# 1

# Soviet and Russian Strategic Nuclear Forces

## Making the First Nuclear Weapons

The Soviet program of nuclear weapons development was based on the scientific and technical capability that existed in the Soviet Union before the World War II. Soviet physicists began working in the field of nuclear physics in the 1920s. In the 1930s, several Soviet research institutes were working in this field. In 1940, shortly after the discovery of fission of the uranium nucleus, the Soviet Academy of Sciences formed a so-called Commission on the Uranium Problem, which was responsible for coordination of research on uranium fission and self-sustaining fission reactions, as well as for exploring possible methods of uranium isotope separation.[1] Although the military applications of uranium fission were well understood at that time, the research program initiated in 1940 was purely a research effort and did not have development of a nuclear explosive device as its goal. Virtually all research in this area was suspended after the beginning of World War II.[2]

A practical program aimed at investigating the possibility of developing a Soviet nuclear weapon began in 1943. The program began as a result of the information about the British and U.S. nuclear programs that the Soviet leadership had had at that time.[3] The State Defense Committee issued a decree on 11 February 1943 calling for establishment of Laboratory No. 2, which became the main organization responsible for the nuclear weapons development. Initially Laboratory No. 2 concentrated its efforts on studying plutonium production in graphite and heavy-water reactors and conducting research on various techniques of uranium isotope separation. Development of a nuclear weapon was not among the laboratory's goals. Wartime conditions did not allow the Soviet Union to allocate to the laboratory sufficient resources for a large-scale nuclear weapons development program. Besides, at that time the feasibility of building a nuclear weapon had not been demonstrated.

The situation changed dramatically after the United States carried out its first nuclear explosion on 16 July 1945 and dropped atomic bombs on Hiroshima and Nagasaki on 6 and 9 August 1945. These events led to substantial acceleration of the Soviet nuclear program, which was reorganized to produce the nuclear bomb as soon as possible. On 20 August 1945 the Soviet Union established the Special Committee, which was given the responsibility of supervising the nuclear weapon development program and reported directly to the Politburo. Practical implementation of the nuclear program was assigned to a new governmental structure: the First Main Directorate of the Council of Ministers.[4]

From that point on, work on the nuclear weapons program was carried out at a very fast pace. The first Soviet experimental graphite reactor went critical on 25 October 1946. Operations of the first plutonium production reactor began in June 1948. By February 1949 the Soviet Union had obtained enough plutonium to build a nuclear weapon. The KB-11 Design Bureau had by that time completed its work on the design of the first Soviet nuclear weapon which was essentially a copy of the U.S. Fat Man device. The first Soviet nuclear weapon, designated RDS-1, was detonated on 29 August 1949 at a test site near Semipalatinsk. The weapon yield was 22 kilotons, as predicted.[5]

Almost immediately after this first detonation the Soviet Union started serial production of nuclear weapons. Assembly of a pilot series of five RDS-1 weapons was completed by March 1950. In December 1951 the Soviet Union began serial production of nuclear weapons of the RDS-1 type.

While the First Main Directorate was setting up the serial production of RDS-1 weapons, the KB-11 Design Bureau concentrated its efforts on the development of more effective weapon designs and working out methods of weapon delivery. In 1951 the Soviet Union tested its first indigenously developed weapon, designated RDS-2, and carried out its first airdrop from a bomber. To work out troop tactics during a nuclear conflict, in September 1954 the Soviet Union held a military exercise that involved a real nuclear explosion. In 1954 the Soviet army commissioned the RDS-3 weapon, versions of which seem to have been the first Soviet nuclear weapons deployed in large numbers.[6]

Parallel to the work on new nuclear weapon designs, the Soviet Union began working on thermonuclear devices. The first Soviet thermonuclear device was the RDS-6, which was tested on 12 August 1953.[7] After this test, work concentrated on developing a deliverable weapon based on the RDS-6 design and new two-stage thermonuclear devices that allowed the production of weapons of yields of a megaton or more. The deliverable version of the RDS-6 and the first two-stage ther-

monuclear device, designated RDS-37, were tested in October–November 1955. The yield of the RDS-37 thermonuclear weapon, detonated on 22 November 1955, was 1.5 megatons.[8]

By the end of the 1950s the main elements of the infrastructure necessary for the mass production of fissile materials and nuclear weapons were in place. Two weapons laboratories, Arzamas-16 (KB-11 Design Bureau) and Chelyabinsk-70, were responsible for weapon design. Tests of nuclear devices and weapons were being conducted at the test sites at Semipalatinsk and Novaya Zemlya. In 1957, the pilot centrifuge uranium enrichment plant began operation at Sverdlovsk-44. In 1958 the Soviet Union completed the construction of a plutonium production complex, which included production reactors and reprocessing plants, at the sites at Chelyabinsk-40, Tomsk-7, and Krasnoyarsk-26. In 1958–1960 two new nuclear weapon assembly plants began operation in Penza-19 and Sverdlovsk-45.

Work on the development of new weapons during the 1950s progressed in tandem with modification of existing delivery systems for carrying nuclear weapons as well as development of new ones. Although bombers remained the primary delivery platform, ballistic missiles were a very serious contender for a nuclear role. Efforts were also being concentrated on deploying nuclear weapons on naval platforms.

The first Soviet ballistic missile that carried a nuclear warhead was the R-5M (SS-3) medium-range missile. In February 1956 the Soviet Union carried out a full-scale test of the R-5M missile with a real nuclear warhead.[9] After the first R-5M regiments were deployed in May 1956, development of nuclear-capable ballistic missiles continued. At the end of the 1950s the Soviet Union began deployment of a new medium-range missile, the R-12 (SS-4). This missile was followed by the intermediate-range R-14 (SS-5) missile, which entered service in the early 1960s. These two missiles later replaced R-5M and for a long time remained the core of the Soviet theater missile force.

Development of naval platforms, capable of carrying nuclear weapons, progressed in three main directions: nuclear-armed torpedoes and submarine-launched cruise and ballistic missiles, which eventually were to be deployed with nuclear warheads. The first nuclear torpedoes were commissioned in 1955. Later that year the Navy carried out the first successful launch of an R-11FM ballistic missile from a submarine. In 1957 the Navy received the first Project AV-611 (Zulu V) submarines, which carried R-11FM missiles. Submarine-launched nuclear cruise missiles also entered service before the end of the 1950s.[10]

## The First Strategic Weapons

By the end of the 1950s the Soviet Union had had a substantial number of nuclear weapons and nuclear-capable delivery systems for tactical and theater missions. At the same time, it was concentrating its efforts on the development of intercontinental delivery systems, capable of reaching the territory of the United States.

These intercontinental delivery systems were especially important for the Soviet Union because of the confrontational turn the U.S.-Soviet relationship took during the postwar years. Although the United States lost its nuclear monopoly with the Soviets' detonation of the RDS-1 in 1949, the Soviet Union had to take into account that the United States was capable of delivering nuclear weapons to the Soviet territory. By the middle of the 1950s the U.S. strategic forces included more than 1,200 bombers capable of delivering about 2,000 weapons to targets in Soviet territory.[11] Since the Soviet Union, unlike the United States, could not deploy its bombers close to the adversary's borders, delivering nuclear weapons to U.S. territory required development of intercontinental platforms.

The first Soviet delivery systems capable of reaching U.S. territory were the intercontinental bombers created in the second half of the 1950s. The Soviet Union had begun development of bombers with a 12,000 km range in the late 1940s, shortly after it attained nuclear capability. In 1949–1951 some of the Tu-4 bombers, which were at that time deployed with Long-Range Aviation, were given aerial refueling capability to extend their range.[12] In 1951 the Tupolev Design Bureau developed a prototype of an intercontinental-range piston engine bomber. These projects were soon terminated, however, for it became clear that piston engine bombers are vulnerable to air defense and jet interceptors. As a result, in 1951 the Soviet Union began development of the 3M (Bison) and Tu-95 (Bear) bombers, which became the first Soviet intercontinental delivery systems. These aircraft, which entered service in 1956, remained until the early 1960s the only Soviet means of reaching the territory of the United States with nuclear weapons.[13] Nevertheless, the scale of their deployment remained limited. By the end of 1962 Long-Range Aviation had about 100 Tu-95 and 60 3M bombers, which could deliver about 270 nuclear weapons to U.S. territory.[14]

The scale of bomber deployment was limited for several reasons. One of the most important was the success of the Soviet ballistic missile development program. The Soviet program for development of ballistic and cruise missiles of intercontinental range began in 1954. One of its results was the R-7 (SS-6) intercontinental ballistic missile (ICBM), flight tests of which started in May 1957. On 3 October and 4

November 1957, during the flight tests, modified versions of the R-7 missile were used to launch the Earth's first artificial satellites. The Soviet leadership considered these launches a clear demonstration of the superiority that the Soviet Union had achieved in the field of ballistic missile development. The propaganda effect of the launches seemed to have played a very important role in the attention that the Soviet leadership paid to the missile development program.

