soviet imports from Western industrialized countries generally exceeded exports, although trade with the West decreased overall. One-half of Soviet agricultural imports were from developed countries, and these imports made up a considerable portion of total imports from the West. Industrial equipment formed one-quarter of Soviet imports from the West, and iron and steel products, particularly steel tubes for pipeline construction, made up most of the rest. Over the course of the 1980s, high-technology items gained in importance as well.

In the 1970s and 1980s, Soviet trade with the Western industrialized countries was more dynamic than was Soviet trade with other countries, as trade patterns fluctuated with political and economic changes. In the 1970s, the Soviet Union exchanged its energy and raw materials for Western capital goods, and growth in trade was substantial. Soviet exports jumped 55 percent, and imports jumped 207 percent. The Soviet Union ran a trade deficit with the West throughout this period.

In 1980 the Soviet Union exported slightly more to the West than it imported. After a temporary shortage of hard currency in 1981, the Soviet Union sought to improve its trade position with the industrialized countries by keeping imports at a steady level and by increasing exports. As a result, the Soviet Union began to run trade surpluses with most of its Western partners. Much of the income earned from fuel exports to Western Europe was used to pay off debts with the United States, Canada, and Australia, from which the Soviet Union had imported large quantities of grain.

In 1985 and 1986, trade with the West was suppressed because of heightened East-West political tensions, successful Soviet grain harvests, high Soviet oil production costs, a devalued United States dollar, and falling oil prices. Despite increases in oil and natural gas exports, the Soviet Union's primary hard-currency earners, the country was receiving less revenue from its exports to the West. The Soviet Union sold most of its oil and natural gas exports for United States dollars but bought most of its hard-currency imports from Western Europe. The lower value of the United States dollar meant that the purchasing power of a barrel of Soviet crude

Carpet weavers and their supervisor in Baku, Azerbaydzhan Republic. Much of the production is exported. Courtesy Jimmy Pritchard

oil, for example, was much lower than is the 1970s and early 1980s. In 1987 the purchasing power of a barrel of Soviet crude oil in exchange for West German goods had fallen to one-third of its purchasing power in 1984.

With the exception of grain, phosphates used in fertilizer production, and high-technology equipment, Soviet dependence on Western imports historically has been minimal. A growing hard-currency debt of US$31 billion in 1986 led to reductions in imports from countries with hard currencies. In 1988 Gorbachev cautioned against dependence on Western technology because it required hard currency that "we don't have." He also warned that increased borrowing to pay for imports from the West would lead to dependence on international lending institutions.

The United States

Trade between the United States and the Soviet Union averaged about 1 percent of total trade for both countries through the 1970s and 1980s. Soviet-American trade peaked in 1979 at US$4.5 billion, exactly 1 percent of total United States trade. The Soviet Union continuously ran a trade deficit with the United States in the 1970s and early 1980s, but from 1985 through 1987 the Soviet Union cut imports from the United States while maintaining its level of exports to balance trade between the two countries.

In 1987 total trade between the United States and the Soviet Union amounted to US$2 billion. The Soviet Union exported chemicals, metals (including gold), and petroleum products in addition to fur skins, alcoholic beverages, and fish products to the United States and received agricultural goods—mostly grain—and industrial equipment in return. The value of exports to the Soviet Union in 1987 amounted to US$1.5 billion, three-quarters of which consisted of agricultural products and one-quarter industrial equipment.

Competition from other parts of the world, improvements in Soviet grain production, and political disagreements between the two countries adversely affected American agricultural exports to the Soviet Union in the 1980s. In 1985 and 1986, trade was the lowest since 1973. The Soviet Union had turned to Canada and Western Europe for one-third of its grain supplies, as well as to Argentina, Eastern Europe, Australia, and China. United States government price subsidies helped to expand grain exports in 1987 and 1988.

The United States has long linked trade with the Soviet Union to its foreign policy toward the Soviet Union and, especially since the early 1980s, to Soviet human rights policies (see table 48, Appendix A). In 1949, for example, the Coordinating Committee for Multilateral Export Controls (CoCom—see Glossary) was established by Western governments to monitor the export of sensitive high technology that would improve military effectiveness of members of the Warsaw Pact (see Appendix C) and certain other countries. The Jackson-Vanik Amendment, which was attached to the 1974 Trade Reform Act, linked the granting of most-favored-nation status (see Glossary) to the right of Soviet Jews to emigrate.

In 1987 the United States had reason to reassess its trade policy toward the Soviet Union. The Soviet Union had restructured and decentralized authority for trade under the Ministry of Foreign Trade, made improvements in human rights policies, cooperated in arms control negotiations, and shown a willingness to experiment with joint ventures. Furthermore, the United States government recognized that restrictive trade policies were hurting its own economic interests. In April 1988, Soviet and American trade delegations met in Moscow to discuss possibilities for expanded trade. Through increased trade with the United States, the Soviet Union hoped to learn Western management, marketing, and manufacturing skills. Such skills would increase the ability of the Soviet Union to export manufactured goods, and thus earn hard currency, and would improve its competitiveness on the world market. The delegations declared that Soviet-American cooperation would be

American fast food served near Gor'kiy Park, Moscow
Courtesy Jimmy Pritchard

expanded in the areas of food processing, energy, construction equipment, medical products, and the service sector.

Western Europe

In the mid-1980s, West European exports to the Soviet Union were marginal, less than 0.5 percent of the combined gross national product (GNP—see Glossary) of countries of the Organisation for Economic Co-operation and Development (OECD—see Glossary). OECD countries provided the Soviet Union with high-technology and industrial equipment, chemicals, metals, and agricultural products. In return, Western Europe received oil and natural gas from the Soviet Union.

Although oil and gas were the primary Soviet exports to Western Europe, they represented only a small percentage of Western Europe's substantial fuel imports: Soviet oil provided 3 percent and natural gas 2 percent of the energy consumed in Western Europe. The completion of the Urengoy-Uzhgorod export pipeline project increased the importance of Soviet natural gas to Western Europe in the second half of the 1980s. In 1984 France, Austria, the Federal Republic of Germany (West Germany), and Italy began receiving natural gas from western Siberia through the pipeline, for which the Soviet Union was paid in hard currency, pumping equipment,

and large-diameter pipe. By 1990 the Soviet Union expected to supply 3 percent of all natural gas imported by Western Europe, including 30 percent of West Germany's gas imports.

Unlike the United States, the countries of Western Europe have not viewed trade as a tool to influence Soviet domestic and foreign policies. Western Europe rejected the trade restrictions imposed by the United States after the Soviet invasion of Afghanistan in 1979 and the declaration of martial law in Poland in 1980. From 1980 to 1982, the United States embargoed the supply of equipment for the Urengoy-Uzhgorod natural gas pipeline, but Western Europe ignored United States pleas to do the same.

Despite the poor relations between the superpowers in the early and mid-1980s, Western Europe tried to improve international relations with the Soviet Union. One major step in this direction was the normalization of relations between Comecon and the European Economic Community (EEC). After fifteen years of negotiations, the EEC approved an accord that established formal relations with Comecon effective June 25, 1988. Although it did not establish bilateral trade relations, the agreement "set the stage" for the exchange of information. This accord marked Comecon's official recognition of the EEC.

Japan

In 1985 trade with the Soviet Union accounted for 1.6 percent of Japanese exports and 1 percent of Japanese imports; Japan was the Soviet Union's fourth most important Western trading partner (see table 49, Appendix A). Japan's principal exports to the Soviet Union included steel (approximately 40 percent of Japan's exports to the Soviet Union), chemicals, and textiles. The Soviet Union exported timber, nonferrous metals, rare-earth metals, and fuel to Japan. In 1986, despite a reduction in trade between the two countries, the Soviet Union had a trade deficit with Japan. In 1987 trade dropped another 20 percent.

Numerous controversies have thwarted Soviet-Japanese trade. The Toshiba affair, in which Japan was accused of shipping equipment to the Soviet Union that was prohibited by CoCom, caused Japanese-Soviet trade to decrease in 1987. In addition, the Japanese constantly prodded the Soviet Union to return the islands off the Japanese island of Hokkaido that had come under Soviet control after World War II (see Soviet-Japanese Relations, ch. 10). For its part, the Soviet Union complained of the trade imbalance and static structure of Japanese-Soviet trade.

In the late 1980s, the Soviet Union tried to increase its exports to Japan and diversify the nature of the countries' relationship.

Soviet proposals have included establishing joint enterprises to exploit natural resources in Siberia and the Soviet Far East, specifically, coal in the southern Yakutiya of Siberia and petroleum on Sakhalin; cooperating in the monetary and credit fields; jointly surveying and studying marine resources and peaceful uses of space; and establishing joint activities in other countries. The Soviet Union also proposed branching out into joint ventures in the chemical and wood chip industries, electronics, machine tools, and fish processing. The first Japanese-Soviet joint enterprise, a wood-processing plant in the Soviet Far East, began operation in March 1988. The Soviet Union provided the raw materials, and Japan supplied the technology, equipment, and managerial expertise.

Finland

In contrast to the variable trade relationships the Soviet Union has had with other West European countries, its relationship with Finland has been somewhat stable because of five-year agreements that regulated trade between the countries. The first was established in 1947, and 1986 marked the beginning of the eighth. Accounting procedures and methods of payment were agreed upon every five years as well by the Bank of Finland and Vneshtorgbank. A steady growth in trade between the two countries occurred throughout the 1970s and 1980s.

In the late 1980s, Finland was the Soviet Union's second most important trading partner among the Western nations, after West Germany. Trade with Finland, however, was based on bilateral clearing agreements (see Glossary) rather than on exchange of hard currency used with other Western trading partners. In 1986 the Soviet Union shipped 4 percent of its exports to and received 3 percent of its imports from Finland. Finland provided the Soviet Union with ships, particularly those suited to Arctic conditions; heavy machinery; and consumer goods such as clothing, textiles, processed foodstuffs, and consumer durables. The Soviet Union exported oil, natural gas, and fuel and technology for the nuclear power industry.

The system of bilateral clearing agreements on which Soviet-Finnish trade was based required that any increase in Finnish imports from the Soviet Union be accompanied by a corresponding increase in exports to the Soviet Union in order to maintain the bilateral trade balance. At the beginning of the 1980s, Finland increased its imports of Soviet oil, which allowed it to increase its exports to the Soviet Union. This procedure accounted for the steady growth in Soviet-Finnish trade into the late 1980s. By 1988 about 90 percent of Soviet exports to Finland consisted of oil.

Because the Finns imported more oil than they could consume domestically, they reexported it to other Scandinavian and West European countries. The Finns complained in late 1987 and early 1988 of a decline in Soviet ship orders and delinquent payments. The share of Finland's exports to the Soviet Union, which had previously been as high as 25 percent, dropped to 15 percent in 1988.

Trade with Third World Countries

The Third World embraces those countries the Soviet Union terms "developing countries." This category includes those countries of socialist orientation that have some sort of privileged economic affiliation with the Soviet Union, such as Afghanistan, Angola, Iraq, and Nicaragua, but excludes the developing countries ruled by Marxist-Leninist (see Glossary) parties, such as Cambodia, Laos, and Vietnam. Soviet trade with the Third World has been marked by two characteristics. First, although the Soviet Union has generally played only a minor role in Third World trade, Soviet imports or exports have formed a large portion of the total trade of some countries. Second, the Soviet Union has concentrated its trade with the Third World in the hands of relatively few partners. For example, in 1987 India, Iran, Iraq, Syria, Argentina, Egypt, Turkey, Afghanistan, Nigeria, and Malaysia together accounted for 75 percent of Soviet imports from and 80 percent of Soviet exports to the Third World.

Although Soviet trade with the Third World increased in volume from 1965 through 1985, it remained between 13 and 15 percent of total Soviet trade for exports and 10 and 12 percent for imports. The Third World's trade with the Soviet Union, however, decreased in the 1970s and into the 1980s. These data include Cuba, since the only figures available concerning Third World trade with the Soviet Union include Cuba. As a percentage of overall Third World trade, the Soviet Union's share fell from 3.9 percent in 1970 to 2.5 percent in 1981. Deducting Soviet trade with Cuba, which has been considerable, would show an even smaller role played by the Soviet Union in Third World trade. In the late 1980s, the Soviet Union sought arrangements that would allow it to maintain a level of trade that minimized the loss of hard currency.

Balance of Trade

During the 1980s, the Soviet Union exported more to Third World countries than it imported from them. Official Soviet statistics showed a trade deficit for this period, but arms and military equipment sales, which were not reported and are thus termed "unidentifiable" exports, accounted for approximately 50 percent

Icebreaker Otto Schmidt, *used to clear the way for cargo ships*
Courtesy United States Navy

of total exports to the Third World throughout the 1980s. Thus, the Soviet Union's hard-currency balance of trade (see Glossary), including arms sales, with the Third World was positive from 1980 through 1986. In fact, the Soviet Union's positive hard-currency trade balance with the Third World exceeded its hard-currency deficit with the Western industrialized countries in 1985 and 1986. For this reason, the Soviet Union showed an overall positive hard-currency trade balance for these years.

Until the mid-1970s, bilateral clearing agreements were the primary means by which the Soviet Union settled accounts with its Third World partners. By the early 1980s, hard-currency payments had become the preferred means of settlement. Clearing agreements were used in less than half of all trade transactions. On occasion, the Soviet Union bartered arms for oil.

Composition of Trade

Not including arms sales, machinery accounted for 20 percent of total sales to the Third World in 1985. Soviet exports of machinery took up an even higher relative share of total sales to Algeria, Iran, Nigeria, Pakistan, the People's Democratic Republic of Yemen (South Yemen), and Turkey. From 1980 through 1984, fuel, mostly oil, made up approximately 33 percent of overall Soviet

exports to the Third World, including 50 percent of its exports to Asia and 60 to 70 percent of its exports to Latin America. Since 1985 greater competition on the world market resulting from falling world oil prices and rising Soviet extraction costs has prompted the Soviet Union to try to replace its export of oil with manufactured goods.

The Soviet Union has been the largest arms exporter to the Third World for a number of years. Major arms customers were concentrated in the belt of countries that stretches from North Africa to India, close to the Soviet Union's southern border. Some 72 percent of Soviet weapons exports went to Algeria, India, Iraq, Libya, and Syria. Other important customers included Afghanistan, Angola, Ethiopia, South Yemen, and the Yemen Arab Republic (North Yemen). The Soviet Union lost arms customers in the 1980s, however, when Brazil and Egypt began to expand their arms sales to the Third World. India, which had experienced improvements in its hard-currency balance in the 1980s, also started to buy arms from other suppliers. In an effort to retain its share of Indian arms customers, the Soviet Union continued to offer India its most sophisticated weapons at even more attractive rates.

The Soviet Union has long been an importer of Third World agricultural products. These imports increased dramatically after 1980 because of poor Soviet harvests from 1979 into the early 1980s and the United States grain embargo against the Soviet Union in 1980 and 1981. From 1980 to 1985, food and agricultural goods, half of them grain, made up 50 percent of Soviet imports from the Third World. In the first nine months of 1986, the decrease in grain purchases accounted for most of the 22 percent drop in imports from the Third World.

Africa and Latin America supplied most of the food imports other than grain. Throughout the 1980s, food imports steadily rose, but imports from individual countries fluctuated. Because of these fluctuations, the Soviet Union was often considered an unstable trade partner compared with Western customers.

Because the Soviet Union was a major producer and exporter of most of the world's minerals, its import requirements for many other commodities (nonferrous metals, in particular) were sporadic. Nonetheless, the Soviet Union was a stable importer of some minerals, particularly bauxite and phosphate rock. The Soviet Union imported up to 50 percent of its bauxite from Guinea, Guyana, India, Indonesia, and Jamaica. Phosphate rock was abundant in the Soviet Union, but because extraction costs were high most of this mineral was imported from Morocco and Syria.

A decline in Soviet imports of manufactured goods in the 1970s led Third World countries to pressure the Soviet Union to increase the import of these goods in the 1980s. In 1982 the Soviet demand for Third World manufactures began to rise. By 1984 manufactured goods, including manufactured consumer goods, made up 25 percent of Soviet imports from the Third World.

Beginning in 1973, in an effort to earn hard currency, the Soviet Union began to import oil from Third World countries for reexport to Western industrialized countries. This activity slowed from 1980 to 1982, recovered in 1983 through 1985, and continued to increase in 1986. Late that year, the Soviet Union signed an agreement with the Organization of Petroleum Exporting Countries (OPEC) that restricted the amount of oil it could buy for reexport. By 1988 this agreement had not cut total Soviet oil receipts, however, because oil was paid to the Soviet Union as compensation for arms sales.

Africa, Asia, and Latin America

During the 1980s, the geographical pattern of Soviet-Third World trade changed markedly (see table 50, Appendix A). A decrease in trade with North Africa and the Middle East balanced a substantial increase in trade with sub-Saharan Africa, South Asia, and Latin America.

In 1987 about 50 percent of the Soviet Union's total identified exports to the Third World went to Asia, and India was the Soviet Union's biggest trade partner. In exchange for Soviet oil and oil products, India supplied food, raw agricultural material, clothing, textiles, and machinery. India was also the Soviet Union's sole significant Third World supplier of equipment and advanced technology, e.g., computers and copiers, much of which was produced by Indian subsidiaries of Western multinational corporations. Malaysia, another important partner of the Soviet Union in Asia, was an important supplier of rubber, palm oil, and tin.

From 1980 to 1983, Soviet exports to Africa increased slightly to 30 percent of its Third World exports and decreased thereafter. Imports from Africa fluctuated from 1980 to 1985 but remained at about 25 percent. Nigeria was the Soviet Union's only important trade partner in sub-Saharan Africa, receiving Soviet machinery and exporting cocoa.

Exports to Latin America grew during the 1980s and reached 8 percent in 1985. Latin America's share of Soviet Third World imports was high (40 percent in 1982) because of large imports of Argentine grain. As the Soviet Union's main grain supplier, Argentina was the Soviet Union's most significant import partner

in the Third World in 1980, 1981, and 1983. In 1986 the Soviet Union renewed its grain agreement with Argentina for another five years. However, because of a US$11 billion trade deficit with Argentina that the Soviet Union had amassed from 1980 through 1985 and the successful Soviet harvest of 1986, the Soviet Union cut its grain imports from Argentina drastically. In 1986 they were at a six-year low.

Countries of Socialist Orientation

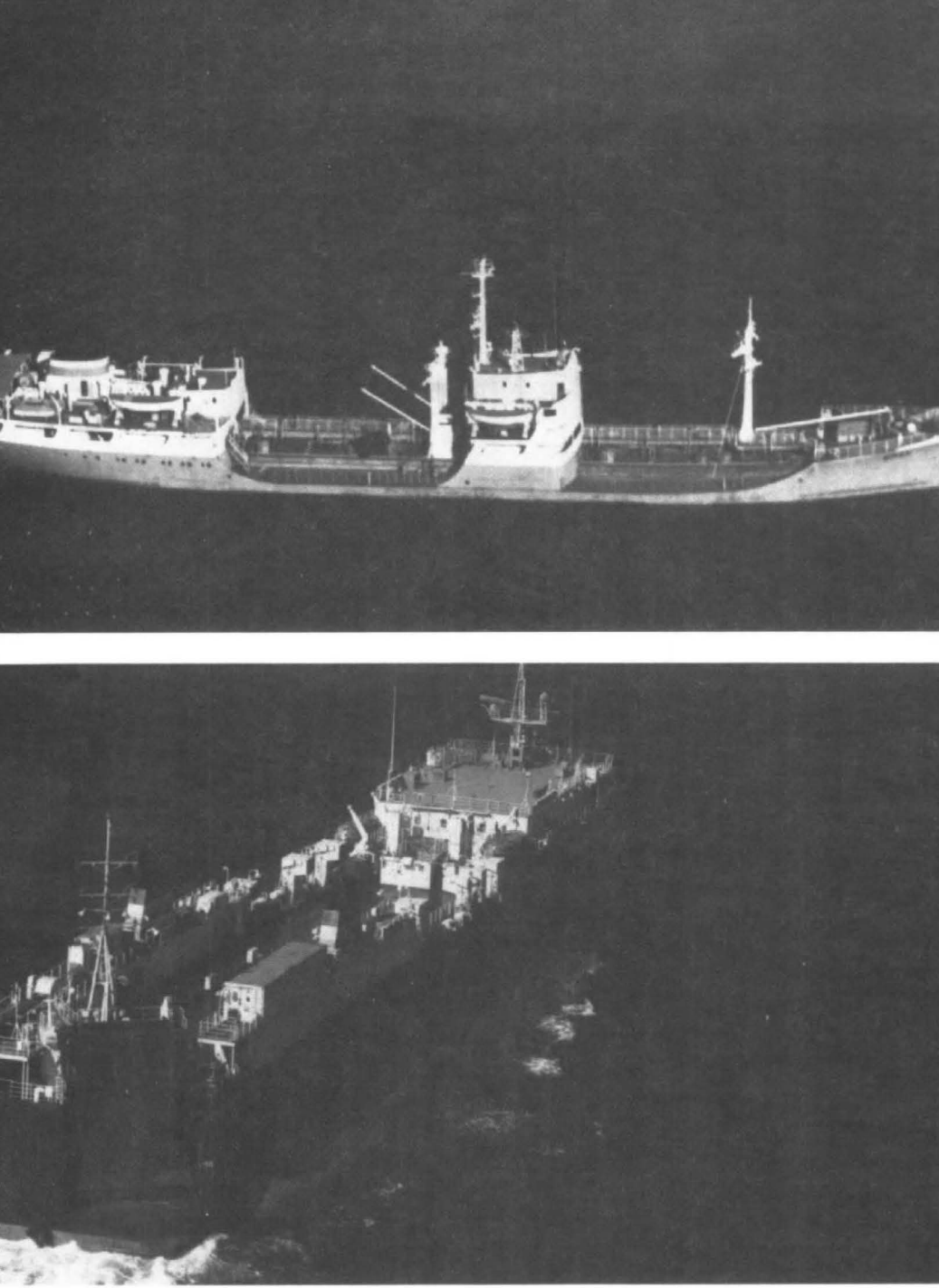
The countries of socialist orientation can be categorized into two groups: those that had observer status in Comecon and those that were not observers but had privileged affiliations with Comecon member countries (see table 51, Appendix A). The Soviet Union's trade with the Third World has always been heavily skewed toward countries of socialist orientation. Soviet aid provided most of the foreign capital for these countries and influenced their domestic economic development significantly. The Soviet Union often profited more politically than economically from this trade: most Soviet surpluses were not repaid but became clearing credit, long-term cooperation credit, or short-term commercial credit.

In 1986 the countries that had formal agreements with, or observer status in, Comecon were Afghanistan, Angola, Ethiopia, Laos, and South Yemen. These countries were all characterized by political instability, low GNP, and low export potential. The share of exports to this group rose from 14 percent of total Soviet identified exports to the Third World in 1980 to 28 percent in the first nine months of 1986. Afghanistan, a recipient of Soviet machinery and military equipment, was the Soviet Union's most significant partner in this group. By contrast, trade with South Yemen was negligible.

Countries that had privileged affiliations with Comecon were Algeria, Benin, Burma, Congo, Guinea, Madagascar, Nigeria, Syria, and Tanzania and, at times, Guinea-Bissau, Mali, Seychelles, and Zimbabwe. Throughout the 1980s, Soviet exports to these countries oscillated, for example, from 27 percent in 1981 to 15 percent in 1983. This fluctuation, as well as fluctuations in imports, was primarily a result of changes in trade with Iraq, a major Soviet arms-for-oil trading partner in the Third World.

Trade with the Organization of Petroleum Exporting Countries

The Organization of Petroleum Exporting Countries (OPEC), particularly Iraq and Algeria, absorbed the largest share of the Soviet Union's "unidentified" exports (see table 52, Appendix A).



Loaded tanker Iman *at sea*
Roll-on/roll-off ship, named for composer Nikolay Rimskiy-Korsakov
Courtesy United States Navy

Although Soviet statistics usually showed a very low or negative trade balance with these countries, the balance was probably high because of arms sales. In the 1980s, some OPEC countries, particularly Iran and Iraq, together with Syria, which was not a member of OPEC, exchanged oil for Soviet arms and military equipment. Oil from these countries was resold to the West for hard currency. In the late 1980s, the Soviet Union attempted to increase its exports of nonmilitary goods to these countries. In May 1986, the Soviet Union and Iraq agreed to increase Soviet nonmilitary equipment sales, and in August 1986 an attempt was made to revive Iraqi gas sales.

Gorbachev's Economic Reforms

When Gorbachev delivered his report on the CPSU's economic policy on June 12, 1985, he noted that growth in exports, particularly machinery and equipment, was slow because the poor quality of Soviet goods prohibited them from being competitive on the world market. In the next three years, Gorbachev introduced many changes that would enable the foreign trade complex to better support his economic policy of acceleration. By May 1988, the structure of the Soviet foreign trade complex had been changed, and operations had been dramatically overhauled (see Structural Reforms, 1986 to Mid-1988, this ch.).

The price reform called for by the Twenty-Seventh Party Congress was an important step in improving Soviet international economic involvement. Soviet officials admitted that pricing was "economically unsubstantiated" and "unrealistic." They understood that although a fully convertible ruble would not be possible for some time, prices that more accurately reflected production costs, supply and demand, and world market prices were essential for developing a convertible currency. The nonconvertible ruble and the Soviet pricing system discouraged Western businessmen who could not accurately project production costs nor easily convert their ruble profits.

The new joint venture law, passed on January 13, 1987, opened up the Soviet economy to foreign participation, particularly in manufacturing. It was believed that the experience gained in such ventures would facilitate integration into the world economy. Specifically, through upgraded production processes, the Soviet Union could export more competitive manufactured goods and decrease its dependency on energy and raw materials to earn hard currency.

In August 1987, the Soviet Union formally requested observer status in the General Agreement on Tariffs and Trade (GATT—see Glossary). The Soviet Union also expressed its desire to join

other international economic organizations and establish contacts with other regional groups. A major step in this direction occurred in 1988 when the Soviet Union signed a normalization agreement with the EEC. The Soviet government, however, professed no interest in joining the World Bank (see Glossary) or the International Monetary Fund (IMF—see Glossary). Although Soviet officials claimed that the international monetary system "was not managed properly," it is more likely that IMF and World Bank regulations were the obstacles: both institutions required that members' currencies be freely convertible and that members provide accurate information concerning gold sales and economic performance.

Gorbachev transformed the role of foreign trade in the Soviet economy. Whereas imports previously were regarded exclusively as a vehicle to compensate for difficulties in the short term, Soviet economists under Gorbachev declared that imports should be regarded as alternatives to domestic investment and that exports should serve to gauge the technical level of domestic production. Foreign economic ties were to support growth in production beyond the capacities of the domestic economy. The Soviet Union could thus take a place in the world market that was commensurate with its scientific and technical progress and political weight.

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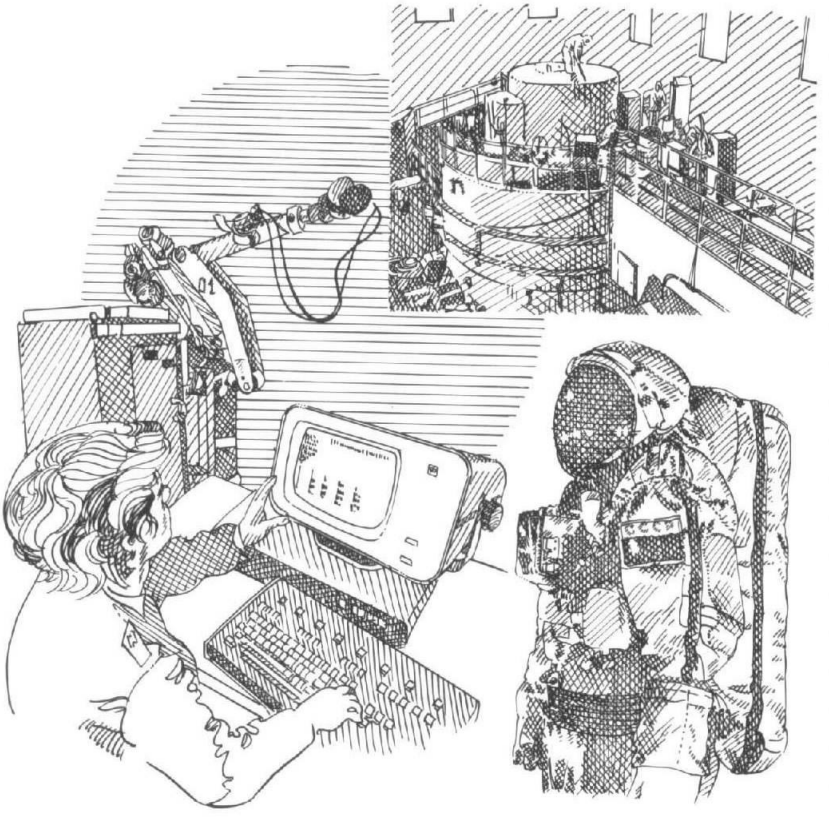
Numerous English-language sources cover aspects of Soviet foreign trade. The foreign economic relations section of volume two of the report submitted to the United States Congress Joint Economic Committee in November 1987 entitled *Gorbachev's Economic Plans* is particularly informative on Soviet-American trade, the Soviet Union's debt situation, and Soviet economic involvement in the Third World. H. Stephen Gardner's *Soviet Foreign Trade* very clearly lays out the institutional and political foundations for Soviet foreign economic decision making through 1980. Two chapters, one by Wilfried Czerniejewicz and another by Kazuo Ogawa, in *Siberia and the Soviet Far East* describe trade relations between the Soviet Union and Western Europe and the Soviet Union and Japan. Although it is dated, *Soviet Foreign Trade* by Glen Alden Smith is one of the best references covering all aspects of Soviet trade.

An accurate source of Soviet trade data is the Central Intelligence Agency's *Handbook of Economic Statistics,* published in September of each year. Jerry F. Hough's *Opening Up the Soviet Economy* devotes one chapter to Gorbachev's foreign trade reforms and another to the way American businessmen and government officials should view these changes. (For further information and complete citations, see Bibliography.)

Chapter 16. Science and Technology



Montage of a nuclear reactor at the Ukrainian Academy of Sciences, a cosmonaut in a space suit, a woman operating a computer, and an industrial robot

SCIENTIFIC AND TECHNOLOGICAL progress has played a crucial role in the domestic and foreign relations of the Soviet Union and other modern, industrialized nations. New domestic developments have promised to strengthen the Soviet economy, enhance military capabilities, and significantly influence Soviet relations with other countries.

The Soviet Union has placed great emphasis on science and technology. Soviet leaders since Vladimir I. Lenin have stressed that the growth of science and technology is essential to overall economic expansion of the country. They have overseen the development of a massive network of research and development organizations that in the 1980s employed more scientists, engineers, and researchers than any other nation. Their commitment also has been reflected in the annual increase in government funds allocated to science and technology and in the efforts made to incorporate science and mathematics courses in the school curriculum at all levels. In 1989 Soviet scientists were among the world's best-trained specialists in several critical fields.

The results of this commitment to science and technology have been mixed. In some areas, the Soviet Union has achieved notable success. For example, in 1964 two Soviet scientists, Nikolai Basov and Aleksandr Prokhorov, shared a Nobel Prize, together with the American Charles H. Townes, for their research in developing the laser. Soviet scientists also have excelled in space research. In 1957 they launched the first artificial earth satellite, Sputnik (see Glossary), and in 1989 they still held several records for longevity in space. Other strengths have included high-energy physics, selected areas of medicine, mathematics, and welding technologies. And in some military-related technologies the Soviet Union has equaled or even surpassed Western levels.

In other areas, the Soviet Union has been less successful. In chemistry, biology, and computers the Soviet Union in 1989 remained far behind the technological levels achieved in the West and in Japan. Research and development in industries producing consumer goods has received little attention, and the goods produced in those industries have long been considered to be of extremely low quality by Western standards.

This disparity in the achievements of Soviet technological development has resulted from a combination of historical, economic, planning, and organizational factors. All have combined to produce

a system in which scientists and engineers have had little incentive to innovate because of immense bureaucratic obstacles and because of limited professional and personal rewards.

In the 1980s, the problems of science and technology received considerable attention in the Soviet Union. Cognizant of their country's serious economic shortcomings, leaders stressed the importance of scientific and technological advances to end the Soviet Union's dependence on extensive economic development (see Glossary) and to move toward intensive development. In the middle of the decade, the new leadership began examining the problems of Soviet science and technology and launched numerous programs and reforms aimed at improving the country's research, development, and production processes.

Early Development

Soviet leaders since Lenin have stated as one of their long-term goals the development of a powerful scientific and technological base. Yet at various times since the Bolshevik Revolution (see Glossary) of 1917, Soviet leaders have faced situations in which the immediate economic, military, and political demands on science and technology outweighed the long-term goals. Thus, the pursuit of short-term objectives affected scientific and technological development at some times by retarding its expansion and at other times by laying the foundation for weaknesses that emerged later. Despite this, Soviet science and technology have grown immensely in terms of organizations, personnel, funding levels, and output.

When the Bolsheviks (see Glossary) seized power in 1917, they inherited a poorly developed scientific and technological base. The major science organization at the time of the Bolshevik Revolution was the Academy of Sciences, founded by Peter the Great in 1725 in hopes of developing an indigenous science base and of eliminating his country's reliance on foreign science. Peter intended the academy to conduct research, serve as an advisory board to the tsar, and organize the empire's higher and secondary education.

In its early years, the academy struggled to resolve such issues as defining its responsibilities and reducing the extensive governmental control over academy activities. Its second charter, issued in 1803, relieved the academy of its educational responsibilities and removed some governmental controls, particularly regarding membership selection. The government continued to interfere in the work of scientists, however, particularly those who advocated progressive ideas that challenged the old order as accepted by the tsar and the Russian Orthodox Church. The academy's third charter (1836) proclaimed it the country's chief scientific body. The

academy continued in this role, focusing primarily on basic research, through the end of tsarist rule. Its achievements during this time were noteworthy. Dmitrii I. Mendeleev (1843–1907) compiled the periodic table of the elements, Nobel Prize recipient Ivan P. Pavlov (1849–1936) conducted research on conditioned reflexes, and Konstantin E. Tsiolkovskii (1857–1935), a pioneer in modern rocketry, studied the theory of cosmic flight.

Another key issue that confronted the academy at the outset was the extent of foreign involvement in Russian science. Peter the Great eagerly opened Russia to the West and encouraged the participation of Western scientists in the development of Russian science. Thus, the academy initially was staffed by scientists from western Europe, principally of Germanic origin. The strong foreign influence continued well into the nineteenth century. A Russian was not elected to the academy until the 1740s, and Russians did not assume control of the academy until the late 1800s. Under the Bolsheviks, science suffered some initial setbacks but then benefited from the government's decision to expand it. In the early years, many Bolsheviks feared scientists because of ideological differences. A number of scientists were arrested or executed; others emigrated to escape from the Bolsheviks. Those who stayed worked under difficult conditions: few facilities, inadequate housing, shortages of food, little access to the West, and strict political controls.