The role of ballistic missiles in the Soviet military plans was underscored by the establishment of the Strategic Rocket Forces as a separate service of the Soviet armed forces in December 1959. The new service included the first R-7 missiles as well as the medium-range-missile units, which had been previously subordinated either to Long-Range Aviation or directly to the Supreme High Command.[15] The organization of the new military service was accompanied by the restructuring of the military industry, during which many design bureaus and manufacturing plants involved in aircraft production were transferred to the new missile production sector.

Although the introduction of ICBMs took the effectiveness of the Soviet strategic nuclear forces to a higher level, the Strategic Rocket Forces had rather limited capabilities, and the ICBMs could not carry out a strategic attack on their own. The level of readiness of R-7 missiles was extremely low. Besides, the high cost of launch complexes predetermined the very limited scale of their deployment.[16] In 1961 the Strategic Rocket Forces received a new missile system, the R-16 (SS-7), which had better readiness and was easier to operate. However, this missile, like the R-7, was not suitable for mass deployment on a scale that would allow the Soviet Union to attain parity with the United States.

By 1962 the number of nuclear weapons that the Soviet Union could deliver to the U.S. territory still did not exceed 300, which was in sharp contrast with the capabilities of the U.S. strategic forces. The United States had more than 1,300 strategic bombers, capable of delivering more than 3,000 weapons to targets in the Soviet Union. In addition, the U.S. forces included 183 Atlas and Titan ICBMs and 144 missiles on nine Polaris submarines. In October 1962 the United States began deployment of Minuteman—a very effective new solid-propellant ICBM.[17]

The strategic superiority that the United States had in the beginning of the 1960s was clearly demonstrated during the Cuban missile crisis of October 1962. The formal cause of the crisis was the Soviet decision to deploy medium- and intermediate-range R-12 (SS-4) and R-14 (SS-5) ballistic missiles in Cuba, from which these missiles could threaten a large part of the U.S. territory. When the deployment was discovered, the United States demanded removal of the missiles and

established a naval blockade of the island. The Soviet Union eventually had to give in to the U.S. demand and withdrew its missiles in exchange for the U.S. pledge not to invade Cuba and to remove its medium-range missiles from Turkey.[18]

The peaceful outcome of the Cuban crisis, which was one of the most serious confrontation of the cold war, became possible mainly because the leaders of the two countries tried to avoid escalation of the conflict by all possible means and were determined to avoid military confrontation. At the same time, the U.S. superiority in capabilities and number of strategic nuclear weapons was one of the most decisive factors that shaped the evolution of the conflict and the positions taken by both countries during the crisis.

**Achieving Quantitative Parity**

The Soviet leadership traditionally paid serious attention to achieving a strategic parity with the United States. Although it was the Cuban crisis that most clearly demonstrated that the cold war confrontation required building effective strategic forces that would be comparable to those of the United States, the Soviet Union had begun its efforts aimed at achieving strategic parity with the United States long before 1962.

In 1959 the Korolev Design Bureau began development of the R-9A (SS-8) intercontinental missile, which had a much higher level of combat readiness than the R-7 or R-16. The flight tests of this missile began in April 1961. In addition, in January 1962 the Yangel Design Bureau began tests of the R-16U missile, a silo-based version of the R-16. This version also had higher combat readiness than its predecessor. Although introduction of the new missiles substantially raised the overall effectiveness of the Soviet ICBM force, neither of these missiles was suitable for large-scale deployment.[19] Besides, the missiles were deployed in closely located silos and therefore were highly vulnerable.

The missile systems that finally allowed the Soviet Union to achieve strategic parity with the United States in the 1960s were the "heavy" R-36 (SS-9) missile and the "lightweight" UR-100 (SS-11) ICBM. Development of these missiles began in April 1962 and March 1963, respectively. The missiles were deployed in individual silos that were set far enough apart that they could not be destroyed by a single weapon. Besides, the missiles were filled with fuel after being installed into their silos, which allowed them to be kept in constant launch readiness. The large throw weight of the R-36 missile allowed it to be deployed with a high-yield warhead that could pose a threat to hardened targets.[20]

The first flight tests of the R-36 missile took place in September 1963, with the tests of the UR-100 following in April 1965. Deployment of the missiles, which began in November 1966, proceeded at a very high rate. By the end of 1969 the Soviet Union had deployed 170 R-36 and about 860 UR-100 missiles. By 1971 the number of deployed R-36 missiles had increased to 260 and the number of UR-100s to 990.[21] In addition to these two systems, in 1968 the Strategic Rocket Forces commissioned the RT-2 (SS-13) missile, the first Soviet solid-propellant ICBM. Although this missile was accepted for service, the scale of its deployment was limited to 60 missiles.

In addition to the ICBM development program, during the 1960s the Soviet Union was working on the development of a strategic submarine that would be comparable to the U.S. Polaris system. Work in this area, which began in 1958, by 1962 led to the development of a preliminary technical design of the Project 667A (Yankee I) missile submarine, which carried 16 R-27 (SS-N-6) ballistic missiles. Construction of the first 667A submarine began in 1964, and in 1967 the first ship of this class entered service.[22] Soon after that the 667A submarines began regular patrols close to the U.S. coast. By the end of 1969 the Soviet Union had deployed 12 submarines of the Project 667A type. The construction program continued, and the total number of 667A submarines eventually reached 34.

Another program that attracted the special attention of the Soviet leadership was the construction of a ballistic missile defense that was thought to be capable of countering a strategic missile attack. Practical work in this direction began in the mid-1950s. In 1962 the Soviet Union deployed a prototype of the Moscow antiballistic missile (ABM) system at a test site and began construction of its first installations around Moscow.[23] Several institutes were also working on a nationwide ballistic missile defense. Since the United States was working on ballistic missile defense as well, the Soviet Union also concentrated on development of systems that could effectively penetrate such defenses. Work in this area resulted in development of the orbital version of the R-36 missile, which was deployed in 1968.[24] In 1969 another version of the R-36 missile was tested with multiple warheads, three instead of one. The warheads were not independently targeted but allowed the missile to penetrate the defenses more effectively than the same missile equipped with a single warhead.[25]

The Soviet modernization program of the 1960s occurred simultaneously with a modernization of U.S. strategic forces. By 1965 the United States had completed deployment of 800 Minuteman I ballistic missiles. In addition to these missiles, in 1966 the United States began deployment of 200 Minuteman II ICBMs, more

accurate than their predecessors. The U.S. ICBM force also included 54 older Atlas missiles. The Polaris submarine production program was completed in 1967, and the total number of deployed Polaris submarines reached 41. (The first Poseidon submarine, carrying C-3 missiles with 10 independently targeted warheads each, was planned to enter service in 1971.) By the end of the 1960s the U.S. Air Force had 360 B-52 bombers. In addition, F-111A medium-range bombers deployed in Europe were also assigned targets in the Soviet Union. As noted above, like the Soviet Union, the United States was working on development of ballistic missile defense systems.[26]

The scale of the strategic modernization programs of the 1960s and the potentially destabilizing effect of ABM deployment forced the Soviet Union and the United States in 1969 to begin negotiations on limitations of defensive and offensive strategic forces. These negotiations resulted in two arms control agreements in 1972: the ABM Treaty and the agreement known as SALT I.

### The SALT I and ABM Treaties

The United States and the Soviet Union first began consultations on arms control in 1967 and in July 1968 agreed to open formal negotiations.[27] After a delay caused by the Soviet invasion of Czechoslovakia and the 1968 U.S. presidential elections, the negotiations finally began in November 1969. The initial intention was that the negotiations would cover limitations of offensive and defensive weapons. The talks revealed fundamental differences, however, between the U.S. and Soviet positions on offensive weapons. The Soviet Union insisted that the scope of the negotiations should include U.S. forward-based systems in Europe.[28] Because the United States refused to include these systems in the strategic balance, the two sides decided to limit the scope of the agreement on offensive weapons and concentrate their efforts on reaching a full-scale agreement on missile defenses.

Progress in limiting missile defenses was made possible by the fact that the Soviet Union as well as the United States understood that effective missile defenses are impossible. At one stage during the negotiations the sides were ready to discuss a comprehensive ban on defense systems.[29] This idea was not pursued, however, partly because it was decided that completion of the missile systems already under development would be allowed.

The approach accepted at the negotiations assumed limits on the number of land- and sea-based ballistic missile launchers. The number of warheads deployed on missiles as well as the number of bombers and their weapons were not limited

by the agreement. During the negotiations, the two sides discussed the possibility of a ban on multiple independently targeted reentry vehicles (MIRVs) but failed to find mutually acceptable terms of agreement on this issue, among other reasons because the U.S. proposals were aimed at denying the Soviet Union this capability and freezing the advantage the United States had in this area.[30]

The documents that resulted from the negotiations—the Treaty on the Limitation of Anti-Ballistic Missile Systems, known as the ABM Treaty, and the Interim Agreement on Certain Measures with Respect to the Limitation of Strategic Offensive Arms, which became known as the SALT I agreement—were signed on 26 May 1972 and entered into force on 3 October 1972. The SALT I agreement had the duration of five years; the ABM Treaty was of unlimited duration.

The most significant provision of the SALT I agreement was its ban on construction of new sea-launched ballistic missile (SLBM) launchers and submarines and ICBM silos. The agreement also banned construction of new heavy-ICBM silos and conversion of existing silos for heavy missile deployment. In effect, the SALT I agreement froze the structure of the Soviet strategic forces, in particular their land-based component. When the agreement was signed, the Soviet Union had 1,416 ICBM silos deployed or under construction. R-36 (SS-9) and R-36M (SS-18) heavy missiles were deployed in 308 of these silos. In addition to that, 18 silo launchers of the orbital version of the R-36 missile at the Baykonur test site were also counted as heavy missile silos.

The limit on the number of deployed missile submarines applied only to submarines built after 1964. As a result, ships of the older Project 629 (Golf), 658 (Hotel), and 701 (Hotel III) types, which carried two or three ballistic missiles, were not counted against the ceiling of 62 "modern" missile submarines set in the agreement. These 62 submarines were allowed to carry 740 SLBMs. The Soviet Union could increase the number of deployed SLBMs to 950 by dismantling 210 launchers of the R-16U and R-9A land-based missiles. This condition in effect allowed the Soviet Union to deploy 950 SLBMs, since the land-based launchers in question were of the "group-start" type and had to be dismantled in any event. In general, the SALT I agreement did not limit the Soviet program of SLBM development in any substantial way.

The most significant provision of the ABM Treaty was its ban on deployment of missile defense of national territories or of any region. The treaty also banned deployment of a base for such defenses. As an exception, each side was allowed to build two missile defense systems, one of which would defend a national capital and the other land-based missile bases. The treaty limited the number of

interceptors in each of the missile defense systems to 100. It also imposed certain limits on the number and areas of deployment of battle management radars. In 1974 the Soviet Union and the United States signed a protocol to the ABM Treaty that reduced from two to one the number of defense systems each side was allowed to deploy.

**Strategic Modernization in the 1970s**

The U.S.-Soviet arms control agreements signed in 1972 were the first real steps toward limiting the scale of the two countries' strategic nuclear arms buildup. The ABM Treaty, which banned deployment of missile defenses, allowed the Soviet Union and the United States to limit the scale of their modernization programs during the 1970s. At the same time, since the SALT I agreement did not restrain the number of warheads each side could deploy, it could not prevent nuclear states from increasing the size of their arsenals by deploying MIRVs on land- and sea-based missiles.

The modernization program of the 1960s had allowed the Soviet Union to attain quantitative parity in nuclear weapons with the Unites States. At the same time, however, it was clear that the as far as the effectiveness of the strategic forces was concerned, the Soviet forces were inferior to those of the United States. In 1970 the United States began deployment in highly protected silos of Minuteman III ICBMs, each carrying three very accurate independently targeted warheads. The Minuteman program called for deployment of 550 ICBMs of that type and was completed in 1975. As noted above, the first Poseidon submarine with the C-3 missile, which carried ten independently targeted warheads, entered service in 1971. By 1973 the number of these submarines deployed had reached 20, and in 1978, when the program was completed, the total was 31. In early 1971 the United States began the B-1 supersonic strategic bomber development program. By the time the SALT I agreement was signed, therefore, the United States, had already initiated a large-scale strategic modernization.

The Soviet Union also began its modernization program before the SALT I negotiations were completed. The most important element of this program was deployment of MIRVed land-based missiles. Another significant component was the measures aimed at obtaining launch-on-warning capability as well as capability to act under a nuclear attack. The launch-on-warning capability required construction of a network of early-warning radars and satellites. The Soviet Union had also started development of a command and control system that would allow it to

transmit launch orders under very tight time conditions or under a nuclear attack. Significant efforts were also directed at improving radiation hardness of all components of missiles and other systems. Special attention was paid to improving the hardness of missile silos against blast effects and further improvement of missile combat readiness.[31]

The main systems deployed by the Soviet Union during the 1970s were the heavy R-36M (SS-18) missile, replacing the R-36, and two lightweight missiles: the UR-100N (SS-19) and MR UR-100 (SS-17) land-based missiles, developed to replace the UR-100 (SS-11). The decisions to develop these missiles had been made in 1969–1970. All of these new ICBMs carried multiple warheads.

The two "lightweight" missiles to replace the UR-100 initially were developed on a competitive basis, and it was assumed that only one of them would be chosen for deployment. The competition was extended, however, to the flight testing stage, which began in 1972, and eventually both systems were accepted for deployment.[32] The first UR-100N and MR UR-100 missiles entered service in 1975.

The UR-100 missile had in the meantime undergone modernization in the early 1970s. The modernized versions, the UR-100K (SS-11 Mod 2) and UR-100U (SS-11 Mod 3), had larger throw weights, better accuracy, and shorter response time than the UR-100. The UR-100K missile carried penetration aids, and the UR-100U had three warheads, though these were not independently targeted.

The decision to start the R-36M development program was made in September 1969. The large throw weight of the missile (8.8 tons) allowed to it to carry eight independently targeted reentry vehicles. Flight testing of the missile began in February 1973, and in December 1974 the missile entered service. Some of the R-36M missiles were deployed with a single high-yield warhead instead of multiple warheads.

During the 1970s, in addition to the development of the new silo-based missiles, the Soviet design bureaus were working on ground-mobile missile development. The first of these operational mobile systems, the Temp-2S (SS-X-16), entered service in February 1976. Deployment of this system was very limited, and it was not officially commissioned. The Temp-2S was later used as a prototype for the Pioneer (SS-20) intermediate-range missile.

In the first half of the 1970s, the naval strategic forces received the 667B (Delta I) ballistic missile submarine, work on which had begun in 1965. The single-warhead R-29 (SS-N-8) missiles, which were deployed on the 667B, had a range of 7,800 km. This meant that the submarines could patrol in the seas close to the Soviet coast and, unlike the 667A (Yankee) submarines, did not have to cross the

antisubmarine warfare (ASW) lines. As a result, the Soviet submarines became much less vulnerable to the U.S. ASW operations.

The first Project 667B submarine entered service in 1972. By 1977 there were 18 nuclear submarines carrying ballistic missiles of this class in the Soviet Navy. In addition to that, in 1975 the Navy received four submarines of the 667BD (Delta II) class, which carried 16 R-29D (SS-N-8 Mod 2) missiles each. The missiles were a version of the R-29 modified to give them a somewhat greater range. Some of the 667B submarines were also fitted with R-29D missiles.

In 1971 the Soviet Union began its solid-propellant SLBM development program. Flight tests of the R-31 (SS-N-17) missile, the result of this program, began in 1976. The missile system, which included 12 missiles, was deployed on the lone 667AM (Yankee II) submarine, converted from one of the 667A (Yankee I) ships. The 667AM entered service in 1980 but was not officially accepted for service and remained the only ship of this class. The experience of operating this submarine, however, convinced the Navy to move toward deployment of solid-propellant SLBMs.

Another important development of the 1970s was the appearance of a MIRVed sea-based missile. The work on this missile, designated R-29R (SS-N-18), began in 1973. The first submarine equipped with the R-29R (16 of them), the Project 667BDR (Delta III) class, entered sea trials in 1976. By the time the system was commissioned in 1979, the number of 667BDR submarines had reached nine.