Not long after the Bolshevik Revolution, Lenin moved to improve the situation facing scientists. In policy pronouncements, he emphasized the need to develop a Soviet scientific and technological base as the way to modernize industry. He argued that technological progress was necessary to counter the perceived threat posed by the West and to demonstrate the strength of socialism (see Glossary) to the world.

During the 1920s, Soviet science began to expand. Many new research institutes were added to the academy, which in 1925 was redesignated the Academy of Sciences of the Soviet Union. Governmental support of science increased under the New Economic Policy (NEP) introduced in 1921 (see The Era of the New Economic Policy, ch. 2). Overall, the living and working conditions of scientists improved as research potentials expanded and as opportunities for the international exchange of information resumed. Research in such fields as biology, chemistry, and physics flourished during this period.

Science and technology underwent significant changes during the years of Joseph V. Stalin's reign. The changes occurred primarily in response to three factors: Stalin's industrialization drive, his

efforts to enforce strict ideological control over science, and the outbreak of World War II.

In 1928 Stalin initiated his drive to transform the Soviet Union into an industrial power, technologically independent of the West. Many new institutions were established to provide the applied research foundation needed to develop industrial technologies. Even institutes subordinate to the Academy of Sciences were directed to stop theoretical research and to focus on "practical" problems applicable to industry. In 1935 the academy adopted a charter that created the Engineering Sciences Division to oversee the academy's increased involvement in applied research.

At the same time that Stalin was encouraging the expansion of science, he also was trying to establish firmer ideological control over science. Over time, his efforts led to a significant reduction in scientific effort. In 1928 Stalin initiated a purge of scientists, engineers, and technical personnel in an effort to remove the old generation and replace them with younger scientists who supported communist ideology. In 1934 the academy was moved from Leningrad to Moscow, where political control was easier to maintain. Stalin's Great Terror (see Glossary) ravaged the ranks of scientists and engineers. Many research and development programs had to be halted simply because the leading experts were either arrested or executed. Scientific ties with the West also were severed during this time. The extent of Stalin's interference in science became evident in the post-World War II era. Stalin insisted that ideology be a part of all scientific research. In the natural sciences, he encouraged research that was compatible with the tenets of dialectical materialism (see Glossary). Such an environment opened the door for the influence of such individuals as Trofim D. Lysenko, a leading biologist and agronomist. Lysenko argued that the characteristics of a living organism could be altered by environment and that those acquired characteristics could be inherited, a theory that he tried to prove by numerous fraudulent experiments. His ideas fit nicely with Marxist emphasis on environmental influences and won him the support of Stalin. With that backing, Lysenko was able to arrange the removal and arrest of scientists who opposed his views. His influence continued well into the 1950s, when genetics research in the Soviet Union came to a virtual standstill.

Another factor affecting science and technology under Stalin was the outbreak of World War II. Soviet science and technology suffered badly during the initial period of the war. Many research institutes and industrial facilities were destroyed or seized during the German offensive. The facilities that remained were evacuated to the eastern portions of the Soviet Union. There, all efforts were

directed toward developing science and technology in support of the war effort. Not surprisingly, military-related research and development thrived, while research and development in civilian sectors received little attention.

The war demonstrated to Stalin the backwardness of Soviet science and technology. After the war, he ordered the continued expansion of the research and development base, particularly in defense and heavy industries. Allocations for science increased, new research facilities opened, and salaries and perquisites for scientists were improved dramatically. All available personnel, including captured German scientists and imprisoned Soviet scientists, were employed. This effort led to some important technological successes, such as the explosion of an atomic bomb in 1949 and the design of new series of tanks, aircraft, artillery, and locomotives.

Stalin's death in 1953 led to a more relaxed environment for science and technology growth. At the Twentieth Party Congress in 1956, Nikita S. Khrushchev denounced Stalin for imprisoning thousands of the country's leading scientists, many of whom Khrushchev later rehabilitated (see Glossary). Under Khrushchev the number of research workers almost tripled, and the number of research institutes doubled. International scientific communications and cooperation resumed. Exchanges with the West were encouraged as a means of acquiring technologies that Soviet scientists could assimilate and then duplicate.

Khrushchev also initiated major changes in the organization of science and technology. In 1957 he abolished the industrial ministries in favor of regional economic councils (*sovety narodnikh khoziaistv—sovnarkhozy*). Khrushchev thought that research, development, and production facilities subordinated to the *sovnarkhozy* could cooperate on programs more easily than they could under the ministerial system. The experiment failed, partly because of excessive duplication of effort. In 1965, under the leadership of Leonid I. Brezhnev, the industrial ministries were restored. The second major organizational change occurred in 1961, when the Academy of Sciences was reorganized. Concerned that the academy had focused too much on industrial research projects, Soviet leaders transferred the industry-oriented institutes to state committees. The leadership then directed the academy to focus on fundamental research.

Under Brezhnev the Soviet Union launched another drive to modernize science and technology. Several economic and organizational reforms were instituted, but none was radical enough to cause significant improvement. Under his policy of détente, scientific contacts and exchanges with the West increased. Soviet leaders sought long-term agreements with Western firms as a means of acquiring

advanced technologies. Eventually, internal disagreements over the appropriate level of technological interaction with the West, coupled with restrictions placed by the West, led to a decline in contacts. Scientific and technological policies under Iurii V. Andropov and Konstantin U. Chernenko brought little change. Of the two leaders, Andropov seemed more interested in accelerating Soviet scientific and technological growth, but neither leader lived long enough to have much impact.

The Administration of Science and Technology

The administration of civilian science and technology encompassed policy making, planning, and financing for the administration of nonmilitary science and technology. Policy making was primarily the responsibility of the Communist Party of the Soviet Union (CPSU) but also involved various all-union (see Glossary) governmental organs. At the all-union level, planning included the Council of Ministers, the State Committee for Science and Technology (Gosudarstvennyi komitet po nauke i tekhnike—GKNT), the Academy of Sciences, and the State Planning Committee (Gosudarstvennyi planovyi komitet—Gosplan). Below the all-union level, planning was handled by branch ministries and by republic or regional academies. Financing involved almost all these organizations, which worked in conjunction with the Ministry of Finance (see Administrative Organs, ch. 8).

Policy Making

The formulation of scientific and technological policy in 1989 was centered in the highest CPSU components, the Politburo and the Secretariat (see Politburo; Secretariat, ch. 7). As the party's top decision-making body, the Politburo defined priorities and the broad policies needed to meet them. Its decisions were reflected in policy deliberations and in decrees issued by the Council of Ministers. Day-to-day decisions on science and technology matters were the responsibility of the Secretariat, the party's chief executive body.

Despite their responsibilities, individual members of the Politburo and the Secretariat did not have the scientific and technical expertise needed to make policy decisions without assistance. They relied on experts working in subordinate party organs and in the governmental apparatus. The Science and Education Institutions Department was the key technical unit within the CPSU Central Committee. It functioned as a high-level advisory staff to the Politburo and as an overseer of policy implementation. The department also was responsible for monitoring the work of the Academy of

Sciences and of education institutions. Other Central Committee departments contributed to policy making for their particular branches.

Advice also was provided by personnel working in GKNT, the Academy of Sciences, and the Council of Ministers. In addition, party authorities relied on advice from special commissions composed of leading scientists and technical experts. These commissions, created by the Council of Ministers, have advised on particularly important science and technology policy matters affecting key sectors of the economy.

Planning

After formulating the nation's broad science and technology policy, the CPSU issued directives to the governmental organs responsible for planning specific programs. At the all-union level, planning involved the Council of Ministers, GKNT, the Academy of Sciences, Gosplan, and, to a much lesser extent, the Supreme Soviet.

The Council of Ministers was responsible for implementing the party's broad directives. It frequently issued decrees that reflected science and technology decisions made by the Politburo. These decrees served as the base on which science and technology plans and programs were formed. The council also confirmed the five-year plans and the annual plans for science and technology, developed measures to improve management of research and development, and resolved issues relating to authors' and inventors' rights, cadre training, and labor wages. The council operated primarily through its Presidium, whose membership included heads of many agencies concerned with science and technology.

Founded in 1965 and subordinate to the Council of Ministers, GKNT functioned as the central organ responsible for overall coordination of scientific and technological programs. GKNT met once or twice a year to decide major policy directions. Between meetings it relied on a collegium to meet weekly to examine issues. GKNT oversaw the work of a small number of research institutes.

The administrative functions of GKNT included working with the Academy of Sciences and other interested organizations to plan and coordinate the development of science and technology. GKNT contributed to the five-year planning process by drafting a list of major problems and working with relevant state committees and the Academy of Sciences to develop proposals. GKNT evaluated the level of scientific and technological development in branches of the economy and worked with science and technology policy-making bodies to develop methods to improve research and innovation.

GKNT also played an important role in coordinating and in monitoring interbranch problems, i.e., those that involved more than one industrial ministry. Proposals to conduct a project on an interbranch problem were submitted by a ministry to GKNT for approval. GKNT then oversaw the implementation of the project. GKNT also was responsible for improving the flow of information within the research and development infrastructure. Finally, GKNT was responsible for establishing and maintaining communications with foreign countries on scientific and technological cooperation and on the purchase of foreign technologies.

Another key organization was the Academy of Sciences, which both administered and performed scientific research and development. Working with GKNT and Gosplan, the academy coordinated and produced research and development plans for its subordinate research facilities and for any facility involved in a program under its jurisdiction. The academy made proposals on funding, personnel, and materials for research and development. It also worked with GKNT to develop and submit to the Council of Ministers proposals for introducing new technology and forecasting trends in the economy.

The Academy of Sciences was responsible for translating national plans into specific programs carried out by subordinate facilities. It oversaw science and technology planning for its divisions, regional branches, and the republic academies of sciences.

As the nation's chief planning organ, Gosplan was responsible for incorporating science and technology programs into the national economic plan. It worked with GKNT and the Academy of Sciences to plan the introduction of research and development results into the economy, to determine the overall volume of needed capital investment, and to decide funding levels for science and technology programs, material supplies, training, and wages. Within Gosplan, the Unified Science and Technology Department was the primary unit engaged in science and technology planning. It was aided by advisory councils and commissions organized in key economic sectors.

Below the top policy-making level, science and technology plans were implemented by the industrial ministries and the Academy of Sciences. The Soviet economy has been organized and directed by a complicated, centralized industrial system (see Industrial Organization, ch. 12). The leadership of each ministry was responsible for planning science and technology programs carried out within its specific industrial branch. The leaders based their plans on the national economic plans given to them by the higher authorities (see Economic Planning and Control, ch. 11).

Officer on the bridge of a modern Soviet merchant ship explaining the instruments, Murmansk, Russian Republic
Courtesy Jimmy Pritchard

The science and technology planning process involved four levels of documents. The broadest plans spelled out the long-term (fifteen to twenty years), comprehensive program. These documents presented the best judgment of experts about future economic trends, probable developments in science and technology, and the resources needed to achieve those developments. The next level of documents consisted of the main directions of economic and social development, which included a section on the development of science and technology. The developmental directions provided preliminary targets for the first five years of the period covered and a very general planning framework for the remaining years (the directions can cover ten to fifteen years). The third-level document was the five-year plan and the annual plans derived from it. This has been the key document used by branch managerial organs to organize their work. The final document, the institute plan, was based on the five-year plan and described the research and development projects to be undertaken by a particular institute.

Financing

Decisions about the financing of Soviet science and technology involved many of the same high-level party and government organs involved in the policy-making and planning processes. One aspect of these processes has been the determination of resources to be allocated to specific science and technology programs. That determination has been made by the CPSU Politburo, the Council of Ministers, GKNT, and the Academy of Sciences. The Ministry of Finance has made specific science and technology allocations in accordance with approved plans. The State Bank (Gosudarstvennyi bank—Gosbank) has issued credit for science and technology development projects.

Several other organizations were involved in the administration of Soviet science and technology. The State Committee for Material and Technical Supply (Gosudarstvennyi komitet po material'no-tekhnicheskomu snabzheniiu—Gossnab) was responsible for supplying science and technology organizations with needed equipment and instruments. The State Committee for Labor and Social Problems (Gosudarstvennyi komitet po trudu i sotsial'nym voprosam—Goskomtrud) was concerned with labor and wage issues. The State Committee for Standards (Gosudarstvennyi komitet po standartam—Gosstandart) assigned and directed the development of nationwide technical and economic standards. It approved new standards and oversaw the adherence of science and technology organizations to the standards. The State Committee for Inventions and Discoveries (Gosudarstvennyi komitet po delam

Oceanographic research ship Vizir, *of the Yug class*
Courtesy United States Navy

izobretenii i otkrytii—Goskomizobretenie) maintained a state registry of inventions and discoveries, and it issued authors' certificates and patents. The All-Union Institute for Scientific and Technical Information (Vsesoiuznyi institut nauchnoi i tekhnicheskoi informatsii—VINITI) functioned as an information center containing abstracts of worldwide scientific and technical literature.

Science and Ideology

The extent to which the CPSU and communist ideology influenced Soviet science and technology has varied over time. During the Civil War (1918–21) and particularly during the Stalin era, party controls over science were extensive and oppressive. In the 1980s, party influence over science has been far less rigid but still evident.

According to one Western scholar, the CPSU controlled science in four ways. First, the CPSU maintained control by formulating the country's overall science and technology policy. Second, the party ensured that its policies were implemented at all levels of government through a network of all-union, regional, and local party organizations that oversaw the work of science and technology organs operating at comparable levels. Even in research institutes or factories, local party committees exerted their authority

by requiring directors and managers to adhere to party dictates (see Primary Party Organization, ch. 7). Local party committees reported to higher authorities on plan fulfillment, labor discipline, and worker morale.

Third, the CPSU exercised full power over appointments to key positions, controlling the appointment of high-level administrators, mid-level managers, and probably institute directors and research laboratory and department heads (see Nomenklatura, ch. 7). The fourth method of control was ideological, including that exercised over both the professional and the private lives of scientists. The CPSU controlled individuals' work through its authority to dismiss personnel, to deny bonuses or fringe benefits, to restrict travel and publishing opportunities, and to impose other disciplinary actions. Control over personal lives was maintained through the Committee for State Security (Komitet gosudarstvennoi bezopasnosti—KGB) and was evident during the 1970s and early 1980s, when the government harshly treated dissident scientists accused of nonconformity with party policies. The treatment eased under General Secretary Mikhail S. Gorbachev, who, for example, permitted dissident physicist Andrei Sakharov to return to Moscow from internal exile in Gor'kiy.

Influence, though, has not been one sided. Science officials have had opportunities to affect party decisions. Since the mid-1950s, many top party officials have cultivated close ties to prominent scientists. This proximity has allowed scientists to influence decisions directly through their associations with policy makers or through appointments to policy advisory councils. Another opportunity has been appointment to top-level party organs. The number of scientists with membership in the CPSU Central Committee rose from seven in 1951 to nineteen in 1981. At the lower levels, facility managers often have used their close ties with party representatives to acquire more funds or better supplies.

Research, Development, and Production Organizations

In 1989 the Soviet scientific and technological establishment consisted of a variety of organizations engaged in the research, development, and production of new products or processes. In general, each organization specialized in one phase of the process and in one sector of industry.

Many types of organizations were involved. Western specialists placed them in three broad categories: research institutions, design organizations, and production facilities. In the first category, the most numerous organizations were the scientific research

institutes (*nauchno-issledovatel'skie instituty*—NIIs), which focused on scientific research, both basic and applied. Each NII was headed by an appointed director, who oversaw a staff of researchers and technical personnel. Another type of research institution, the research laboratory (*laboratoriia*), operated independently or as a component of a larger NII or a production plant.

The second category, design organizations, included design bureaus (*konstruktorskie biuro*—KBs) and technological institutes (*tekhnologicheskie instituty*). Each of these encompassed a range of facilities with such titles as special design bureau (*spetsial'noe konstruktorskoe biuro*—SKB), central design bureau (*tsentral'noe konstruktorskoe biuro*), and project design and technology bureau (*proektno-konstruktorskoe i tekhnologicheskoe biuro*). Design bureaus planned new products and machines, although some also conducted research. Technological institutes had responsibility for designing new processes, installations, and machinery.

The third category included production facilities that manufactured the new product or applied the process developed by the research and design facilities. The output and testing of industrial prototypes, industrial innovation processes, or small-batch production prior to the stage of mass production occurred in experimental production or pilot plants (various Russian designations, e.g., *opytnye zavody, opytnye stantsii*). These functioned independently or were attached to production facilities, research institutions, or design organizations.

In addition to their categorization according to the operational phase in which they were most involved, research, development, and production facilities were characterized according to their organizational affiliation: industrial ministries, university and higher education, or the Academy of Sciences system.

Industrial ministries controlled the majority of science and technology organizations, including all types of research institutions, design organizations, and production facilities. The precise number of facilities in 1989 was not available because the Soviet press stopped publishing such statistics about a decade earlier. Western specialists, however, reported that in 1973 there were 944 independent design organizations, and in 1974 there were 2,137 industrial NIIs. The number of production facilities undoubtedly exceeded both those figures.

Industrial science and technology organizations tended to concentrate on one broad area, such as communications equipment, machine tools, or automobiles. They were directly subordinate to the industrial ministry responsible for that sector (see Industrial Research and Design, ch. 12). Science and technology work in

ministries was directed by scientific-technical councils within the ministries; the councils comprised the ministry's leading scientists and engineers.

The second organizational affiliation, the higher education system, has been administered by the Ministry of Higher and Specialized Secondary Education. In addition to training scientists, the ministry's system provided a research base whose contribution to national scientific research and development has been growing. Its system included such varying scientific organizations as NIIs, design bureaus, problem laboratories (*problemnye laboratorii*), branch laboratories (*otraslevye laboratorii*), scientific sectors (*nauchnye sektory*), and such specialized institutions as computer centers, observatories, and botanical gardens. The number of organizations in the Ministry of Higher and Specialized Secondary Education and the percentage of the country's overall science budget allocated to them remained relatively small. In the late 1980s, their contribution was increasing with the expansion of contract research.