In the late 1960s or early 1970s, the Soviet Union initiated a program to develop a supersonic strategic bomber as a direct response to the B-1 bomber program, which began in the United States at about that time. This project, which eventually led to development of the Tu-160 Blackjack bomber, was not completed, however, until the 1980s. The main Soviet bomber project of the 1970s was the development of the Tu-22M Backfire intermediate-range bomber aircraft. The first prototypes of the Tu-22M aircraft were built in 1969–1972, and in 1976 the bomber was accepted for service. The capabilities of this aircraft became one of the most contentious issues at U.S.-Soviet disarmament negotiations during the 1970s. Although the Tu-22M bomber did not have intercontinental range, the United States insisted that the aircraft in some cases could reach U.S. territory and therefore should be counted as a strategic bomber.[33]

### The SALT II Treaty

Arms control negotiations continued after the United States and the Soviet Union signed the SALT I agreement in 1972. These negotiations, however, proved to be

more difficult than those for SALT I. Since the new agreement, unlike SALT I, was to be a comprehensive treaty, the Soviet Union insisted that it should account for the U.S. forward-based systems located in Europe in the overall strategic balance.[34] The United States, in turn, concentrated its efforts on limiting the number and capabilities of Soviet land-based missiles, paying particular attention to the heavy missiles and MIRVs. Limiting Soviet heavy-missile capabilities became a pressing problem for the United States after the Soviet Union carried out its first flight test of an R-36M missile with multiple independently targeted warheads in 1973. The advantage that the Soviet Union had in the overall throw weight of its missiles, together with the SALT I ban on new missile deployment, had the potential to translate into a significant Soviet advantage in the number of deployed warheads.[35]

In 1974, during a summit meeting in Vladivostok, the United States and the Soviet Union reached an agreement that was designed as an outline of the future treaty. The Vladivostok agreement called for limiting the total number of strategic launchers in each country to 2,400, only 1,320 of which could carry MIRVs.

The Vladivostok agreement involved serious concessions from the Soviet Union, which withdrew its requirement that the forward-based U.S. systems be included in the overall strategic balance. In addition, the Soviet Union agreed on equal limits for both sides, changing its long-standing position that an arms control agreement should result in equal *capabilities* of strategic forces rather than merely equal numbers. The United States, on the other hand, agreed that the future treaty would include strategic bombers and stopped its attempts to reduce the number of Soviet heavy missiles or redefine heavy missiles to include the UR-100N (SS-19).[36]

Although the Vladivostok agreement outlined the main features of the proposed treaty, almost immediately after the summit, the two sides found out that they differed in their interpretation of certain points of the agreement. Among the problems that appeared after the Vladivostok summit were questions about the strategic capabilities of the Tu-22M Backfire bomber and problems with accounting for long-range air-launched cruise missiles (ALCMs). For reasons noted above, the United States insisted that the Tu-22M Backfire was a strategic aircraft and therefore should be limited by the future treaty. The Soviet Union insisted on counting every ALCM as a separate strategic launcher.[37]

In 1976, in an attempt to overcome the problems, the United States and the Soviet Union reached a preliminary agreement according to which every ALCM-carrying bomber was counted as a MIRVed launcher. In addition, the United States suggested setting a separate limit on the number of deployed Tu-22M aircraft.[38] Although these

proposals did not help the sides reach accord on the treaty in 1976, they eventually became a part of the final agreement.

These negotiations, which eventually led to the SALT II Treaty, continued until 1979. As during the early stages of the talks, the United States continued to seek limits on the number of warheads that the Soviet Union could deploy on its land-based missiles. The Soviet efforts in the negotiations were concentrated on establishing a limit on deployment of air-based cruise missiles. In addition, the Soviet Union sought a ban on deployment of sea- and land-based cruise missiles. Among other issues that slowed the progress at the negotiations were the aforementioned debates over the strategic capabilities of the Tu-22M bomber and the problems with verification of the agreement.

Since the new treaty was not ready by October 1977, when the term of the SALT I agreement came to an end, the United States and the Soviet Union declared that they would continue to observe the SALT I limits. By the end of 1978, however, the two sides had agreed on the main points of the treaty, and SALT II was eventually signed on 18 July 1979 during the summit meeting in Vienna.

The SALT II Treaty was based on the main provisions agreed on in Vladivostok, supplemented by a number of additional conditions. Among the additional requirements of SALT II were the obligation to reduce the number of strategic launchers over the two years subsequent to the signing, limits on the number of warheads on launchers, and certain restrictions on modernization programs. The treaty was to be in force until 31 December 1985 and was accompanied by a three-year protocol that restricted deployment of land-mobile ICBMs and sea- and land-based cruise missiles.[39]

The main provision of the SALT II Treaty was the limit it imposed on each country of 2,400 deployed strategic launchers. The sides further agreed to reduce the number of strategic launchers to 2,150 by 1 January 1981. Of these launchers, only 1,320 were allowed to carry MIRVs; this number included land- and sea-based ballistic missiles, as well as bombers that carried ALCMs. Excluding bombers, the number of MIRVed launchers could not exceed 1,200. A separate ceiling limited the number of MIRVed land-based ballistic missiles, which could not exceed 820.

To limit the total number of warheads, the SALT II Treaty set limits on the number of warheads on any single delivery platform. In particular, the treaty banned increasing the number of warheads on land-based ICBMs and prohibited deployment of more than 14 warheads on SLBMs. Existing types of heavy bombers were limited to carrying 20 cruise missiles. In addition, any new bombers introduced could carry no more than an average of 28 cruise missiles per bomber. As a result, the SALT II

Treaty, unlike the SALT I agreement, set a definite limit, although a relatively high one, on the total number of deployed strategic warheads.

The treaty confirmed the ban on new ICBM silo construction initiated in SALT I as well as the ban on converting existing light-missile silos into heavy missile silos. It also prohibited deployment of ICBMs that would be heavier (in terms of launch weight and throw weight) than existing heavy missiles. As an additional measure, the treaty banned orbital missiles (the fractional orbital bombardment system, or FOBS), which also counted as heavy missiles. The Soviet Union agreed to dismantle 18 silos of the orbital version of the R-36 missile deployed in Baykonur or to convert them to use for test purposes only.

The SALT II Treaty had provisions that aimed at slowing down the weapons modernization programs of the two countries. Each side could deploy only one ICBM of a new type during the treaty's duration, and that new type could carry no more than 10 warheads. This provision was included in the treaty mainly to allow the United States to complete development of its MX Peacekeeper missile, begun in 1971.[40] The United States thought that the new missile on the Soviet side would be the single-warhead Topol (SS-25); the Soviet Union later announced, however, that the Topol was a modification of the RT-2P (SS-13) missile and that its new missile under the treaty would be the RT-23 (SS-24), which carried 10 warheads. It should be noted that the Topol missile did not fit the definition of a new missile, since its throw weight (1,000 kilograms) exceeded that of the RT-2P (600 kilograms) by more than the 5% allowed by the treaty.[41]

An additional provision concerning land-based missiles was included into the protocol to the treaty. This provision prohibited deployment of land-mobile missiles and testing of ICBMs from mobile launchers. In addition, the Soviet Union agreed to dismantle its land-mobile Temp-2S ICBMs, which by that time had been deployed only in limited numbers.

Certain provisions of the SALT II Treaty and its protocol limited sea-based components of the strategic forces, but they were insignificant compared to those provisions concerning ICBMs and strategic aviation. The treaty changed the rules for counting SLBM launchers to include old diesel submarines that were used as testbeds for modern missiles. In addition, it prohibited deployment of SLBMs that carried more than 14 independently targeted warheads. The protocol to the SALT II Treaty included, in addition to the ban on land-mobile ICBM deployment, a ban on deployment of sea- and land-based cruise missiles, as well as on tests of such cruise missiles with multiple warheads. The sides also agreed for the duration of the protocol neither to test nor to deploy air-based ballistic missiles.

In general, although the SALT II Treaty set certain limits on quantitative development of each country's strategic forces, it could not seriously limit their strategic modernization programs. By the time the treaty was signed, the Soviet Union and the United States had completed deployment of MIRVed missiles. Besides, at the negotiations leading up to the treaty, the sides did everything they could to protect their future strategic modernization programs. By imposing certain agreed-upon limits on these programs, however, the treaty made the development of strategic forces more predictable, a significant achievement given the deterioration of U.S.-Soviet relationships in the late 1970s.

This deterioration in U.S.-Soviet relationships prevented the SALT II Treaty from ever entering force. After the Soviet invasion of Afghanistan in December 1979, the Carter administration withdrew the treaty from Congress and suspended its ratification. Since neither side expressed its intention not to ratify the treaty, however, the United States and the Soviet Union complied with most of its provisions. As an exception, the Soviet Union did not reduce the number of strategic launchers to 2,400, as the treaty required. In addition, the Soviet Union broke the treaty conditions by announcing the Topol (SS-25) missile as a modification of the RT-2P (SS-13) rather than as a new missile.