The third organizational affiliation, the Academy of Sciences, in 1989 was divided into four sections: physical sciences, engineering, and mathematics; chemistry and biology; geosciences; and social sciences. Grouped into these subject areas were approximately 300 research institutes employing more than 58,000 people. The network also included the separate academies of sciences in each of the fifteen union republics of the Soviet Union (except the Russian Republic, which was represented by the all-union academy) and regional divisions, the most prominent of which has been the Siberian Division. The academy also had responsibility for specialized schools, such as the All-Union Academy of Agricultural Sciences and the Academy of Medical Sciences.

As the most prestigious scientific establishment in the Soviet Union, the Academy of Sciences has attracted the country's best scientists. Membership has always been attained through election. In January 1988, the academy had approximately 380 academicians and 770 corresponding members. Of these, about 80 academicians and 170 corresponding members were elected in December 1987. This election was noteworthy because it was the first held since the review of academy personnel policies had begun a year earlier. The review led to a number of measures directed at removing some of the older members from active participation, such as requiring them to retire at age seventy-five. The new rules also lowered the age at which a scientist could be elected to the academy and established an age limit beyond which officials who were not academicians could hold top-level administrative positions, such as institute director. Once voted into the academy, a member held

that title for life (as an example, dissident Sakharov retained his academician status even while in internal exile in Gor'kiy).

The members of the academy usually met once a year in general assembly to discuss major issues, to vote on organizational matters, and to elect new members. In October 1986, the general assembly elected Gurii Marchuk, formerly chairman of GKNT, as its president. Marchuk replaced Anatolii P. Aleksandrov, who had served as president for eleven years.

Soviet scientists and governmental officials have debated the precise role of the Academy of Sciences in the development of science and technology since the inception of the Soviet state. Such discussions continued during the 1980s. Statutes defined the academy's mission as conducting primarily basic or fundamental research. Some scientists and administrators, even within the academy, have argued that this was appropriate and that the academy should not engage in applied research. Many others, however, have argued that the academy has to be involved in applied research not only because it employs the best scientific talent in the nation but also because fundamental science drives technological development and causes technological breakthroughs. In his speech to the Nineteenth Party Conference in June 1988, academy president Marchuk stressed that "fundamental scientific research is the basis of all science and all scientific and technical progress. It defines the prospects for ten to twenty years hence, it achieves the breakthroughs both in the production sphere and in the sphere of knowledge of nature and society."

Soviet Innovation: Problems and Solutions

Central to an understanding of Soviet science and technology is an understanding of the innovation process. Innovation, which is the transfer of a scientific discovery (new product or process) into production, has long been a problem for the Soviet Union. Despite a strong scientific base, the country has had a mixed record of innovation. Although in some—particularly defense-related—industries Soviet scientists and engineers have scored major technological successes, in many other—particularly consumer—industries they have failed to implement useful innovations. In the late 1980s, the status of innovation was a key concern of the leadership, which sought new policies and institutional arrangements to facilitate the process.

In the 1980s, several key problems affected Soviet innovation. One was that factory managers had little incentive to introduce new products or processes. Innovation in a command economy differs greatly from innovation in a market economy. In the latter,

the drive to introduce technological change emanates from the producers, who attempt to satisfy consumer demand before competitors do. In the Soviet economy, production of innovative products and processes has been assigned by government planners. Producers have been directed by top-level planning organs to incorporate in their plants' output a newly innovated product or process. Yet in the Soviet economy a plant's success has been measured by the gross output required by the annual plan. Factory managers have strived to fulfill the plan in terms of the quantity of goods produced. Managers have viewed introducing a new product or process, which may result in a slowdown in production, as an impediment to their goal of plan fulfillment. They generally have been unwilling to forgo certain success in exchange for potentially greater, yet unguaranteed, future capability.

Another problem concerned pricing policies. In the Soviet economy, prices of goods have been determined by central planners rather than in response to market demand. To boost innovation, planners sometimes permitted factory managers to charge higher prices for newly introduced products. These prices often were set too low to compensate for the increased cost of production and for the risk of failure. Therefore, prices have done little to encourage innovation. In fact, according to one Western specialist, this pricing mechanism often has been counterproductive. It promoted a practice whereby managers tended to exaggerate the degree of novelty of a new or improved product to central pricing authorities in an attempt to receive permission to charge higher prices and thus boost profits. Incentives given to industrial research development personnel on the basis of the expected return from a new innovation also have failed to improve the process.

Yet another problem has been the organizational separation among the various facilities engaged in research, development, and production. The separation occurred because Soviet scientific and technological facilities have tended to specialize in one phase of the research-to-production cycle. Research institutions, design organizations, testing facilities, and production facilities operated independently from one another. As a result, the transfer of a scientific discovery from the necessary development and testing phases to final production has necessitated crossing multiple organizational boundaries. To be successful, such transfers required stringent interorganizational cooperation to ensure proper timing and exchange of information. Soviet and Western observers agree that this cooperation has been generally lacking in the Soviet Union, where institutional interests have tended to override other considerations

Geological research ship Morskoi geolog, *of the Meridian class*
Courtesy United States Navy

and information exchange among scientists and engineers has been limited.

Organizational separation, however, was not limited to the successive stages of the research-to-production cycle. Soviet facilities also were separated in terms of their organizational affiliation. The results of scientific research and design work often must cross organizational boundaries to enter production. This has imposed yet another layer of bureaucracy, which has done little to encourage innovation. The most difficult barrier has been that existing between research institutions subordinate to the Academy of Sciences and production facilities subordinate to an industrial ministry. Even within the industrial ministry system, production facilities subordinate to one ministry have been hesitant to cooperate with those subordinate to a different ministry.

The ability to innovate also has been hurt by a lack of research and development equipment and of experimental testing and production facilities. Equipment has been inadequate in quality and quantity. The absence of appropriate testing facilities has affected all science and technology organizations but has been particularly evident in the Academy of Sciences organizational network. Academy scientists generally have had to rely on industry to make available testing and production facilities, but, as they often stated

in the 1980s, industry did not comply. As a result, academy officials, especially those in the Siberian Division and in the Ukrainian Academy of Sciences, initiated the development of the academy's own experimental facilities.

Funding has been another key factor adversely affecting innovation. In theory, one of the advantages of a command economy is the ability to concentrate resources in a given area. Over the years, the Soviet Union has repeatedly taken advantage of this ability by focusing resources on technologies and industries considered to have strategic importance, e.g., the military. Yet priority allocation, by definition, has been limited. Not all industries can receive the same attention. Indeed, the Soviet experience has been one in which selected industries and technologies were developed at the expense of others.

To some degree the innovation problems in the 1980s were a result of deliberate choices made in response to conditions arising after 1917. According to Ronald Amann, a Sovietologist affiliated with the University of Birmingham in England, some decisions made by Soviet leaders to overcome technological backwardness significantly influenced the long-range development of technology. The decisions were those that focused on replicating Western models instead of fostering Soviet innovation, that concentrated resources on industries considered by the leadership to have strategic importance, and that compensated for the shortage of skilled manpower by developing specialized and centralized research and development organizations in each branch of industry. These decisions contributed to the evolution of a system that in the 1980s was characterized by uneven technological progress and by the separation of science and production facilities.

From the mid-1960s to the mid-1980s, Soviet leaders' responses to these innovation difficulties has been a series of economic and organizational reforms. They have introduced measures aimed at improving planning and at providing greater financial incentives to organizations engaged in innovation. They also have tried to overcome the barriers separating research, development, and production facilities. The implementation of reforms accelerated under Gorbachev, who viewed the improvement of Soviet science and technology as crucial to his goal of economic restructuring (*perestroika*—see Glossary).

In September 1987, the CPSU Central Committee and the Council of Ministers issued a decree called "On the Changeover of Scientific Organizations to Full Cost Accounting and Self-Financing." Basically, the decree changed the way in which all types of scientific organizations were financed. Instead of receiving state funds

allocated to finance the operation of the entire organization, scientific establishments would be financed on the basis of specific research, planning, and design projects. These would be arranged through contracts with other organizations, primarily industrial enterprises (see Glossary). The theory behind this change was to encourage scientific organizations to generate a "product" more useful to industry and to assume more responsibility for the applicability of their output. To increase the incentives for assuming greater responsibility, the decree also stipulated that the basic source of an organization's wage and incentive funds would be the profits earned by that organization. A similar decree, the Law on State Enterprises (Associations), was issued at approximately the same time. It granted to industrial enterprises greater authority to manage their own operations and established a closer link between funds for worker benefits and enterprise profits.

The organizational remedies instituted under Gorbachev expanded several arrangements to attempt to bridge the gap between scientific and production entities. The first involved the scientific production associations (*nauchno-proizvodstvennye ob"edineniia*—NPOs), which were introduced in the late 1960s. NPOs combined under one management all facilities involved in a particular research-to-production program—the research institutions, design organizations, testing facilities, and production facilities. Soviet lead ers considered this arrangement more conducive to innovation because it enabled one leading component, usually the research institution, to coordinate the work of the other components engaged in the process. Although officials admitted that NPOs have had operational problems (such as poor planning and lack of an experimental base), they rated NPOs as successful overall. In 1986 they began an expansion in the number of NPOs. Whereas in 1985 there were approximately 250 NPOs (roughly the same number that existed in the early 1970s), in 1986 there were 400, with an additional 100 projected for the following year.

A similar organizational remedy was the formation of the interbranch scientific-technical complex (*mezhotraslevoi nauchno-tekhnicheskii kompleks*—MNTK). Based on so-called engineering centers established in the Ukrainian Academy of Sciences, MNTKs were initiated in 1985. MNTKs differed from NPOs in that they encompassed, as their name implies, facilities subordinate to various administrative authorities, including the Academy of Sciences. MNTKs were also larger than NPOs; in fact, some MNTKs included several NPOs and industrial production associations. In January 1988, Soviet officials reported that more than twenty MNTKs, including approximately 500 organizations and enterprises and

elements of more than sixty ministries and departments, had been formed.

MNTKs were charged with coordinating and performing all the research and development work in their given area, from basic research to production. To facilitate their work, MNTKs were empowered to request resources in addition to those allocated by the plan; to receive priority in establishing pilot production bases and in ordering materials and resources; and to have the right to demand full delivery of the ordered amounts.

In an assessment of the MNTKs published in January 1988, two Soviet economists discussed the accomplishments of the "Rotor" and "Mikrokhirurgiia glaza" MNTKs. The former had expanded the production of automatic rotary and rotary conveyor lines in 1987 and expected to more than double production in 1988. The Rotor MNTK also developed a rotary conveyor line for the injection molding of items made of thermoplastic materials. The Mikrokhirugiia glaza MNTK was credited with developing a new technology for performing higher quality operations that significantly shortened overall treatment time. On the negative side, however, the economists listed several problems hindering the operation of MNTKs: lack of cooperation of superior organs, substantial lag in the development of experimental facilities, shortage of designers and manufacturing engineers, insufficient authority to obtain financing, absence of a unified plan for an MNTK, and confusion regarding the composition of MNTKs. Despite these criticisms, Soviet authorities in the late 1980s repeatedly stated their support of MNTKs and presented them as a promising link between science and production.

Technology and Information Transfer

Soviet leaders have tried to overcome technological backwardness by acquiring technology from the more advanced Western and Asian countries. Since 1917 Soviet officials have worked to obtain not only foreign equipment but also technological processes, know-how, and information. Acquisitions have helped the Soviet Union, in some cases, to compensate for a poorly developed indigenous technology and, in other cases, to bolster or provide a missing component in an otherwise fairly well-established industry.

The transfer of foreign technology began not long after the Bolshevik Revolution and continued through the 1980s, although the official emphasis, as well as the kind and quantity of technology transferred, varied greatly over time. Lenin initially wanted to avoid any dependence on Western technological imports, but the lack of funds for indigenous development forced him to seek

limited foreign investments. Stalin emphasized technological autarchy. He expended huge resources in efforts to develop indigenous science and technology, and he severely restricted contacts with Western businessmen and scientists. Nonetheless, severe backwardness in some key industries forced Stalin to engage in short-term borrowing from the West. During World War II, the Soviet regime used captured German equipment and technological experts to help develop lagging Soviet industries.

The post-Stalin era brought renewed interest in dealing with the West. Khrushchev eased restrictions on Soviet access to Western technology but found that Western governments sought political concessions in return for trade agreements. Under Brezhnev, Soviet technology acquisitions increased markedly. Many long-term agreements, as well as accords providing for foreign construction of industrial plants in the Soviet Union, were signed during the Brezhnev era. By the late 1970s, however, both Western and Soviet leaders began to question the political and economic wisdom of technology transfers. By the early 1980s, technology transfers from the United States to the Soviet Union were curtailed severely in response to political, economic, and military concerns. At the same time, however, the Soviet Union began trying to obtain Japanese technology—particularly electronics, computer science, and metallurgy—because the Japanese were much less restrictive in their exports.

In 1986 Gary K. Bertsch, a United States specialist in Soviet technology, described five means by which technology has been transferred to the Soviet Union. The most direct, and probably the most common, was the commercial sale of equipment to the Soviet Union. When the West provided opportunities, Soviet leaders increased purchases of Western equipment.

The second type of transfer included the extensive and complicated modes of industrial cooperation between Western firms and their Soviet counterparts. According to Bertsch, this cooperation has had many forms, among them: sales of equipment (sometimes for complete production systems or turnkey plants), including technical assistance; licenses of patents, copyrights, and production know-how; franchises of trademarks and production know-how; purchases and sales between partners, involving exchanges of industrial raw materials and intermediate products; subcontracts involving the provision of production services; sales of plant, equipment, and technology with payment in resulting or related products; production contracting, involving agreement for transferred production capabilities in the form of capital equipment and technology; coproduction agreements allowing partners to produce

and market the same products resulting from a shared technology; and joint research and development.

Another type of transfer involved foreign travel by Soviet scientists, participation by them in academic and scholarly conferences, and screening of literature. In the early 1980s, as part of a general tightening of policies on technology export, the United States government began restricting Soviet scientists from traveling in and attending meetings in the United States to prevent their access to American science and technology. Screening of literature has been a valuable source of information for the Soviet Union. Soviet scientists have had easy access to Western and Japanese publications, and for years they have relied heavily on this literature as a primary source of foreign technology.

The fourth type of transfer was covert acquisition. This kind of transfer was the most feared because of its potential impact on Soviet and United States military development. The ways in which the Soviet Union acquired technology varied and involved more than their intelligence services. For example, some acquisitions were carried out by Soviet diplomats stationed worldwide. Other acquisitions were made by diverting controlled technology products from legitimate trade destinations to the Soviet Union. Finally, some acquisitions occurred through legitimate firms established by the Soviet Union or East European countries in Western nations.

The fifth type of transfer was intergovernmental agreements on scientific and technological cooperation. In the early 1970s, for example, the United States and the Soviet Union concluded eleven separate agreements pledging cooperation in such fields as science and technology, environmental protection, atomic energy, medicine, and energy. In some cases, these agreements led to frequent exchanges between American and Soviet scientists cooperating in specific areas. This type of arrangement, however, decreased markedly in the late 1970s as the United States responded to Soviet emigration policies and to Soviet involvement in Afghanistan and in Poland. Under Gorbachev, cooperative agreements resumed.

Using these forms of transfer, the Soviet Union obtained a range of technologies, some of which probably had significant military applications. The chemical and automotive industries relied heavily on Western imports. In the early 1980s, the Soviet Union bought equipment badly needed for the gas pipeline it was building from Urengoy to Uzhgorod. It acquired technologies applicable to the military, including complete computer systems designs, concepts, and software, plus a variety of Western general-purpose computers, minicomputers, and other hardware. It acquired low-power, low-noise, high-sensitivity receivers; optical, pulsed power source and

other laser-related components; and titanium alloys, welding equipment, and furnaces for producing titanium plates applicable to submarine construction.

These acquisitions raised concerns in the West that the Soviet Union was deriving too many military and economic benefits inimical to Western interests. Some critics argued that technology transfers allowed the Soviet Union to save millions of rubles (for value of the ruble—see Glossary) in research and development costs and years of development time. They also argued that Soviet acquisitions allowed the regime to modernize critical sectors of industry without absorbing rising military production costs, to achieve greater weapons performance, and to incorporate countermeasures to Western weapons. They further argued that the West should impose stricter controls on such transfers. This position was adopted by the United States government in the early 1980s, when it began imposing strict controls and urging West European governments to follow suit.

Not everyone agreed with this position, however. Western analysts in the late 1980s pointed out that both the econometric and the case-study approaches used to assess the impact of technology transfers produced tentative results. One conclusion was that the Soviet experience in using and assimilating Western technology was a mixed success. In some cases, particularly in military-related industries, the Soviet Union was successful in incorporating Western equipment or processes. In other areas, the equipment was used inefficiently or not at all.

Many Soviet scientists and policy makers shared this negative assessment. During the 1980s, the Soviet press published many articles in which Soviet officials complained that they were wasting valuable hard currency to purchase equipment that lay idle because of industry's inability or unwillingness to install it. Other officials, including former Academy of Sciences president Aleksandrov, argued that the Soviet Union did not need to import Western technology because it had the capability to develop it domestically. In fact, too much reliance on Western imports had harmed the Soviet Union because indigenous institutions had been denied the opportunity to develop the technology and, hence, to grow technologically.

Despite these arguments, the policy under Gorbachev appeared to Western observers to increase technological trade. Soviet authorities instituted some organizational changes to facilitate and to encourage more contact with Western firms. Yet Gorbachev also expressed concern over the balance of payments issue and cautioned against too many purchases from the West.

Military Research and Development

Science and technology in defense and civilian sectors differed markedly in both organization and performance. Military research and development generally functioned more efficiently and produced more advanced technologies.

The principal organizations involved in Soviet military science and technology were subordinate to the defense industrial ministries. The ministries responsible for research, design, and production of military equipment and weapons or their components consisted of the Ministry of the Aviation Industry, the Ministry of the Communications Equipment Industry, the Ministry of the Defense Industry, the Ministry of the Electronics Industry, the Ministry of General Machine Building, the Ministry of the Machine Tool and Tool-Building Industry, the Ministry of Medium Machine Building, the Ministry of the Radio Industry, and the Ministry of the Shipbuilding Industry. These nine ministries were among the eighteen ministries of the machine-building and metal-working complex (MBMW) under the control of the Defense Council (see Machine Building and Metal Working, ch. 12). Each of the nine ministries incorporated institutes engaged in applied research and a network of bureaus responsible for designing and developing new military equipment and processes. In 1989 these ministries directed the work of thousands of plants making weapons and weapons components, at least 450 military research and development organizations, and approximately fifty major design bureaus. (Other industrial ministries contributed to military research, development, and production. For example, some military vehicles were produced by the Ministry of Automotive and Agricultural Machine Building, and fuel and chemical warfare agents were produced by the Ministry of the Chemical Industry.)

The second category consisted of the Ministry of Defense and its subordinate research facilities. Little information on these institutes has been published, but their work undoubtedly has been concentrated on those areas most relevant to military requirements. These institutes maintained close contact with the industrial research institutes and the design bureaus. Their main function appeared to be to evaluate the latest scientific achievements and to forecast the development of the Soviet armed forces.

The third category comprised the facilities considered part of civilian science. These primarily were the 300 research institutes affiliated with the Academy of Sciences. Some of the country's most important military research programs were conducted by the Academy of Sciences. Other institutes in this category included

university facilities and research establishments subordinate to the civilian production ministries.

The final category consisted of the coordinating agencies. The most powerful organization was the Military Industrial Commission (Voenno-promyshlennaia komissiia—VPK), which included representatives from the defense industry ministries, the Ministry of Defense, Gosplan, and probably the CPSU Secretariat. VPK monitored and coordinated all military research and development and production. It reviewed new weapons proposals for their technical feasibility and for production requirements, approved research-to-production timetables submitted by lead organizations, and participated in planning and supervising major technological programs, apparently including those conducted by Academy of Sciences institutes.

The second important coordinating agency was GKNT. Although mandated to plan, oversee, and regulate scientific research and development, evidence on its operation suggested that it had little direct influence over the defense sector. Nevertheless, GKNT exerted some general influence over military research and development in that it formulated the basic scientific and technical problems of the country and worked out the programs needed to address them.

The various institutional components of military research and development interacted in a way that generally was far more productive than that of the civilian sector. The defense sector more often succeeded in seeing a scientific idea through the various development stages into production. Many of those ideas may not have represented a leading-edge technology (Soviet military research and development were thought to be more evolutionary than revolutionary), but at least they were carried through into production.

One of the reasons Soviet military research and development fared better has been the high priority given to it by the regime. The defense sector received not only more funds but also better resources and the best personnel. Perhaps most important in terms of priority was the level of political commitment. Maintaining a strong military capable of matching United States military strength has been a high priority for Soviet political leaders. This translated into a strong commitment to ensure that military science and technology developed and functioned to support the Soviet military. High priority was not the only factor explaining the military sector's superior performance. Another factor was that defense researchers had better access to development facilities. Research projects in the military tended not to "die" because of lack of research facilities' access to development facilities.

Another factor affecting military research and development was that the defense sector was not so rigidly bound to production quantity rather than quality. Civilian production enterprises often were reluctant to innovate because of the time needed to adjust a plant's operations to the production of the new item or use of the new process. Such adjustments have been viewed in the civilian sector as interruptions because they cut into the time needed to meet a plant's production quotas. Military production facilities, which had rigorous quality-control measures, faced less pressure to meet a specified production goal.

Finally, coordination among military research and development establishments was more effective than that in the civilian sector. Facilities involved in the various phases of the military research-to-production cycle were more inclined to interact with one another. Furthermore, design facilities in the defense establishment tended to be larger and more capable of developing a research idea further through the research-to-production cycle. Design organizations in the military also tended to generate better design documentation for production plants to implement. Some of the administrative barriers encountered in the civilian sector were overcome in the military sector, in part by giving lead institutes the power to coordinate efforts for specific programs.

The success of the defense industry has been something Soviet leaders wanted to replicate across the spectrum of scientific and technological sectors. Gorbachev patterned many of the reforms instituted during the mid-1980s after organizational arrangements and policies in the defense sector. For example, the decision to switch financing of research and development work from funding of institutes to funding of specific projects, as well as emphasizing contract work, was adapted from the military sector. Improving the long-range planning process and the quality-control process were other examples. To facilitate the reforms, Gorbachev moved several defense managers into key civilian positions. The idea was that these individuals would use skills learned in the defense sector to strive for improvements in the civilian sector.

Training

Training of scientists and engineers has been an important aspect of the country's overall scientific and technological effort. Soviet leaders since Lenin have strongly emphasized education and its contribution to the development of science and technology. The result has been the emergence of a network of education institutions that have trained some of the world's best scientists.

Training in science and engineering has generally begun in the secondary schools. The nationwide curriculum in effect during the 1980s emphasized mathematics, the natural sciences, and languages. By the time students completed their secondary education, they had taken two years of algebra, two years of geometry, and one year each of trigonometry, calculus, physics, chemistry, and biology. Beginning in the seventh grade, those with special skills in the sciences could enroll in optional science courses. Western specialists have considered Soviet science education, particularly in physics and mathematics, superior to that received in secondary schools in the United States.

Soviet institutions of higher learning (*vysshie uchebnye zavedeniia*—VUZy) included universities and institutes. The universities in the Soviet Union offered five-year programs that tended to be narrowly focused. Advanced training in many technical fields was provided in specialized institutes. The VUZy represented an additional source of research for the development of science and technology. Until 1987 that research was funded primarily through the state budget and, less frequently, through contracts with industry. The 1987 decree, which changed scientific organizations to self-financing status, charged Soviet administrators to develop a plan for transferring VUZy to the same financial arrangement.

Despite the success in education, the Soviet Union during the 1980s faced several key problems affecting its ability to train scientists and engineers and to place them where needed. Schools, especially those outside the major urban areas, suffered from a lack of qualified staff, supplies, and equipment. Efforts during the mid-1980s to launch an extensive program of computer training were hampered by the lack of computers on which to train students. Other problems included a high dropout rate and the refusal of many graduates to seek jobs in geographic locations and in specialties targeted for development by government planners. In response to these problems, Soviet officials during 1987 and 1988 initiated measures to reform the education system once again. Among the stated goals were an improvement in the overall training of scientific and technical specialists and the institution of greater cooperation between VUZy and industry.

The need to provide good training to scientists and engineers and to tear down bureaucratic impediments between the development of technology and its application in industry became especially important in the late 1980s. Gorbachev's program to reverse the country's economic decline demanded the increased application of science and technology to make industry more effective. Although much of the needed technology was available in the West,

the Soviet Union could neither politically nor economically afford to neglect development of its own scientific and technological base.

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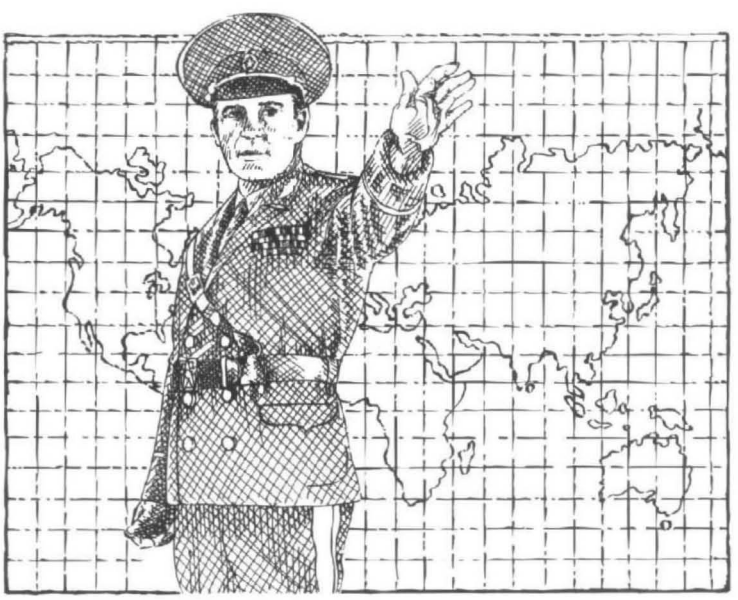
Many excellent books and articles have been written about Soviet science and technology by such authors as Loren R. Graham, Philip Hanson, Bruce Parrott, Simon Kassel, and Thane Gustafson. Some of the more recent publications by these and other authors include *Science, Philosophy, and Human Behavior in the Soviet Union* by Loren R. Graham; *The Communist Party and Soviet Science* by Stephen Fortescue; and *Trade, Technology, and Soviet-American Relations,* edited by Bruce Parrott. Another excellent source on all aspects of science and technology policy is the compendium of papers submitted to the Joint Economic Committee of the United States Congress. The latest edition was released in 1987 and is titled *Gorbachev's Economic Plans.* A number of studies on particularly defense-related Soviet technologies have been published. They include *The Technological Level of Soviet Industry,* edited by Ronald Amann, Julian M. Cooper, and R.W. Davies; *Industrial Innovation in the Soviet Union,* edited by Amann and Cooper; and *Technical Progress and Soviet Economic Development,* also edited by Amann and Cooper. For information on current science and technology issues, the best sources are the Radio Free Europe/Radio Liberty research reports, the Foreign Broadcast Information Service's *Daily Report: Soviet Union,* and the Joint Publication Research Service's translations series, *USSR: Science and Technology Policy.* (For further information and complete citations, see Bibliography.)

Chapter 17. Military Doctrine and Strategic Concerns



An officer describing military strategy

UNDERSTANDING THE STANCE that the Soviet Union has adopted on military affairs requires analyzing the meaning the Soviet regime has given to concepts such as military doctrine, military policy, and military science, as well as comprehending the ideological basis of these terms. In Soviet military writings, these concepts overlapped considerably, and Soviet military theorists stressed their interdependence. Military doctrine represented the official view on the nature of future wars and on the methods of fighting them. Military policy offered practical guidelines for structuring the Soviet armed forces and for building up Soviet defenses. Military science—the study of concepts of warfare and of the weapons needed to accomplish military missions—supported the formulation of doctrine and policy. Military doctrine and military policy directed the findings of military science toward fulfillment of the political goals of the Communist Party of the Soviet Union (CPSU).

Soviet military doctrine was grounded in Marxist-Leninist (see Glossary) theory as the CPSU interpreted it. The party understood the world as a battleground of classes and social systems and predicted the "inevitable victory of socialism." Thus the party's interpretation of Marxist-Leninist doctrine provided the Soviet military with a framework for developing strategic and operational concepts for winning wars.

Soviet military doctrine was the most fundamental and the most influential of the theoretical concepts that governed the conduct of Soviet military affairs. It influenced procurement of weapons, colored threat assessments, and provided a theoretical basis for the party's military policy. It determined Soviet arms control proposals and the kinds of arms control agreements that the Soviet Union would be willing to sign. Together with the government's military policy, military doctrine shaped Soviet military-strategic initiatives abroad.

Until 1956 Soviet doctrine was based on Lenin's thesis of the "inevitability of war" between capitalism and socialism (see Glossary). Such a war would be fought in defense of the socialist motherland and end with the clear-cut victory of socialism. Thus, it would be both defensive and victory oriented. The development and deployment of nuclear weapons changed doctrinal views on war's inevitability. It soon became clear that nuclear war would cause such widespread destruction that it could not be a rational tool of

policy, that victory in a nuclear war was problematic, and that a nuclear power ought to deter rather than fight such a war. Soviet civilian leaders and military theorists expressed their belief in nuclear deterrence by declaring that a world war with capitalism was no longer unavoidable. They also argued that the shift in the correlation of forces and resources (see Glossary) in favor of socialism has made war avoidable. But Soviet political and military leaders did not condemn the use of nuclear weapons for fighting a war, and they did not relinquish the requirement to win. As a result, Soviet military doctrine combined the concepts of nuclear deterrence, nuclear war, and victory.

Consequently, even in the nuclear era, Soviet military science remained, in the words of the eighteenth-century Russian commander Aleksandr Suvorov, a "science of victory" in armed conflict. The most important component of military science, military art, and the latter's highest level, military strategy, continued to aim at complete defeat of the adversary. The drive to prevail at all costs and under all circumstances directed the other two components of military art: operational art and tactics. In the late 1980s, theoretical concepts for the study and conduct of armed warfare—such as the laws of war, the laws of armed conflict, and the principles of military art—continued to emphasize victory.

Marxist-Leninist military doctrine has had considerable effect on arms control. On all levels—strategic nuclear, theater nuclear, and conventional—the doctrine's orientation toward victory has demanded capabilities for fighting and winning wars.

The Soviet Union never allowed arms control to interfere with achievement of its military objectives nor to constrain the strategic goals of the armed forces. Even in the late 1980s, in spite of General Secretary Mikhail S. Gorbachev's "new thinking" (see Glossary) and his strong emphasis on arms reductions, the military remained mistrustful of political solutions and reluctant to accept sweeping changes in doctrine and strategy.

Marxist-Leninist Theory of War

The Marxist-Leninist theory of war provided a basis for Soviet military theory and practice. Karl Marx and Friedrich Engels developed Marxism (see Glossary), which was further elaborated by Vladimir I. Lenin, the first leader of the Soviet Union. The Marxist-Leninist view of war rested on the principle that war is a continuation of politics and that the aim of war is to achieve military victory so as to hasten the political victory of socialism. Soon after the Soviet Union acquired nuclear weapons, a debate arose in Soviet leadership circles over whether a catastrophic nuclear war could be a

continuation of politics. Theorists debated whether waging nuclear war was in the best interests of socialism, or whether Marxist-Leninist policy should exclude nuclear war.

Since the 1950s, two lines of argument concerning nuclear war as a tool of policy have existed in the Soviet Union. Some civilian and military leaders have maintained that because nuclear war is too destructive, one should never be fought. Conversely, the authors of a volume entitled *Marxism-Leninism on War and the Army,* which has appeared in six editions since 1957 and sets forth the Marxist-Leninist philosophy of war as well as the CPSU's official views on conducting war, have consistently upheld nuclear war as a legitimate continuation of politics and have endorsed the use of nuclear weapons.

Marxist-Leninist theory of war has not only established theoretical foundations for fighting and averting nuclear wars but also has provided practical guidelines for categorizing wars according to their "class essence" as just wars (see Glossary) and unjust (predatory) wars. It also has purportedly discovered objective "laws of war" (see fig. 26). These laws governed the conduct of war and promoted victory.

War as a Continuation of Politics

According to Marxist-Leninist theory, the essence of war is political. Lenin adopted the dictum of the nineteenth-century Prussian strategist Carl von Clausewitz that war is a continuation of politics by other, i.e., violent, means. In contrast to Clausewitz, however, who understood politics as the relationship between states, Lenin regarded politics as class struggle within states. Lenin also believed that class struggle within states dictated the kinds of preparation that these states made for war, the declarations of wars between states, the conduct of wars between states, and the outcome of wars.

Contemporary Marxist-Leninist interpretation of war derived from Lenin's understanding of war as the outcome of class struggle. According to this view, noncommunist states were ruled by classes that were hostile to the "dictatorship of the proletariat" established by the Soviet Union and other socialist states. In particular, the Marxist-Leninist understanding of war attributed to the United States, as the most powerful representative of "imperialism" (the final stage of capitalism), the goal of altering the course of world development by destroying communism (the final stage of socialism). Marxism-Leninism assigned to the Soviet armed forces the task of preventing the destruction of communism by

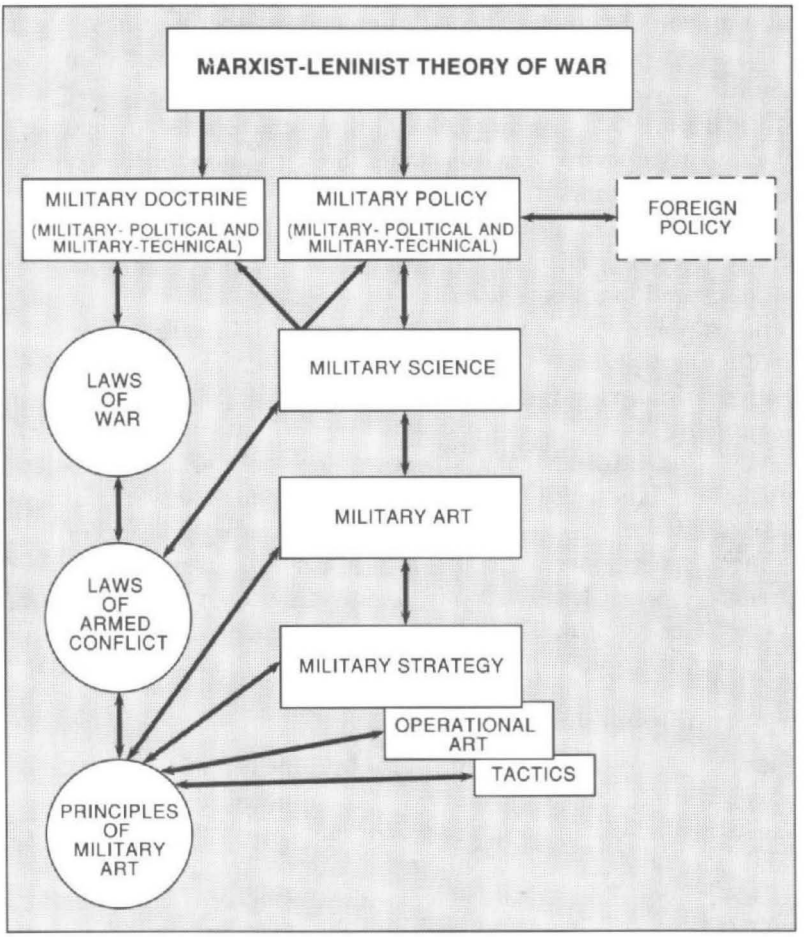


Figure 26. Soviet Military-Political Concepts, 1989

waging a defensive but victorious war with all modern weapons at their disposal.