### The Modernization Program at the End of the 1970s

The main features of the modernization programs that were carried out by the United States and the Soviet Union in the late 1970s were improvements in the counterforce capabilities of each country's strategic systems and efforts at the same time to reduce the vulnerability of their missile launchers.

In 1977 the United States made a decision to equip 300 of its Minuteman III missiles with a new high-yield warhead. The deployment of these new warheads, which began in 1979, significantly increased the counterforce capabilities of the Minuteman III missiles. At the same time, the United States concentrated its efforts on finding invulnerable basing for its new MX Peacekeeper missile.

Among the new programs initiated by the United States in the second half of the 1970s was the development of a new sea-based missile, the C-4, which it began deploying on its Poseidon submarines in 1979. The missile was also to be deployed on new submarines of the Trident class, first of which, the *Ohio*, entered service in 1982. In 1992 the United States terminated its B-1 strategic bomber development program and concentrated its efforts on deployment of cruise missiles on B-52 bombers.

Among the modernization programs that the Soviet Union carried out during the second half of the 1970s were the development of UR-100NUTTH and MR UR-100UTTH versions of the SS-19 and SS-17 missiles. These missiles entered service in 1978–1979. In September 1979 the Strategic Rocket Forces received the R-36MUTTH (SS-18 Mod 4) missile, which carried 10 warheads. Although provisions of the SALT II Treaty limited the scale of deployment of these systems, the Soviet Union was able to finish its replacement of old ICBMs with new MIRVed missiles. The systems that had to be dismantled under the SALT II Treaty provisions—the Temp-2S (SS-X-16) and the orbital version of the R-36 (SS-9)—were to be withdrawn from service in any event. The treaty did not limit development of new Topol (SS-25) and RT-23 (SS-24) mobile missiles, which began in 1976–1977.

In 1976 the Soviet Navy received its first missile submarine of the Project 667BDR (Delta III) type. This submarine carried MIRVed R-29R (SS-N-18) missile.

In 1977, the Soviet Union laid the keel of a submarine of the Project 941 (Typhoon) type, which carried 20 solid-propellant R-39 (SS-N-20) missiles. Another program, initiated in 1979, developed the new liquid-propellant R-29RM (SS-N-23) missile, which was later deployed on Project 667BDRM (Delta IV) submarines.

In the late 1970s the Soviet Union began deploying cruise missiles on Tu-95 strategic bombers. The first test launches of Kh-55 (AS-15) long-range cruise missiles from a Tu-95 bomber were carried out in 1978. In 1979 the Soviet Union began production of the Tu-95MS bomber, which could carry six cruise missiles (a later version of the Tu-95MS bomber, still in service, can carry up to 16 ALCMs). The Soviet Union also continued development of a new supersonic strategic bomber.

In general, the early 1980s were marked by a significant deterioration in U.S.-Soviet relations. Among the events that had a significant impact on these relations was the decision by the North Atlantic Treaty Organization (NATO) in 1979 to deploy 108 Pershing II intermediate-range ballistic missiles and 464 land-based cruise missiles in European territory. Because the U.S. missiles deployed in Europe could reach targets on a significant part of Soviet territory, the Soviet Union considered this deployment an attempt to circumvent the SALT II Treaty. The United States, however, insisted that this decision was a direct response to the Soviet deployment of Pioneer (SS-20) intermediate-range missiles begun in 1976 and that any measures that would reverse the decision would have to be conditioned on liquidation of Soviet SS-20 missiles.[42]

As a result of the deterioration in U.S.-Soviet relations in the 1980s, arms control negotiations were essentially brought to a halt, and the United States and the Soviet

Union intensified their strategic modernization. In 1981 the Reagan administration announced that it would not seek ratification of the SALT II Treaty. In October 1981, the administration resumed the B-1B strategic bomber development program and announced plans to deploy the MX Peacekeeper missile in silos and to begin deployment of long-range sea-based cruise missiles on submarines.

This renewed U.S. modernization program caused serious concern among the Soviet leadership, in part because it could undermine Soviet efforts to achieve parity with the United States and provide the United States with the capability of launching a disarming strike. The Soviet Union had just completed building an early warning network, which provided it with launch-on-warning capability. In 1982 the Soviet Union pledged itself to a policy of no-first-use of nuclear weapons, which indicated that it was ready to rely on the early warning network and ability of its forces to ride out an attack.[43]

The Soviet Union considered the U.S. program an attempt to acquire first-strike capability and devalue much of the recent Soviet efforts. The deployment of higher-yield warheads on the Minuteman III missiles beginning in 1979 as well as the development of the very accurate MX Peacekeeper ICBM had given the United States the capability to target hardened Soviet missile silos. U.S. development of the Trident II (D-5) sea-based missile, which was to have accuracy comparable to that of the MX, potentially made the Soviet silos vulnerable to an SLBM attack as well. The counterforce capabilities of sea-based ballistic missiles were potentially a very serious problem, because the Soviet Union lacked adequate early-warning capability against SLBM launches.[44] Another potential problem was the capability of sea-based cruise missiles to avoid detection. The flight time of the ballistic and cruise missiles deployed in Europe was very short, and they could therefore pose a very serious threat to time-urgent targets, such as command and communication centers.

Another U.S. program that caused serious concern to the Soviet leadership was the Strategic Defense Initiative (SDI), undertaken in 1983. This program aimed at development and deployment of a large-scale missile defense of the U.S. territory. The Soviet Union considered this program to be yet another attempt by the United States to alter the strategic balance of the late 1970s.

In response, the Soviet Union continued the modernization programs it had begun in the late 1970s. The only new program initiated by the Soviet Union in the 1980s was that for development of the R-36M2 (SS-18) missile, the latest version of the R-36M heavy ICBM. All the other programs in which the Soviets engaged in the

1980s—the Project 667BDRM (Delta IV) and Project 941 (Typhoon) missile submarines and the deployment of the Kh-55 (AS-15) cruise missile on the Tu-95MS (Bear H) and Tu-160 (Blackjack) strategic bombers, as well as the development of the Topol (SS-25) land-mobile ICBM and the RT-23/RT-23UTTH (SS-24) railroad-mobile and silo-based missile system—had begun in the late 1970s.

**The START I Treaty**

The negotiation process that had led to the conclusion of the SALT II Treaty was suspended in 1981 when the Reagan administration announced that it would not seek ratification of the treaty. At the same time, the United States suggested opening new talks that would be aimed at reduction of the nuclear arsenals of both nations. These talks were formally opened in June 1982, but the state of U.S.-Soviet relationships at the time made any substantial progress virtually impossible. The United States and the Soviet Union were carrying out at the time the modernization programs each had initiated in the late 1970s, which fit into the framework of the SALT II Treaty. In this situation a new agreement would require significant modifications of the current development plans, which neither side was ready for.

During the early 1980s the main efforts of the negotiations were directed toward solving the problem of the intermediate-range forces in Europe. As noted above, the Soviet Union considered NATO's planned deployment of U.S. ballistic and cruise missiles in Europe as an attempt to circumvent the SALT II Treaty restrictions. Negotiations concerning nuclear weapons in Europe began in October 1980 and resumed in 1981, after a pause caused by the change in presidential administrations in the United States. Among the most contentious points at the talks was the question of the British and French nuclear forces. The Soviet position was that the U.S. NATO allies should be taken into account in determining the balance achieved, and the Soviet Union was not ready to reduce the number of its intermediate-range ballistic missiles (IRBMs) below the NATO aggregate level, which would include the British and French missiles. The United States insisted on accounting for the U.S. and Soviet forces only and agreed to forgo its plans for deployment of Pershing II IRBMs and ground-based missiles only in exchange for liquidation of all Soviet IRBMs.[45]

On 23 October 1983 the Soviet delegation left the negotiations on nuclear forces in Europe, after a deep crisis developed in U.S.-Soviet relations in the wake of the incident with the downed Korean airliner on 1 September 1983. The formal reason

given for the breakup of the negotiations was the final U.S. decision to begin deployment of its nuclear forces in Europe, which began soon afterward. On 8 December 1983, the Soviet Union also left the strategic arms reduction talks.