In the 1960s, before development of the concept of limited nuclear war, Soviet strategists debated whether or not nuclear war could be a rational tool of policy because the widespread destruction it would cause could prevent it from promoting socialism's final victory. Some Soviet leaders, notably Nikita S. Khrushchev and the Soviet military theorists who shared his views, maintained that, considering the extremes of nuclear violence, nuclear war could not be a continuation of politics by means of armed force (see Evolution of Military Doctrine, this ch.). In the 1970s, Leonid I. Brezhnev

claimed that whoever started a nuclear war would be committing suicide, and he asserted that the Soviet Union would never be the first to use nuclear weapons. In the 1980s, Soviet civilian and military leaders adopted a similar stance, repeatedly declaring that no victor could emerge in a general nuclear war and that it would lead to the destruction of humanity. These statements seemed to modify Lenin's dictum that war is the continuation of politics.

By contrast, the official position on war, as communicated to the military in consecutive editions of *Marxism-Leninism on War and the Army,* one of the fundamental works of Soviet military theory, has remained unchanged. The 1968 edition maintained that all wars, "even a possible thermonuclear one," are and will be "a continuation of politics by means of armed force." The most recent edition available in 1989, *Marxist-Leninist Teaching on War and the Army,* published in 1984, deemed a nuclear attack reprehensible but regarded as "just and lawful" the use of nuclear weapons either to respond to an enemy strike or to forestall an impending nuclear strike by an adversary. According to this edition, "nuclear missile war fully retains the general social essence of war" and is "a continuation of politics by other, violent means."

This apparent regarding of all weapons, no matter how destructive, as "just and lawful" means for the defense of socialism stemmed from Marxist-Leninist teaching on just and unjust wars. According to this teaching, wars waged by the Soviet Union and socialist states allied with it were a "continuation of the politics of revolution" and led to a revolutionary transformation of the world. Hence, in the Marxist-Leninist scale of values, all wars fought by socialist armies were both just and revolutionary. By contrast, all wars waged by "imperialists" were, by definition, unjust. Marxist-Leninist theory also asserted that all wars fought in defense of the socialist motherland were unconditionally just and could be fought with all modern weapons, including nuclear ones.

Laws of War

The belief that history was on the side of socialism and that Marxism-Leninism was a basis for discovering "objective" laws governing social and economic change has caused a proliferation of laws and principles in Soviet military thought. On the most general level, the laws of war were factors determining the course and outcome of wars. These laws expressed the political philosophy of the CPSU in the military sphere. These laws, however, were not immutable and could change with the emergence of new military technologies and new operational concepts.

Joseph V. Stalin, general secretary of the party between 1922 and 1953, believed in the existence of five "permanently operating factors": the stability of the rear, the morale of the army, the quantity and quality of divisions, the armaments of the armed forces, and the organizational ability of the commanders. These factors served as forerunners of the laws of war that were in force in 1989. Because Stalin's permanently operating factors did not take nuclear weapons into account, by the 1960s Soviet military political writers had largely discounted them. A new set of laws, taking into account new weapons, the new strategic environment, and the probability that future war would be mainly nuclear, did not appear until 1972, with the publication of Colonel Vasilii E. Savkin's *The Basic Principles of Operational Art and Tactics.* Savkin's four laws of war in the nuclear era specified four factors upon which the course and outcome of a war waged with unlimited use of all means of conflict depended. First, he said it depended on the correlation of available military forces; second, on the correlation of the overall military potential of each side; third, on the political content of the war; and fourth, on the correlation of the moral-political capabilities (see Glossary) and the psychological capabilities of the people and armies of the combatants.

In 1977 the *Soviet Military Encyclopedia* refined and augmented Savkin's laws and listed six laws of war that the 1984 edition of *Marxist-Leninist Teaching on War and the Army* reiterated almost verbatim. According to the most recent set of laws, the course and outcome of war depended on the following factors: the political goals of the war, which had to be just and revolutionary; and the correlation of the economic forces, scientific potentials, moral-political forces, and military forces of the warring sides. Yet another law, added in the 1984 edition of *Marxist-Leninist Teaching on War and the Army,* stressed the "dependence of the development and changes in the methods of warfare on quantitative and qualitative changes in military technology and on the moral and combat qualities of the military personnel."

Since Savkin first formulated his laws of war in 1972, a reordering of priorities has occurred. Savkin put the strictly military, primarily nuclear capabilities in first place. In 1977 and 1984, however, they occupied last place, with political goals in first place. The 1984 edition reflected the realization that new weapons and new strategies could revolutionize future warfare and that high standards of training and combat readiness of military personnel would assume more importance than before.

In addition to the laws of war just listed, which mainly influenced the course of war, Marxist-Leninist thought ostensibly has discovered the "law of objective victory," which predetermined

Soviet and American officials observing the detonation of a Soviet SS-12 missile in compliance with the Intermediate-Range Nuclear Forces Treaty
Courtesy United States On-Site Inspection Agency

the outcome of war and expressed the "historical inevitability of the triumph of the new over the old." That is, victory would go to the side that represented the new, more progressive socioeconomic system and that used the country's potential more effectively. Soviet military-political writers often cited Soviet victory in World War II as historic proof that no force in the world was capable of stopping the progress of a socialist society. Soviet military theorists also have invoked the experience of World War II to prove the superiority of a socialist economy in supplying weapons and war matériel. They have stressed Soviet ability to produce sophisticated military technology. "Victory will be with the countries of the world socialist system," Soviet military writers announced confidently in 1968, because "they have the latest weapons." In 1984 Colonel General Dmitrii A. Volkogonov, chief editor of the 1984 edition of *Marxist-Leninist Teaching on War and the Army,* made the relationship between weapons and victory even more specific when he wrote that "the attainment of victory is directly dependent on the availability and sufficient quantity of modern means of warfare."

The Party and Military Doctrine and Policy

Marxist-Leninist teaching on war and the armed forces defined

the essence of wars, their origins, and the laws governing the conduct of war. In developing Soviet military doctrine and policy, the CPSU relied on this teaching and on its forecasts of the nature of future wars, as well as on the concepts and weapons proposals formulated by Soviet military science. Military doctrine was the party line on military affairs. It defined the potential adversaries, the nature of future wars, the force requirements, the general direction of military development, the preparation of the country for war, and even the type of weapons needed to fight a war. The party's military policy defined the political aims of the Soviet state and proposed concrete measures for developing and strengthening the state's military might by improving the organization and the armaments of the armed forces.

Soviet military theorists asserted that military doctrine had a military-political and a military-technical component and that doctrine overlapped with military science and strategy. Marxist-Leninist teaching shaped the political aspect of doctrine, which defined the party's overriding military-political goals and was by far the more important of the two components. The technical dimension of military doctrine dealt with available means and capabilities, as well as with future technologies, and drew on the findings of Soviet military science. In its concern with capabilities, the technical aspect of doctrine also overlapped with the technical component of military policy and with military strategy. The latter coordinated technical means and methods with military concepts for the attainment of political goals.

Soviet leaders maintained that Soviet military doctrine always had been defensive, yet because it favored an offensive strategy and stressed the need to achieve victory, Western analysts have often termed Soviet military doctrine offensive. The acquisition of nuclear weapons by the Soviet armed forces not only caused disagreement over whether nuclear war could be a continuation of politics by violent means but also introduced divergence into Soviet views on the role nuclear weapons could play in deterring or fighting a war. Soviet military strategists appeared to endorse both nuclear deterrence and nuclear war-fighting (see Glossary) but placed a greater stress on war-fighting. Even the adoption of conventional options and the downgrading of the military utility of nuclear weapons by some military leaders in the 1980s did not remove the doctrinal requirement to fight and prevail in a nuclear war.

Evolution of Military Doctrine

Soviet military theorists first formulated a uniform military doctrine in the 1920s under the influence of both Lenin's teachings

on the defense of the socialist homeland and the writings of Mikhail V. Frunze, a prominent Bolshevik (see Glossary) commander in the Civil War (1918–21) and a military theoretician. Frunze considered the basic conditions for the vitality of doctrine to be, first, its uniformity, i.e., doctrine should be the same for all services of the armed forces, and, second, "its conformity with the state's objectives and the resources at its disposal."

Since Frunze, Soviet doctrinal views on the nature and likelihood of future war have evolved as Soviet theorists have attempted to adapt doctrine to the changing nature of future war, to the shifting alignment of forces in the world, and to changes in the domestic economy and in the combat potential of the Soviet armed forces.

The most important changes in Soviet views on the nature of war came after World War II. At that time, Stalin added the concept of the "two camps"—two mutually irreconcilable coalitions—and their impending worldwide clash to the traditional Soviet concepts of capitalist encirclement (see Glossary) and inevitability of capitalist attack. In February 1956, the Twentieth Party Congress modified the idea of inevitability when Khrushchev declared that a world war with capitalism was no longer "fatalistically inevitable."

Doctrinal views on the methods of fighting a future world war also have changed significantly since the end of World War II. Stalin, who for most of his rule did not have a nuclear arsenal, envisioned future war as a fierce combined arms struggle in Europe. As both the United States and the Soviet armed forces in Europe acquired nuclear weapons in the 1950s, Soviet views gradually changed. In 1960 and 1961, Khrushchev tried to impose the concept of nuclear deterrence on the military. Nuclear deterrence holds that the reason for having nuclear weapons is to discourage their use by a potential enemy. With each side deterred from war because of the threat of its escalation into a nuclear conflict, Khrushchev believed, "peaceful coexistence" (see Glossary) with capitalism would become permanent and allow the inherent superiority of socialism to emerge in economic and cultural competition with the West.

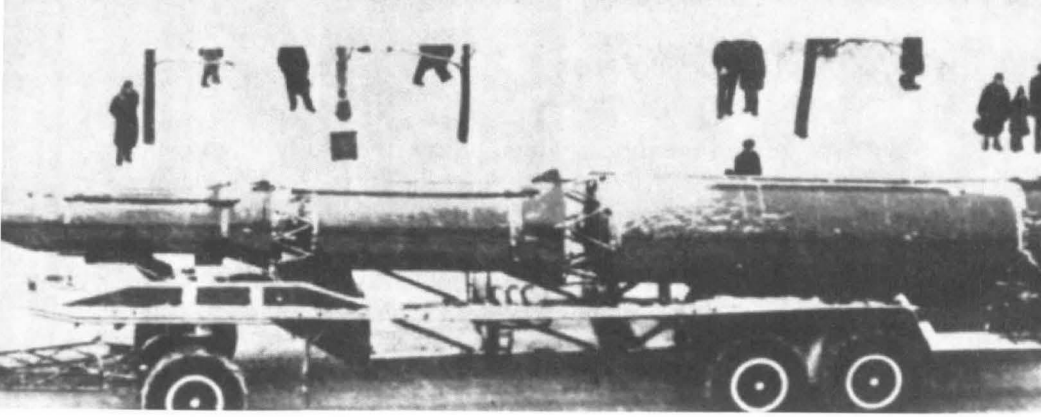
Khrushchev hoped that exclusive reliance on the nuclear firepower of the newly created Strategic Rocket Forces would remove the need for increased defense expenditures (see Strategic Rocket Forces, ch. 18). He also sought to use nuclear deterrence to justify his massive troop cuts; his downgrading of the Ground Forces, traditionally the "fighting arm" of the Soviet armed forces; and his plans to replace bombers with missiles and the surface fleet with nuclear missile submarines.

Khrushchev's attempt to introduce a nuclear doctrine limited to deterrence into Soviet military thought misfired. Discussion of nuclear war in the first authoritative Soviet monograph on strategy since the 1920s, Marshal Vasilii D. Sokolovskii's *Military Strategy* (published in 1962, 1963, and 1968) and in the 1968 edition of *Marxism-Leninism on War and the Army,* focused upon the use of nuclear weapons for fighting rather than for deterring a war. Should such a war break out, both sides would pursue the most decisive aims with the most forceful means and methods. Intercontinental ballistic missiles and aircraft would deliver massed nuclear strikes on the enemy's military and civilian objectives. The war would assume an unprecedented geographical scope, but Soviet military writers argued that the use of nuclear weapons in the initial period of the war would decide the course and outcome of the war as a whole. Both in doctrine and in strategy, the nuclear weapon reigned supreme.

After Khrushchev's ouster in 1964, Soviet doctrine began to consider the new United States concept of "flexible response," i.e., a graduated response to aggression on several levels, beginning with conventional arms. In the mid-1960s, Soviet military thinkers allowed for the possibility of a phase of conventional warfare preceding a general nuclear war. Another adjustment also occurred in the mid-1960s, as doctrine evolved to maintain that a world war need not inevitably escalate to an intercontinental nuclear exchange between the Soviet Union and the United States. Soviet doctrine allowed for the possibility of avoiding such an exchange altogether and limiting nuclear strikes to specific theaters of war. Soviet military strategists held that nuclear war could be fought in and confined to Western and Central Europe and that both United States and Soviet territory might escape nuclear devastation. Finally, after 1967, when the North Atlantic Treaty Organization (NATO) officially adopted the "flexible response" concept and began to structure its forces accordingly, Soviet doctrine began to consider the possibility of fighting an entire war with conventional arms. It did, however, allow for the likelihood of the adversary's escalating to the use of nuclear weapons.

Military Doctrine in the Late 1980s

The 1970s and 1980s were a period of questioning and transition in Soviet doctrine and strategy. Soviet military doctrine continued to assume that the Soviet Union could fight and prevail in a nuclear war and that Soviet strategic nuclear missiles could influence a war's course and outcome. Nevertheless, prominent military figures voiced concern about the military efficacy of nuclear weapons,



SS-13 intercontinental ballistic missile
Courtesy United States Department of Defense

among them the former chief of the General Staff, Marshal of the Soviet Union Nikolai V. Ogarkov; Colonel General Makhmut A. Gareev, author of a monograph on military theoretician Frunze; and Volkogonov, chief editor of *Marxist-Leninist Teaching on War and the Army*. They each expressed reservations about whether a world war of the future could be fought and won with nuclear weapons. Ogarkov, in particular, advanced the revolutionary view that a twenty-first-century battlefield might be dominated by non-nuclear, high-technology armaments and a global war could be fought with conventional weapons alone.

In the mid- to late 1980s, CPSU leaders and some military officials began to focus on the political aspects of Soviet national security and deemphasized its military aspect. They advocated a new military doctrine based on the defensive concept of "reasonable sufficiency" and on a military potential "sufficient for safeguarding the security of the country" but not adequate for launching offensives, especially surprise attacks on an adversary. In 1987 some military spokesmen also mentioned the possible reformulation of Soviet military doctrine. The chief of the General Staff, Marshal of the Soviet Union Sergei F. Akhromeev, and the minister of defense, Marshal of the Soviet Union Dmitrii T. Iazov, declared that a new Soviet military doctrine was being developed in accordance with the principles of the "new thinking" in foreign and military policy. In May 1987, the Warsaw Pact's Consultative Committee met in East Berlin and adopted a document on a defense-oriented military doctrine. In particular, the document called for reduction of conventional armaments in Europe to a level that could not support offensive operations.

When asked to explain the purportedly new concepts of war prevention and military sufficiency, however, Warsaw Pact and

Soviet spokesmen mentioned an emphasis on quality, high combat readiness, and decisive counteroperations, in short, a victory orientation that a purely defensive doctrine based on "reasonable sufficiency" could not support. The contradiction at the heart of Soviet doctrine, which claimed to be defensive but posited war scenarios calling for applying force offensively, damaged Soviet credibility in the West and led to conflicting views on Soviet intentions. Many Western analysts, among them William T. Lee and Richard F. Staar, continued to interpret Soviet intentions as "very aggressive." Others, such as Michael MccGwire and Raymond L. Garthoff, who focused on the Soviet viewpoint, saw the Soviet Union as being constrained by doctrinal requirements and threat assessments to adopt a force posture adequate for fighting a world war with both nuclear and conventional weapons.

In the late 1980s, a consensus emerged in the West on the probable Soviet doctrine. Western specialists believed that the Soviet Union would not start a nuclear war without provocation.

They also believed, however, that, should a war start, the Soviet Union would strive for victory and for protection of its territory from enemy strikes. Western specialists also held that the Soviet leadership would prefer to fight a conventional war in Europe and, should such a war escalate, would try to limit a nuclear war to Central and Western Europe. A protracted conventional conflict in the shadow of nuclear weapons, possibly worldwide, was another likely option. Many Western analysts also thought that, despite having in 1982 unilaterally forsworn the first use of nuclear weapons, the Soviet Union retained the option of a surprise first strike against the United States. They maintained that Soviet leaders would consider this option if they believed they could thereby win the war and limit damage to the homeland.

Doctrine and Weapons Programs

The relation between the military-political and military-technical aspects of Soviet doctrine and weapons programs was direct and unmistakable. A direct link existed between the military-political component of doctrine, operational requirements, weapons programs, and force deployments. Doctrinal requirements could remain unfulfilled for years, but they usually were met as technologies became available. Hence, a knowledge of the military-political component of Soviet doctrine was helpful for forecasting the direction of Soviet military technology.

The doctrine developed by the Soviet Union in the early 1960s bore little relation to actual conditions, and the Soviet Union needed fifteen years to develop the weapons described in the 1962 edition

of Sokolovskii's *Military Strategy.* In October 1986, Ogarkov wrote that the Soviet Union required an industry capable of solving the most difficult defense-equipment problems and producing the sophisticated weapons needed to win a war without using nuclear weapons. He projected a future requirement to develop new equipment and weapons, a requirement that Soviet industry might not be able to fulfill for many years. And, should the party's doctrinal view of a future war differ from Ogarkov's, this requirement might never be translated into actual weapons programs.

When formulating their goals for new, important weapons systems, Soviet leaders considered both doctrinal pronouncements on the nature of future wars and estimates of the external military threat supplied by the General Staff (see General Staff, ch. 18). The services of the armed forces reviewed their missions and drew up weapons acquisition plans in cooperation with research institutes and design bureaus (see Research, Development, and Production Organizations, ch. 16). The General Staff prepared a consolidated plan, which it forwarded to the Defense Council to be recommended for the Politburo's approval (see Defense Council, ch. 18). Although the professional expertise of the military influenced the weapons request that filled a doctrinal requirement, the party made the final decision on the weapons to be produced.

Military Policy of the Communist Party of the Soviet Union

In addition to developing military doctrine, the CPSU developed military policy, which was much broader than doctrine. Whereas doctrine contains the guiding principles on the essence of future wars and on the methods and weapons for fighting them, military policy guides the development and strengthening of the state's military might through improving the organization and armaments of the armed forces so that they can be used successfully to achieve the state's political goals. Military policy is closely linked to military strategy. Policy defines the objectives of war and focuses the attention of strategy on the tasks to be performed. Strategy's dependence on policy increased with the acquisition of nuclear weapons, the use of which was controlled by the political leadership. Like military doctrine, Soviet military policy had two components: military-political and military-technical. Soviet military theorists frequently referred to these components simply as military-political policy and military-technical policy.

According to the Soviet understanding of the term, military-political policy defined the political aims of the state, evaluated the international environment and the military potentials of probable adversaries, and established guidelines for Soviet military

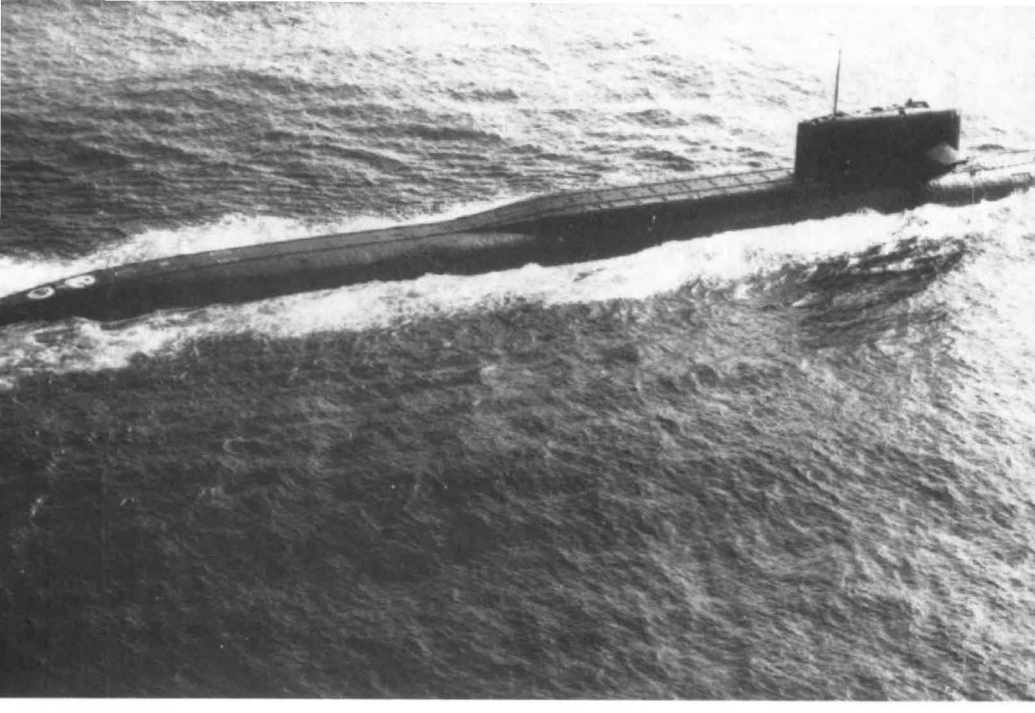
involvement in the world. It both overlapped and supported Soviet foreign policy. Military-political policy took into account the economic, social, scientific, and specifically military capabilities of the Soviet state and was used by the party to determine the optimal directions for structuring the armed forces and for strengthening the economic-technical base of the state's defense. Concerned about the integrity and security of the state, the party could modify its military policy as the interests of the state changed. Soviet spokesmen nevertheless stressed the continuity and consistency of the party's military policy and of the military-political course of the Soviet Union.

The Soviet military-industrial complex was run according to the military-technical component of the party's military policy, which determined the cycles of military modernization. According to Soviet sources, major weapons development programs were carried out every ten to twelve years. As in doctrine, military recommendations influenced policy, but the party retained complete control over the formulation of a uniform military-technical policy and over its implementation by government organizations.

Military Science

Although the party formulated doctrine and policy, military science—the study and practice of armed conflict—was the preserve of military professionals. According to Soviet military theorists, military science was a system of knowledge dealing directly with the nature and laws of armed conflict, the preparation of the armed forces and the country for war, and the methods of waging war. It comprised both the theory of military affairs and its practical applications in combat. Military scientists studied and defined the laws of armed conflict, which were said to be objective, i.e., independent of human consciousness. They also formulated subjective interpretations of these laws, known as principles of military art. Unlike doctrine, military science permitted differing views and even debates among military professionals concerning the nature and methods of armed combat.

The principal components of military science are military art, subdivided into military strategy, operational art, and tactics; the command and control of troops; the structuring (or development) of the armed forces; training and indoctrination; military economics; military geography and history; and the increasingly important military-technical sciences, such as artillery science, naval science, cybernetics, topography, and geodesy. A main component of military science is military art, which focuses on the theory and practice of conducting military actions on land, at sea, and in the air.



Yankee-class nuclear-powered ballistic missile submarine under way
Courtesy United States Navy

Reputedly, scientific forecasting is one of the most important functions of military science. Computer modeling and operations research are used to predict the military-technical nature of future wars and the evolution of military technology and of military affairs in general. Forecasting provides valuable input into military doctrine and can cause modification of doctrinal pronouncements on the type of war the Soviet Union may have to fight in years to come. Another key function of military science is long-term planning for development and deployment of the most effective weapons for future conflicts.

Like doctrine and policy, Soviet military science traced its origins to Lenin's teachings on the defense of the socialist motherland. Soviet military theorists credited Lenin not only with laying the foundation of Soviet military doctrine and policy but also with founding Soviet military science. Lenin also has played a prominent role in developing Soviet military strategy. Lenin's belief that political solutions would promote the spread of communism better than would military ones and that armed conflict was merely a continuation of politics by forcible means relegated military science to a subordinate role. Thus Soviet military science was not autonomous but was, in fact, a handmaiden of the party's military doctrine and policy.

Laws of Armed Conflict

Soviet military scientists studied and defined objective laws of armed conflict that focused on the military struggle. These laws represented the professional military consensus on the best methods of waging combat in order to achieve victory on the battlefield. Although Soviet military theorists maintained that the laws of armed conflict "express the internal, essential, necessary, stable relationships between the phenomena manifested in the course of an armed conflict," the laws were far from immutable. They retained their validity until Soviet military thinkers discovered other laws that provided better solutions to the same problems. Thus the laws of armed conflict defined in the 1970s that relied on massive strikes with nuclear weapons for the solution of most military tasks appeared outdated in the 1980s, when the Soviet military was emphasizing conventional options.

Two laws of armed conflict, however, purportedly remained unaffected by technological change. They were the law of dependence of the forms of armed combat on the material basis of the battle and operation, i.e., on people and equipment, and the law stating that the side with the greater combat power will always be favored in any battle or operation.

Principles of Military Art

The principles of military art are the basic ideas for the organization and conduct of battles, operations, and wars, and they can be applied on tactical, operational, and strategic levels. These principles evolve over time: some lose their significance, others acquire a new content, and new principles emerge. The 1978 *Soviet Military Encyclopedia* listed the following eleven principles of military art: high combat readiness; surprise and striving to seize and retain the initiative; full use of all means and methods of combat; close cooperation among the services, also known as the principle (or concept) of combined arms; concentration of essential efforts; simultaneous destruction of the enemy to the entire depth of the enemy's deployment; full use of the moral-political factor; strict and uninterrupted troop control; steadfastness and decisiveness; comprehensive security of combat activity; and timely restoration of reserves. These principles guided Soviet commanders in planning, preparing, and waging armed combat.

Military Art

Military art is the theory and practice of preparing and conducting military actions on land, at sea, and in the air. Its three components—military strategy, operational art, and tactics—are

interconnected and mutually supporting. Military strategy is concerned with the conduct of the war as a whole.

Operational art deals with the preparation and conduct of military actions within geographical limits of a theater of military operations (*teatr voennykh deistvii*—TVD; see Glossary). Operational art is employed to achieve the goals set under strategy. It links strategy and tactics, in that tactical missions are assigned to support theater operations. Military tactics defines combat methods for the battlefield. Although it is subordinate to operational art and strategy, tactics can influence both the operational and the strategic levels of war.

Military Strategy

Military strategy is the most important component of military art. The study of strategy was an important part of Soviet military life, and all services of the Soviet armed forces followed the same military strategy. Strategists investigated the nature of war and its conduct, as well as the conduct of strategic operations. They defined the missions of the armed forces and specified the resources needed to accomplish them. Soviet strategists also studied the capabilities and strategies of probable adversaries and devised measures to counter them. Military strategy and military science supplied policy makers with the results of military-scientific research on the best methods for attaining a war's objectives. At the same time, the recommendations of military strategy and military science helped shape military doctrine, the principles of which then guided strategy in the conduct of war.

Nuclear Strategy in the 1950s

After the explosions of the first Soviet atomic device in 1949 and the Soviet hydrogen bomb in 1953, the Soviet armed forces acquired nuclear weapons. Also introduced in the 1950s were ballistic- and cruise-missile technologies, jet engines, and artificial earth satellites, as well as computers and automated control systems. These important events were known in the Soviet Union as the "revolution in military affairs." Of all the new developments, nuclear weapons most affected Soviet strategy. Nuclear weapons altered the nature and methods of armed struggle on the strategic level because they could accomplish the military's strategic tasks without operational art and tactics. Not until Stalin's death in 1953, however, could the Soviet military begin exploring the full strategic potential of the new weapons. Although he had pushed for the development of the "bomb," Stalin played down its importance and did

not encourage the military to formulate a new strategy incorporating nuclear weapons.

Transition to a nuclear strategy began in the mid-1950s, when Soviet military thinkers began recognizing the importance of surprise, of the initial period of war, and of using nuclear strikes to determine the course and outcome of a war. In February 1955, Marshal Pavel A. Rotmistrov published in the Soviet journal *Voennaia mysl'* (Military Thought) a ground-breaking article on "surprise." He stressed the importance of landing the first, "preemptive" nuclear blow to destroy the enemy's weapons when the latter was preparing a surprise attack. Since the mid-1950s, the concept of preempting an enemy's nuclear weapons has become firmly entrenched in Soviet military thought.

As the Soviet military came to view nuclear weapons as particularly suitable for general war, it needed a strategy for their use. In 1957 a series of military seminars at the highest level helped leaders develop the elements of a new nuclear strategy. A group of Soviet military strategists under the direction of Marshal Sokolovskii continued the work of the seminars. In 1962 they published *Military Strategy,* the first Soviet treatise on strategy since 1927.

The Sokolovskii Era, 1962–68

In January 1960, Khrushchev unveiled the new nuclear strategy in a speech to the Supreme Soviet. According to Khrushchev, this strategy's aim was deterring war rather than fighting it (see Evolution of Military Doctrine, this ch.). Despite Khrushchev's emphasis on deterrence and reductions in military manpower, Sokolovskii's *Military Strategy* focused on apocalyptic scenarios for fighting a world war with nuclear weapons and stressed the need for mass armies. The idea of preemption resurfaced, this time on an intercontinental basis, because the Soviet Union had acquired nuclear intercontinental ballistic missiles (ICBMs) and could threaten the territory of the United States. Sokolovskii maintained that the Soviet side had to "frustrate" an enemy coalition's attack by delivering massive nuclear strikes on the enemy's territories. These strikes would destroy not only the enemy's weapons but also the enemy's will to continue the war, thus limiting the damage from a retaliatory strike.

This view of nuclear strategy prevailed during most of the 1960s. Soon after the publication of the third edition of his *Military Strategy* in 1968, however, Sokolovskii wrote with an eye on the future: "Military affairs are entering or have already entered the next stage of their development, and apparently it is necessary to introduce

essential changes into military art." Such changes began to occur in the 1960s and continued through the 1970s and 1980s.

New Strategic Options, 1968–89

Beginning in the mid-1960s, the Soviet military leadership tried to add new, less destructive, strategic options, not only as a response to NATO's "flexible response" concept but also because the leaders began to doubt the possibility of a true victory in an all-out nuclear war. Although most military writings upheld the obligatory belief in socialism's victory, doubters hinted that not only imperialism but also socialism could perish in a nuclear holocaust.

The search for options intensified in the 1970s, after the Soviet Union had achieved rough nuclear parity with the United States, thereby making a nuclear war with the West less likely. If escalation had been imminent, the Soviet Union had the capability—accurate and reliable ICBMs with multiple warheads—to limit its strikes to the adversary's weapons, thus reducing the level of violence. Other options examined in the 1970s and 1980s included a nuclear war limited to Europe, a combined arms offensive with both nuclear and conventional weapons, and a completely conventional strategic operation in Europe, where Soviet nuclear weapons deterring Western use of nuclear weapons.

In 1989 two possible future strategic options—space warfare and ballistic missile defense—had not been officially endorsed but were available to Soviet planners. Since the 1957 launching of Sputnik (see Glossary), the Soviet Union had been interested in the military use of space and had conducted research in this field. Moreover, in late 1987 Gorbachev admitted that for years the Soviet Union had been conducting basic research on a space-based defense against ballistic missiles, similar to the United States Strategic Defense Initiative (SDI).

Yet even in 1989, the addition of new strategic options did not alter the basic nuclear war scenario of the 1960s. Two monographs published in 1985 and 1986 by Gareev and Lieutenant General Pavel A. Zhilin, respectively, reaffirmed the increased importance of surprise during the initial period of a nuclear war. According to these specialists, such a "surprise nuclear strike," if successful, could determine both the course and the outcome of a war. Soviet belief that the United States was acquiring nuclear missiles capable of delivering a surprise strike and was developing an antimissile shield to protect United States territory from Soviet retaliation contributed to the Soviet military's perception of the growing role of strategic surprise.

Operational Art

Operational art involves the translation of strategic goals into military objectives in TVDs by conducting decisive theater campaigns. Although a single military strategy existed for the Soviet armed forces, each of the five armed services had its own operational art and tactics. Three enduring concepts that have shaped Soviet operational art since the 1920s have been the concept of the TVD, the principle of combined arms, and the theory of deep offensive operations.

TVDs divided the world into manageable military-geographic sectors. In 1983 the Soviet *Military Encyclopedic Dictionary* defined a TVD as part of a continent or an ocean "within the boundaries of which are deployed strategic groupings of the armed forces and within which military operations are conducted." Around its periphery the Soviet military recognized five continental TVDs with their surrounding seas: the Northwestern, Western, Southwestern, Southern, and Far Eastern. Oceanic TVDs were located in the Atlantic, Pacific, Indian, and Arctic oceans (see fig. 27).

The combined arms concept is a major principle of Soviet military art. It means that all services are integrated and coordinated to achieve victory in a war, an operation, or a battle. The concept originated in the 1920s, when Marshal of the Soviet Union Mikhail N. Tukhachevskii understood combined arms primarily as the cooperation between artillery and infantry in land warfare. Since then, as the Soviet armed forces have added new weapons systems such as tanks, aircraft, submarines, and ballistic and cruise missiles, combined arms acquired a new meaning as it began to signify the interaction of all services of the armed forces to attain strategic goals.

The deep offensive operation theory evolved in the 1920s and 1930s as an outgrowth of the combined arms concept. The deep offensive operation called for the destruction of the enemy to a substantial depth of its deployment, for the use of mobile groups in the enemy's rear, for a breakthrough of tactical defense, and for encirclement and subsequent destruction of enemy troops. During World War II, Soviet commanders stressed coordination of troops, operational maneuver, and operational breakthrough, as well as the necessity of conducting an operation with combined forces on several fronts. New types of operations emerged, such as air and antiair operations, and combined operations of the Ground Forces, Air Forces, and Naval Forces. In the 1950s, the increased mobility of armor and the striking power of nuclear weapons bolstered the concept of the deep offensive operation.

Nuclear weapons produced fundamental operational changes. The scope and depth of an operational offensive grew, and its violence intensified. Soviet military thinkers believed that they could

achieve a decisive victory by delivering preemptive nuclear strikes on objectives deep in the enemy's rear and, subsequently, by encircling, cutting off, and destroying the enemy's troops with nuclear and conventional munitions. Soviet military writers soon began to point out, however, that radioactive contamination, fires, and floods caused by massive nuclear strikes could interfere with the success of operations.