After an interruption of more than a year, the Soviet Union and the United States agreed to open new negotiations, which were to cover nuclear weapons in Europe and space weapons in addition to the traditional questions of strategic arms control. The final agreement about the date of opening the new talks was reached in January 1985, and the first round of the negotiations opened on 12 March 1985. The opening of the negotiations coincided with the changes in the Soviet leadership, which later proved to be the main factor that affected the direction of the negotiations and their outcome and led to profound changes in the U.S.-Soviet relations. On 11 March 1985 Mikhail Gorbachev assumed the post of General Secretary of the Central Committee of the Communist Party of the Soviet Union (CPSU).

One of the first steps the new Soviet leadership took was organizing a U.S.-Soviet summit meeting, which took place in November 1985. Although the meeting did not yield any concrete results, it provided the United States and the Soviet Union with a chance to outline the problems that needed to be solved. One of the questions the United States and the Soviet Union failed to agree on was SDI. The Soviet Union insisted on setting strict limits on the scale of the missile defense development efforts. The Reagan administration considered the SDI program one of its highest priorities and wanted to continue the program without any restrictions.

In January 1986, in an attempt to change the direction of the U.S.-Soviet dialogue, the Soviet leadership published an ambitious disarmament proposal that called for complete elimination of nuclear weapons by the year 2000. Although the proposal was clearly unrealistic, some of its elements—the proposals for the elimination of intermediate-range missiles and a 50-percent reduction in the number of strategic launchers—later formed the basis of the Soviet position at the arms control negotiations.

The formal Soviet position that incorporated these proposals was revealed to the United States at the summit meeting in Reykjavik held in October 1986.[46] During the meeting the United States and the Soviet Union agreed on a 50-percent reduction in all segments of their strategic forces, including the reduction of the number of Soviet heavy missiles. In addition, the Soviet Union again agreed to exclude the U.S. forward-based forces in Europe from the strategic balance and also agreed to exclude the British and French weapons from the balance of intermediate-range

forces and to consider total elimination of the Soviet IRBMs in Europe. The Soviet concessions were conditioned, however, on restriction of the SDI missile defense program. In particular, the Soviet Union suggested an agreement by which the sides would agree not to exercise their right to withdraw from the ABM Treaty for 10 years. Since the United States did not accept this restriction of its missile defense development plans, the Soviet Union withdrew all its proposals.[47]

In March 1987 the Soviet Union decided to separate the question of intermediate-range forces in Europe from the SDI problem. As a result, the sides quickly reached an agreement on complete elimination of intermediate-range missiles. Moreover, during the negotiations the scope of the agreement was broadened to include all missiles with a range from 500 to 5,000 kilometers. On 8 December 1987, the United States and the Soviet Union signed the Intermediate-Range Nuclear Forces (INF) Treaty, which entered into force on 1 June 1988. During implementation of the treaty, the Soviet Union eliminated all its Pioneer (SS-20) missile systems, its old R-12 (SS-4) and R-14 (SS-5) IRBMs, and its Oka (SS-23) tactical missiles that had a range less than 500 kilometers.[48]

Since the questions of strategic arms reductions were still linked to the U.S. position on missile defense, negotiations on that issue went on much more slowly. By June 1988 the sides reached an agreement on basic elements of the future treaty. According to this agreement, each side would reduce the number of its strategic launchers to 1,600 and the number of its warheads to 6,000. The number of warheads on land- and sea-based ballistic missiles would not exceed 4,900 for each side. The Soviet Union confirmed its readiness to halve its heavy missile force. The sides agreed to limit aggregate throw weight of ballistic missiles and formulated the counting rules that would apply to ALCM-carrying bombers.

In September 1989 the Soviet Union announced that it was ready to separate the ABM Treaty compliance issue from negotiations on the strategic arms reduction treaty. In another important decision, the Soviet Union agreed that the arms reduction treaty would not cover sea-launched cruise missiles. Although these decisions eventually opened the way to reaching the agreement, it took almost two more years to finalize the treaty and solve the remaining technical problems. Eventually, the U.S.-Soviet strategic arms reduction agreement, known as the START I Treaty, was signed on 31 July 1991.[49]

The START I Treaty required the United States and the Soviet Union to reduce the number of deployed strategic launchers to 1,600. These launchers were allowed to carry in total no more than 6,000 warheads on each side. Since the treaty includes complicated rules for counting the warheads, however, the actual number of

deployed warheads could be higher than the treaty limit. An additional ceiling provided by the treaty limited the number of warheads deployed on land- and sea-based ballistic missiles to 4,900 on each side. The treaty also limited the number of warheads deployed on land-mobile missiles, which were allowed to carry no more than 1,100 warheads. The number of heavy missiles was to be reduced by half, so that the Soviet Union would have no more than 154 deployed missiles of this class. The aggregate throw weight of ICBMs and SLBMs was limited to 3,600 metric tons.

According to the treaty's accounting rules, each missile was counted as deployed with the maximum number of warheads it was able to carry. The rules for counting the number of warheads deployed on strategic bombers were more complex. A bomber equipped for gravity bombs was counted as carrying one warhead regardless of the actual number of bombs it could carry. The rules for counting air-launched cruise missiles were different for the United States and the Soviet Union. For the Unites States, within the quota of 150 ALCM-carrying bombers, each such bomber was counted as carrying 10 cruise missiles. Other strategic bombers equipped for ALCMs were counted as carrying the maximum number of cruise missiles they could. For the Soviet Union, all ALCM-equipped bombers within the quota of 180 aircraft were counted as carrying eight warheads. Another provision prohibited deployment of more than 20 and 16 long-range air-launched cruise missiles on U.S. and Soviet bombers, respectively.

The treaty allowed the number of warheads associated with a particular type of missile to be reduced, but with only two existing missile types, and the total number of warheads "downloaded" from a certain type could not exceed 500. The United States also had the option of reducing the number of warheads on Minuteman III missiles, but it could not exercise this option until after the seven-year period during which the other reductions under the treaty were to be implemented. To minimize a possible effect of the downloaded warheads' being returned to their launchers, the treaty limited the total number of downloaded warheads to 1,250 on each side. The number of warheads taken off a missile of any particular type could not exceed four. In addition, if this number exceeded two, the warhead platforms had to be destroyed. This requirement also applied to platforms of the Minuteman III missiles.

The treaty devoted considerable attention to land-mobile ICBMs. Along with the limit on the number of warheads on these missiles, the treaty put certain restriction on their patrol procedures. At the same time, these restrictions seem to have taken into account the established practice of land-based mobile missile patrol. The treaty

included another provision that detailed a stricter liquidation procedure for land-based missiles than that for silo-based missiles. Whereas liquidation of a silo-based missile or SLBM was considered completed after destruction of its silo, liquidation of a mobile missile required the destruction of both the launcher and the missile itself.

Among the most substantial drawbacks of the START I Treaty was the lack of restrictions on sea-launched cruise missiles. When the treaty was signed, the United States and the Soviet Union made political statements in which they agreed to limit the number of deployed SLCMs to 880 on each side and inform each other about their deployment.

At the time the treaty was signed, the Soviet strategic forces included 1,398 ICBMs, 940 sea-based missiles on 62 submarines, and 162 strategic bombers, 62 of which carried long-range cruise missiles. According to the treaty's counting rules, these 2,500 launchers carried 10,271 nuclear warheads. The United States had 2,246 strategic platforms that were counted as carrying 10,563 warheads. The U.S. strategic forces included 1,000 land-based missiles, 672 SLBMs, and 574 bombers, of which 189 were equipped for long-range cruise missiles. The aggregate throw weight of Soviet missiles was 6,626.3 metric tons; that of U.S. missiles was 2,361.3 metric tons.

Soon after the START I Treaty was signed, the United States and the Soviet Union undertook unilateral measures that decreased the readiness of their strategic forces. These measures, announced in September–October 1991, were aimed at reducing the danger of accidental or unauthorized launch. Among the measures, taken at that time, was early deactivation of missiles that were to be eliminated under the treaty and taking strategic bombers off alert. The most important step taken at that time was withdrawal of all nuclear sea-launched cruise missiles and other nonstrategic nuclear weapons from submarines and surface ships. Some of these weapons were dismantled; others were put in storage. In addition, it was announced that all army tactical nuclear weapons were to be dismantled.[50] The Soviet Union also agreed to end its program of rail-mobile missile deployment, and the existing rail-mobile missile systems were confined at their bases.

**The Breakup of the Soviet Union**

The most important development of 1991, and the one that had the greatest impact on START I Treaty ratification and implementation process, was the breakup of the Soviet Union. Its successor, the Commonwealth of Independent States, was

established on 8 December 1991. On 25 December 1991, the president of the Soviet Union resigned and passed the command over the strategic forces to the president of Russia.

A major part of the nuclear weapons production complex and infrastructure of the strategic forces remained on Russian territory. At the time of the breakup Ukraine had 130 silos of UR-100NUTTH (SS-19) missiles and 46 silos of RT-23UTTH missiles. In addition to that, 19 Tu-160 bombers as well as 25 Tu-95MS and 2 Tu-95 bombers also remained on Ukrainian territory. Belarus hosted 81 land-mobile RT-2PM Topol (SS-25) missile systems, and Kazakhstan had 104 R-36M (SS-18) missile silos and 40 Tu-95MS bombers.

The problem of succession of the START I Treaty obligations of the Soviet Union was solved in May 1992, when four former Soviet republics that had nuclear weapons in their territory—Russia, Ukraine, Kazakhstan, and Belarus—and the United States signed a protocol to the treaty, known as the Lisbon Protocol.[51] According to the protocol, the former Soviet republics assumed the obligation to carry out the START I Treaty reductions. Another provision of the protocol required Ukraine, Belarus, and Kazakhstan to join the Nuclear Nonproliferation Treaty as nonnuclear states. These states therefore had either to eliminate all the nuclear weapons on their territories or to transfer them to Russia. Kazakhstan and Belarus later agreed that all the nuclear weapons in their territory were Russian property, and therefore Russia assumed the responsibility for dismantling those weapons. Ukraine, in contrast, declared the strategic launchers in its territory Ukrainian property, and it is responsible for their dismantlement. Nuclear warheads on Ukrainian territory remained under Russian jurisdiction and were later transferred to Russia.

Transfer of nuclear warheads from Kazakhstan to Russia was completed in April 1994. All missile silos on Kazakhstan's territory have been dismantled, and all missiles and bombers have been transferred to Russia. All nuclear weapons in Ukraine had been moved to Russia by June 1996.[52] Currently Ukraine is carrying out dismantlement and liquidation of missile silos and ballistic missiles that remained on its territory. Eight Tu-160 and three Tu-95 bombers located in Ukraine were transferred to Russia in 2000. In November 1996, Russia completed the transfer of the Belarussian Topol (SS-25) missile systems to Russia. As a result, by the end of 1996 all Soviet nuclear weapons had been moved to Russia.[53]

The START I Treaty had been ratified by all five of its current parties by the end of 1994 and entered into force on 5 December 1994. The treaty requires that all the reductions delineated in the treaty be completed by 2001—seven years after the

treaty entered into force. After that, the Treaty will remain in force for eight more years, until 2009.

### The START II Treaty

Work on a new treaty that would call for reductions of strategic weapons even deeper than those in START I began almost immediately after the breakup of the Soviet Union. A framework agreement between Russia and the United States that contained the most important elements of the new treaty was reached in June 1992. The main elements of this agreement were reduction of strategic forces to 3,000–3,500 warheads total on each side and complete elimination of MIRVed land-based ballistic missiles, including the heavy missiles.[54] The United States and Russia also agreed to change the counting rules for bomber warheads.

The START II Treaty was signed on 3 January 1993.[55] The treaty was concluded quickly because it was based on the procedures and provisions outlined in START I and in fact just set up new numerical limits and outlined some additional procedures.

The main element of the START II Treaty is the obligation it places on the parties to reduce the number of their strategic warheads to 3,000–3,500 on each side by 2003. An additional ceiling, not included in START I, requires that each side's sea-based ballistic missiles carry no more than 1,750 warheads. Another key requirement of the treaty is the elimination of all MIRVed land-based missiles and all heavy missiles. Silos of MIRVed missile are to be either eliminated or converted for deployment of single-warhead ICBMs. All heavy missiles and their silos are to be eliminated according to special procedures set forth in the treaty. As an exception, Russia is allowed to convert 90 R-36MUTTH/R-36M2 (SS-18) silos for deployment of single-warhead missiles.

The START II Treaty accelerates the dismantlement schedule enacted in START I. Under the provisions of START II, by the end of the START I Treaty term, December 2001, each side would have only 4,250 deployed warheads, not the 6,000 permitted by START I. The heavy missile dismantlement schedule in START I would also have to be accelerated under the terms of START II, so by December 2001 Russia would have only 65 deployed SS-18 missiles. All reductions required by the START II Treaty will have to be completed by 1 January 2003.

Because both the United States and Russia planned to carry out at least some of the START II reductions by changing the declared number of warheads on deployed missiles, the treaty removed almost all START I restrictions on reduction of the

number of declared warheads. In particular, START II has no requirement that in changing the declared number of warheads, the total number of warheads on any given type of missile cannot be reduced by more than 500, as START I requires. In addition, under the START II Treaty the total number of downloaded warheads can exceed 1,250 on missiles of all types. The START II Treaty still does not allow the declared number of warheads on any given missile to be changed by more than four, however, with one exception, which permits Russia to remove five warheads from 105 UR-100NUTTH (SS-19) missiles. Along with removing the restriction on total number of downloaded warheads, the START II Treaty eliminates the START I requirement that warhead platforms be destroyed if the number of warheads they are carrying is decreased by more than two. Unlike the START I, the START II Treaty does not require the United States to destroy warhead platforms of Minuteman III missiles if they are converted to single-warhead missiles.

The START II rules for counting warheads on strategic bombers significantly differ from those of the START I Treaty. According to START II, a bomber with long-range cruise missiles is counted as carrying the maximum number of cruise missiles for which it is equipped. The START II Treaty also allows conversion of 100 bombers (not equipped for ALCMs) for nonnuclear missions. Under the terms of START II, these aircraft could later be converted back to nuclear missions.

In general, during the START II negotiations Russia made serious concessions that later complicated the treaty's ratification by the Russian Duma. The treaty was submitted to the Duma on 20 June 1995 but was not approved until 14 April 2000 (the U.S. Senate approved the treaty for ratification on 26 January 1996).

Among the problems that complicate the treaty's ratification by the Duma were its implementation schedule and the asymmetry in the capabilities of the United States and Russia to increase the number of deployed warheads should they decide to pull out of the treaty (so-called breakout potential). This asymmetry was a result of many factors, the most significant of which were the treaty's lifting restriction on downloading and the fact that Russia had most of its warheads deployed on MIRVed land-based ICBMs, which will have to be eliminated and therefore could not contribute to the breakout potential. Another problem was that to bring its forces to the START II levels of 3,000–3,500 warheads, Russia would have to deploy a large number of single-warhead missiles. In 1997 Russia and the United States reached an agreement that was supposed to help solve at least some of these problems and to facilitate the Duma's ratification of the treaty. In September of that year, they signed a protocol to the Treaty that extended its implementation deadline by five years to 31 December 2007. All the systems scheduled for

dismantlement under the START II Treaty, however, will still have to be deactivated by the original deadline, 1 January 2003. This protocol was ratified by the Russian Duma in April 2000 as part of the START II Treaty but has yet to be approved by the U.S. Senate.

Among other provisions of the agreements reached in 1997 was an understanding that after the START II enters into force the United States and Russia will start negotiations on the next treaty, START III, which would reduce the strategic forces to the level of 2,000–2,500 warheads on each side. According to the agreement, the new treaty will include measures on elimination of warheads removed from strategic launchers, which could alleviate the problem of asymmetry in the breakout potentials of the two countries.

**The Current State and Future of Russian Strategic Forces**

By 2001 Russia had almost completed the decommissioning of strategic systems that were scheduled for elimination under the START I Treaty.

By the beginning of 2001, Russia had eliminated all land-based UR-100K/UR-100U (SS-11), RT-2P (SS-13), MR UR-100UTTH (SS-17), and silo-based RT-23UTTH (SS-24) missiles and their silos. In addition, Russia had begun dismantlement of UR-100NUTTH (SS-19) missiles and heavy R-36MUTTH/R-36M2 (SS-18) ICBMs. In January 2001 Russia had 174 R-36MUTTH/R-36M2 (SS-18) and 150 UR-100NUTTH (SS-19) missiles, 36 railroad-based RT-23/RT-23UTTH (SS-24) ICBM systems, and 360 RT-2PM Topol (SS-25) road-mobile ICBMs.

While it was dismantling these old missile systems, Russia continued development of a new Topol-M (SS-27) missile system. The Topol-M missile completed the first series of flight tests in 1997, and in December 1997 the first two missiles of this type entered service, deployed in UR-100NUTTH (SS-19) missile silos. Silos of RT-23UTTH (SS-24) missiles, as well as those of the R-36MUTTH/R-36M2 (SS-18), could also be used for Topol-M deployment. By the beginning of 2001 24 Topol-M silo-based missiles were deployed.[56] A road-mobile version of the Topol-M system is currently undergoing testing and will later be deployed along with the silo version of the system.