In the 1970s, the Soviet Union built up its conventional forces in Europe and adopted new operational concepts for the conduct of a deep offensive operation using both conventional and nuclear weapons. A conventional phase was to precede the nuclear phase. By the early 1980s, the Soviet military had developed an all-conventional option for a deep offensive operation in a TVD (see Offensive and Defensive Strategic Missions, this ch.).

Tactics

Tactics is the aspect of military art concerned with the preparation and conduct of offensive and defensive combat actions by elements of the armed forces on land, in the air, and at sea. Soviet military writers distinguish four basic tactical combat actions: offense, the meeting engagement (in which both belligerents meet while advancing), defense, and withdrawal. They view defense as a temporary action, for only offense can bring about a complete rout of the enemy and victory.

In the early 1960s, nuclear weapons became the "basic means of destruction on the field of battle." Soviet tacticians believed that nuclear strikes during an engagement would help the Soviet armed forces to seize and retain the initiative on a tactical level and achieve victory in battle. The new emphasis on nuclear weapons led to changes in tactical concepts. Instead of massive concentration of forces on the main direction of attack, theorists advocated concentration of nuclear strikes and maneuver by troops and by nuclear missiles.

Soviet military theorists came to realize that use of nuclear weapons by both belligerents could complicate offensive tactical combat by slowing down the Soviet advance while strengthening the enemy's defense. Because increased mobility and high rates of advance formed the most important Soviet operational and tactical principles, the Soviet military began to perceive nuclear weapons as problematic. Thus, in the late 1960s and the 1970s, Soviet military planners began to reorient tactics away from reliance on nuclear weapons toward reliance on new conventional weapons. Concepts such as the concentration of forces on the main

Source: Based on information from United States, Department of Defense, *Soviet Military Power, 1987,* Washington, 1987, 16.

Figure 27. Theaters of Military Operations, 1987

axis, partial victory, and economy of force again assumed their prenuclear importance.

Soviet tactics in the 1980s has experienced a resurgence, in part because improved conventional weapons with greater ranges and accuracies became available. Also, the 1979 Soviet invasion of Afghanistan provided a training ground for tactical conventional combat in mountainous and desert terrain and drew the attention of Soviet military theorists to the importance of tactics in warfare. Two revised editions of Lieutenant General Vasilii G. Reznichenko's *Tactics* were published in the 1980s: one in 1984 and a revised and augmented one in 1987. Reznichenko described tactics as the most dynamic component of contemporary military art, a component that could influence the operational and even the strategic levels of war. In the 1987 edition of *Tactics,* Reznichenko included new defensive concepts but emphasized the offensive, supported by air superiority, fire superiority, and electronic warfare. He favored conventional rather than nuclear preemption, for, if used preemptively, long-range precision-guided munitions could predetermine the outcome of a combined arms battle.

Strategic Missions of the Armed Forces

The General Staff had the responsibility for formulating the strategic missions of the five services of the Soviet armed forces. The Soviet military has defined a strategic mission as one "whose fulfillment in the course of an armed conflict leads to an abrupt change in the operational strategic situation . . . . Successful accomplishment of a strategic mission usually results in attainment of numerical superiority over the enemy, in seizure of important areas and installations on his territory . . . . Successful accomplishment of a series of strategic missions leads to the attainment of intermediate and ultimate strategic goals." Because the ultimate strategic goal of war is victory over the adversary, the successful accomplishment of strategic missions is indispensable.

The General Staff had the responsibility for assessing external threats and drawing up Soviet war plans. It reconciled its plans with Soviet military doctrine and policy. The General Staff also determined the nature of strategic missions, as well as the weapons used and the size of forces needed to accomplish these missions (see table 53, Appendix A).

Traditionally, the Soviet military has structured its armed forces offensively, on the basis of worst-case threat assessments. The primacy of offense over defense was challenged in the nuclear age, when strategic offense was often combined with strategic defense. In 1989, in spite of the new doctrinal emphasis on defense, most

branches of the Soviet armed forces, such as the Strategic Rocket Forces, the Air Forces, the Naval Forces, and the Ground Forces, still had mainly offensive missions. The Ground Forces played a leading role in the combined arms strategic operation in a TVD. By contrast, the Air Defense Forces were to carry out active defense of the homeland by destroying the enemy's weapons and aircraft, whereas Civil Defense was to protect the country from nuclear devastation. In the 1980s, the Soviet military reinforced the combined arms concept on the strategic level by reorganizing and restructuring the Soviet armed forces.

Threat Assessments and Force Requirements

Since the nuclear era began, worst-case threat assessments have dominated Soviet military thinking. As a result, even during the years of détente and strategic arms control, Soviet military policy and doctrine have called for disproportionately large forces for the fulfillment of strategic missions, and Soviet military planners have drawn up plans in response to doctrinal requirements.

In the 1980s, Soviet worst-case scenarios centered on the modernization of the United States ICBMs, on United States deployment of the Trident ballistic missile submarine armed with long-range, accurate nuclear missiles, and on United States procurement of low-flying ground-, sea-, and air-launched cruise missiles. Soviet spokesmen also persisted in portraying SDI as an offensive system and claimed that it would enable the United States to launch a first strike against Soviet territory with impunity.

Dmitrii Iazov, appointed minister of defense in 1987, adopted a contradictory position on Soviet military planning and threat assessment. Implying that the Soviet Union was willing to scale down its military expenditures and would modify its military doctrine and strategy, Iazov publicly endorsed reductions in the nuclear and conventional armaments of both the United States and the Soviet Union to a level commensurate with a defense-oriented doctrine and strategy. Yet he retained the traditional worst-case scenario when he called for a robust Soviet nuclear capability that could punish an attacker "even under the most unfavorable circumstances." Although he relied on "reasonable sufficiency" rather than on superiority, Iazov also defined "reasonable sufficiency" in traditional terms as the ability to "reliably guarantee the defense of the Socialist Community" with armed forces structured and equipped for offensive action.

Offensive and Defensive Strategic Missions

Traditionally, the overall mission of the Soviet armed forces has been to deter war in peacetime and to defend the Soviet Union

and the socialist states allied to it in wartime. Should war break out, the Soviet armed forces were expected to fight decisively and to achieve victory. Soviet unified military strategy, common to all services, was primarily offensive, and defense was only a temporary expedient. The primacy of strategic offense over strategic defense appeared indisputable. Since the advent of nuclear weapons, however, strategic offense and defense have become intertwined, and offensive and defensive strategic missions frequently coalesced. The combined arms concept was expressed in this growing interdependence between offense and defense in Soviet unified strategy because many strategic missions involved overlap and cooperation and would be performed by more than one service (see Military Art, this ch.). The Soviet military envisaged most strategic operations, both offensive and defensive, as mutually reinforcing components of a single strategic plan. In the 1980s, Soviet strategists believed that the synergistic effect of combined arms would maximize the armed forces' potential to achieve unambiguous victory.

To reinforce the combined arms concept on a strategic level, the Soviet military reorganized the Soviet armed forces. It centralized command and control, established theater commands in TVDs directly responsible to the Supreme High Command, and improved early warning systems (see Main Military Council, ch. 18). The new Soviet command infrastructure would enable the Soviet military to change speedily from a peacetime to a wartime footing.

Strategic Offense

The Strategic Rocket Forces, the Naval Forces, the Air Forces, and the Ground Forces have had predominantly offensive missions. Since their founding in 1959, the Strategic Rocket Forces have been charged with using their intercontinental and intermediate-range ballistic missiles to destroy military and economic targets in the United States and on the Eurasian landmass in the initial period of war. The Strategic Rocket Forces were to preempt an enemy attack by launching Soviet missiles first or to prevent the destruction of Soviet missiles by launching them soon after the enemy's missiles had left their silos. Thus the Soviet initial strike could be both offensive and defensive. In their offensive posture, the Strategic Rocket Forces could change the correlation of forces and resources and tip the nuclear balance in the Soviet Union's favor. At the same time, should the Soviet strike succeed in destroying United States missiles before launch, it would prevent a United States nuclear strike (see Military Doctrine in the Late 1980s, this ch.).

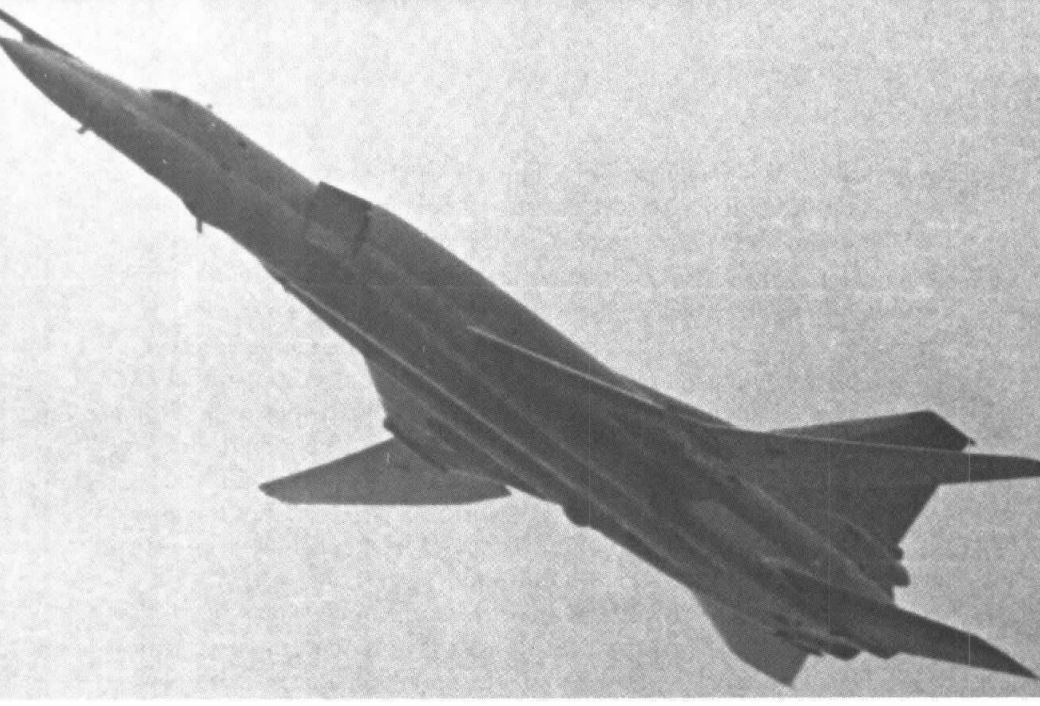
In the 1960s and 1970s, the Strategic Rocket Forces enjoyed an undisputed predominance in nuclear strategy. By the 1980s,

however, the Soviet military appeared to have downgraded the Strategic Rocket Forces. Soviet spokesmen, beginning with Ogarkov in 1981, began to refer to these forces, together with the nuclear Naval Forces and the Air Forces, as an integral part of a combined arms triad of "strategic nuclear forces."

The Air Forces also have had an offensive-defensive mission similar to that of the Strategic Rocket Forces. In contrast to the Strategic Rocket Forces, however, the Air Forces' intercontinental capabilities had been very limited until the early 1980s. In addition to the Tu-26 (Backfire) bomber with a largely theater-level use, in the mid-1980s the Soviet military deployed the intercontinental Tu-160 bomber and equipped its Tu-95 bombers with air-launched cruise missiles (ALCMs). Because cruise missiles could be conventionally armed, in the late 1980s the Air Forces were beginning to acquire a significant conventional capability for strategic missions.

Of all the services, the Naval Forces experienced the most dramatic mission expansion after the 1960s. Their mission evolved from coastal defense to worldwide power projection in peacetime and to denial of the use of the seas to adversaries in wartime through the disruption of sea lines of communication. In the 1970s, the "father" of the modern Soviet Naval Forces, Admiral Sergei Gorshkov, had lobbied for independent strategic missions for the Naval Forces. Admiral Vladimir Chernavin, however, who succeeded Gorshkov as the Naval Forces commander in chief in 1986, appeared content to have a strong but less independent Naval Forces, well integrated into the traditional combined arms concept and a uniform, all-services strategy. The strategic nuclear mission was the only Naval Forces mission in which Western analysts had noted some retrenchment since the 1960s. In the 1960s, nuclear war was expected to start with a massive nuclear exchange, and strikes by submarine-launched ballistic missiles (SLBMs) were to supplement the initial strike by the Strategic Rocket Forces. In the 1970s and 1980s, when the Strategic Rocket Forces built up their counterforce capability, the primary strategic mission of the Naval Forces was to provide a secure reserve force, withheld from the initial nuclear strikes, and to protect this force from enemy antisubmarine warfare.

The strategic mission of the Ground Forces has been defense of the territorial and political integrity of the Soviet Union and its socialist allies and, in case of war, conducting combined arms operations in the TVDs with the support of air, air defense, and navy elements. In Europe the goal of the strategic combined arms mission



Tu-26 (Backfire) strike bomber
Courtesy United States Navy

has been defeating NATO as quickly as possible and occupying Western Europe without destroying its economic base.

Strategic Operation in a Theater of Military Operations

The concept of the combined arms operational offensive in a theater of military operations (*teatr voennykh deistvii*—TVD) developed in the 1920s as the theory of the deep offensive operation (see Military Art, this ch.). According to this theory, Soviet infantry, armor, and artillery would coordinate to achieve operational goals with operational breakthroughs and firepower. The deep offensive operation concept underlies the modern, expanded theater operation, which, according to Marshal Ogarkov, is "no longer a front or group of fronts, but a strategic operation in a TVD" and can lead directly to the achievement of strategic objectives. Since the mid-1970s, such an operation in the Western TVD, covering NATO's Central Region, was expected to be fought mainly with new, improved conventional weapons. Although primarily offensive, the modern strategic operation also incorporated defensive concepts because of changes in NATO strategy.

American military expert Phillip Petersen believed that a conventional air operation against NATO's airfields and nuclear weapons sites would substitute aviation and the fire of conventional

missiles for nuclear strikes. The air operation could neutralize NATO's air defense assets, destroy nuclear weapons, and disrupt command and control capabilities. Highly mobile first- and second-echelon ground forces, known as operational maneuver groups, could break through the forward defenses and penetrate deep into the enemy's rear. If NATO's nuclear weapons could be successfully destroyed, Warsaw Pact tanks and armored personnel carriers could advance rapidly across Western Europe to the North Sea coast and to the Danish Straits before NATO could mobilize fully and bring reinforcements from North America. Similar operations would take place in the Northwestern and Southwestern TVDs and would continue until Soviet troops achieved the strategic objective of victory in Europe.

Although Soviet military theorists traditionally have deemphasized defensive operations, in the 1980s they paid more attention to defensive concepts on the strategic, operational, and tactical levels and called defense "an essential form of combat action." In the 1980s, Soviet military writers also emphasized the increased depth of operational defenses in connection with the deep-strike concepts incorporated in the United States Army's AirLand Battle doctrine (see Glossary) and in NATO's Follow-on-Forces-Attack (FOFA—see Glossary) concept. The Soviet concept of defense has been distinguished by extreme "combat activeness," i.e., using massive firepower to destroy the enemy's aircraft and attacking ground forces while Soviet forces prepare a counterattack.

Strategic Defense

The Air Defense Forces, known until their 1980 reorganization as the National Air Defense Forces, was the one service whose mission was almost entirely defensive (see Air Defense Forces, ch. 18). These forces were to protect the country from nuclear attack. Formed in 1948 to counter the threat of strategic bombers, the National Air Defense Forces had no capability against ballistic missiles, which became the main threat in the 1960s. The preemptive mission of the Strategic Rocket Forces filled this gap and lightened the burden of the National Air Defense Forces.

The principal mission of the Air Defense Forces has remained practically unchanged since the 1950s. However, according to Sokolovskii's *Military Strategy,* air defense included both defense against ballistic missiles and space defense. In 1989 one antiballistic missile site around Moscow protected both the capital and the National Command Authority housed there. Extensive Soviet

research on defense against ballistic missiles, however, pointed to a possible change in Soviet reliance on strategic offense.

In addition to the active defense that the mission of the Air Defense Forces has called for, the Soviet Union has invested heavily in civil defense. The declared mission of civil defense has been to provide "reliable protection for the population against weapons of mass destruction in wartime" through construction of shelters for the leadership, hardening and dispersal of industry, and evacuation of leadership and civilians from cities. Such efforts continued in the 1980s, despite civilian leaders' statements denying the viability of defense against nuclear weapons and acknowledging that nuclear war would be suicidal.

Global Strategic Concerns

Since the late 1960s, when the Soviet Union was about to achieve nuclear parity with the United States, Soviet military support for the global task of promoting Marxism-Leninism intensified. Hoping that the attainment of strategic parity with the United States would deter the latter from interfering with Soviet international activism, the Soviet Union set out to aid and abet the forces of socialism and "national liberation" worldwide.

Soviet doctrine called not only for nuclear and nonnuclear capabilities to fight a world war but also for adequate conventional forces to support the "external function" of the Soviet armed forces in defense of "socialist gains" and of the fighters for world revolution. Two components of the "internationalist duty" of the Soviet armed forces emerged: "socialist internationalism," the defense of socialist countries allied to the Soviet Union; and "proletarian internationalism," the assistance given to "wars of national liberation" in the Third World.

Soviet spokesmen have emphasized repeatedly that the Soviet Union does not believe in the "export of revolution" but opposes the export of "counterrevolution," i.e., actions by Western powers that would hinder the historic progress of socialism. In the 1970s, combating "counterrevolution" became part of the "internationalist duty" of the Soviet armed forces.

The Soviet Union has attempted, not always successfully, to reconcile Marxist-Leninist doctrine with state interests. Soviet leaders have tried to satisfy doctrinal requirements while pursuing the military and foreign policies of the Soviet state. Projected worldwide, Marxism-Leninism evolved from a purely revolutionary ideology into an ideology rationalizing the actions of a superpower. Often state interests were a more reliable guide than ideology to understanding Soviet actions.