The Russian Navy by the beginning of 2000 had almost completed the decommissioning of missile submarines of old types: Project 667A (Yankee I), Project 667B (Delta I), and Project 667BD (Delta II). Four remaining submarines of the Project 667B (Delta I) type will be decommissioned in the nearest future. The Navy has also begun the decommissioning of Project 667BDR (Delta III) submarines. In

addition to the submarines of old types, which are scheduled for elimination under the START treaties, the Navy has deactivated two relatively new Project 941 (Typhoon) submarines.

As a result, at the beginning of 2001, the Navy had four submarines of the Project 667BDR (Delta III) class, seven Project 667BDRM (Delta IV) submarines, and four heavy submarines of the Project 941 (Typhoon) class in active service. In 1996 Russia laid the keel of the new missile submarine, which is the first ship of the new Project 955 class, also known as *Yuri Dolgorukii*. Submarines of this class will carry a missile system with solid-propellant missiles, which is currently under development.

As of early 2001, Russia had practically completed elimination of old Tu-95 Bear strategic bombers and their modifications that carried gravity bombs and short-range cruise missiles. In 1999 Russia reached an agreement with Ukraine under which Ukraine transferred to Russia eight Tu-160 and three Tu-95MS bombers.[57] These bombers were transferred to Russia in 2000. In addition, one new bomber, the Tu-160, entered the Russian Air Force in 2000. As a result, the core of the Russian strategic aviation currently consists of 62 Tu-95MS Bear H and 15 Tu-160 Blackjack bombers equipped to carry about 550 Kh-55 (AS-15) long-range cruise missiles. Russia is developing a new long-range cruise missile that will replace the Kh-55 on strategic and other bombers.

In July 1998 the Security Council of the Russian Federation approved a program that will largely determine the future of the Russian strategic forces. The program assumed that the START II Treaty will eventually enter into force and therefore puts emphasis on development of START II–compliant systems.

Under the Security Council's program, the main strategic system that will be produced in Russia is the SS-27 Topol-M single-warhead ICBM. According to the plan, the production rate will gradually increase from the current 10 missiles a year to the level of 40–50 missiles annually, so that Russia will be able to deploy about 300 Topol-M missiles by the end of 2008.

Another strategic system under development is a new missile submarine, the Project 955 class. As noted above, the keel of the lead ship of this new class, the *Yuri Dolgorukii*, was laid at the end of 1996. According to the initial plan, the submarines of this class would accommodate the R-39UTTH missile, which was developed as a follow-on to the R-39 (SS-N-20) SLBM. The same missile was to be deployed on Typhoon submarines. The Security Council's program canceled the development of the R-39UTTH missile, however, because of a series of test failures and decided to begin development of a new SLBM that is to be deployed on the

*Yuri Dolgorukii* and other submarines of the Project 955 class. Construction of the submarine has thus been suspended, since it has to be designed to accommodate the new missile.

The Security Council's program also calls for continuing development of strategic aviation. It is likely that the 1999–2000 purchase of Tu-160 and Tu-95MS bombers from Ukraine was based on a decision made as part of the 1998 Security Council plan.

To complete the START I reductions, Russia will dismantle its remaining Project 667B (Delta I) submarines and Tu-95 bombers. In addition to that, Russia will have to eliminate 20 heavy missile silos to reduce their number to the 154 permitted by the START I Treaty. Then, since the treaty requires that the number of warheads deployed on ballistic missiles not exceed 4,900, Russia will have to decommission additional sea- or land-based missiles. This could be done by eliminating RT-23 and some of the RT-23UTTH railroad-mobile systems, which reached the end of their original operational lives in 1998–2000.

After the START I reductions are completed, the future of the Russian strategic forces will be determined primarily by the retirement schedule of deployed systems and rate of production of new strategic systems. (It will also depend, to a large extent, on whether the START II Treaty, which as noted above the Duma ratified in April 2000, actually enters into force.) In assessing Russia's maintenance and production capabilities we should take into account that part of the ICBM development and production infrastructure remains outside of Russia. As long as this is the case, Russia cannot resume production of R-36M (SS-18) and RT-23 (SS-24) missiles and will experience certain difficulties with servicing deployed missiles of these types. Production of the Topol-M (SS-27) missile systems, on the other hand, was transferred to Russia after the breakup of the Soviet Union, and this system will most likely be the only land-based missile produced in Russia in the next decade.

In contrast to the situation with land-based ICBMs, the development base of sea-launched missiles, submarines, and strategic bombers is concentrated in Russia. As noted above, Russia had to suspend construction of the first missile submarine of the Project 955 class, begun in 1996, until a new solid-propellant ballistic missile to be deployed on these submarines is developed. Russia's production of strategic bombers would most likely be limited to completion of construction of Tu-160 Blackjack bombers, which was suspended in 1992 but resumed in 1998.

If the START II Treaty enters into force, Russia will have to eliminate all of its remaining R-36MUTTH/R-36M2 (SS-18) heavy missiles as well as its silo- and

railroad-based RT-23/RT-23UTTH (SS-24) missile systems. Russia could retain 105 UR-100NUTTH (SS-19) missiles by converting them to carry a single warhead. The UR-100NUTTH missiles in excess of these 105 will have to be eliminated. Silos of the eliminated MIRVed missiles could be converted, under the terms of START II, for deployment of the single-warhead Topol-M (SS-27) missiles. The only exception to this would be the silos of R-36MUTTH/R-36M2 (SS-18) missiles, only 90 of which could be converted under the treaty.

After the START II reductions Russia would have 105 UR-100NUTTH (SS-19) missiles, converted to carry a single warhead, and about 360 Topol (SS-25) road-mobile systems. To deploy the new Topol-M (SS-27) missile in the existing silos, Russia would have to convert 155 of those silos. After they reach the end of their operational life, UR-100NUTTH missiles could also be replaced by Topol-M silo-based systems. Decommissioning of Topol missiles as they reach end of their operational life and replacing them with Topol-M missiles would result in Russia's having about 300 Topol-M (SS-27) missiles deployed by the year 2008.

Since the START II Treaty does not place any additional restrictions on the Russian sea-based strategic forces beyond those enacted in START I, their future will be determined primarily by the existing capability to maintain the current strategic fleet and the success of the new submarine production program. Russia will most likely keep in service submarines of the 667BDR (Delta III), 667BDRM (Delta IV), and 941 (Typhoon) class. Production of the new Project 955 class submarine is scheduled to be completed in 2002 but will almost certainly be delayed, for the reasons noted above. After the first submarine is completed, the plan is to commission one new submarine annually. Submarines of the 667BDR class will be decommissioned by 2003, when these ships reach the end of their operational life. Project 941 (Typhoon) submarines will be decommissioned even sooner, for the production of R-39 (SS-N-20) missiles for them has been discontinued. As a result, the Russian sea-based strategic force in 2008 would probably consist of seven submarines carrying about 450 warheads.

Russian strategic aviation currently consists of Tu-95MS Bear H and Tu-160 Blackjack cruise missile-carrying bombers. Since these bombers were produced in the second half of the 1980s, they could stay in service until 2010–2015. As a result, in 2007 Russia could have 62 Tu-95MS and 15 Tu-160 bombers, which could carry about 550 long-range cruise missiles.

If the START II Treaty is implemented, Russia could have about 1,400 warheads by the year 2008. The United States, after the implementation of the START II Treaty, could maintain its forces at the level of 3,500 warheads and would have a

capability to increase the number of deployed warheads quickly to about 5,500 (the so-called breakout potential).

If the START II Treaty does not enter into force, Russia could keep R-36M2 (SS-18) MIRVed missiles, which could stay in service until 2007–2010. In addition to that, Russia could retain the UR-100NUTTH (SS-19) missiles in a multiple-warhead configuration. These missiles could also stay in service until 2007. These measures would allow Russia to keep its strategic forces at the level of about 3,000–3,500 warheads in the next decade. However, after R-36M2 and UR-100NUTTH (SS-19) missiles reach the end of their operational life in 2008–2010, the number of warheads in the Russian strategic forces will be reduced to or even below the START II levels. The United States in this case could maintain its forces at the level of 6,000 warheads permitted by the START I Treaty. A more attractive alternative to Russia is a new strategic arms reduction agreement, START III, that would bring the strategic forces to the level of about 1,500 warheads on each side. The current plan for development of the Russian strategic forces is based on the presumption that Russia and the United States will reach such an agreement before 2003.