NUCLEAR STATUS REPORT

NUCLEAR WEAPONS, FISSILE MATERIAL, AND EXPORT CONTROLS IN THE FORMER SOVIET UNION

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DESIGN: CUTTING EDGE GRAPHICS

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Introduction

THE PROLIFERATION of weapons of mass destruction remains the single greatest threat to the security of the United States and other countries around the world. Of the many aspects of this threat, one of the most acute is the tenuous state of the nuclear complex in Russia and the other Newly Independent States (NIS). After almost ten years of cooperative effort with the United States and other countries—efforts that have brought significant progress—the situation in the NIS continues to pose serious proliferation challenges. These challenges pertain both to the enormous amount of nuclear weapons, material, and expertise present in the NIS nuclear archipelago and to the policies pursued by the post-Soviet states with respect to nuclear exports and nonproliferation.

This sixth issue of the *Status Report* provides a detailed picture of the sprawling nuclear complex in Russia and in the other post-Soviet states. It is a landscape marked by dozens of nuclear weapons bases, many thousands of strategic and substrategic nuclear weapons, more than five dozen major nuclear facilities, and hundreds of metric tons of fissile material. It is also the home of thousands of nuclear scientists and technicians with access to nuclear material and know-how.

A great deal of cooperative work has been done over the past decade to reduce and secure nuclear weapons in the Soviet nuclear successor states. International programs of nonproliferation assistance also have contributed to the strengthening of nuclear material control and accounting practices, physical protection, and export controls. These accomplishments are chronicled in this report, as are many of the major proliferation problems that remain owing to the economic disarray of the NIS nuclear complex, the relatively low priority attached to nonproliferation by senior political leaders, and the inadequacies of safeguards currently in place at many nuclear facilities.

The first chapters of this report detail the composition of the Russian nuclear weapons arsenal, the status of U.S.-Russian strategic arms control reduction negotiations, the implementation of U.S. nonproliferation assistance programs, and the structure of nuclear facilities in the former Soviet Union. As in earlier editions, the report also includes a detailed description of the export control systems that have been established to regulate nuclear exports and prevent unauthorized transfers. It also includes information on the membership of the 15 successor states to the Soviet Union in different international export control regimes.

The new features of this *Status Report* include:

- Extensive data on the current Russian nuclear arsenal and projections for future force developments
- Easy-to-read layout for NIS facilities known to possess nuclear materials
- Site descriptions of Russian naval facilities where nuclear materials might be at risk of theft or diversion
- An updated map of nuclear facilities in the NIS

This report has been prepared jointly by the Monterey Institute of International Studies and the Carnegie Endowment for International Peace as a resource to assist in monitoring the rapidly evolving events related to nuclear weapons and weapons-usable materials in the former Soviet Union. The report is published in English and is distributed free of charge to officials and analysts in both the United States and the Newly Independent States. The Carnegie Moscow Center will translate the report into Russian for distribution in Russia and the states of the former Soviet Union. The entire report is available on the web sites of the Carnegie Non-Proliferation Project at www.ceip.org/npp and the Monterey Institute's Center for Nonproliferation Studies at www.cns.miis.edu.

We wish to thank the individuals whose contributions have made this report possible, including the editors, Jon Wolfsthal of the Carnegie Endowment and Cristina-Astrid Chuen and Emily Ewell Daughtry of the Monterey Institute. These three individuals shared primary responsibility for gathering, assembling, and preparing for print the information in this report. Justin Anderson, Josh Hanson, Todd Sescher, and Adrienne Weiner of the Carnegie Endowment, and Kenley Butler, Michael Jasinski, John Lepingwell, Clay Moltz, Lauren Nolen, Scott Parrish, Elena Sokova, Nikolai Sokov, and Ray Zilinskas of the Monterey Institute also provided invaluable research, editorial, and technical assistance.

Outside reviewers whose comments have enhanced this volume but who may not necessarily agree with all its contents include: Oleg Bukharin, Matthew Bunn, Vladimir Orlov, Dmitriy Kovchegin, Elina Kirichenko, Maria Drohobycky, Phil Robinson, Greg Sheppard, Dastan Eleukenov, and officials from the U. S. Department of Energy.

The authors also wish to thank the Carnegie Corporation of New York, the Ford Foundation, the John D. and Catherine T. MacArthur Foundation, the John Merck Fund, the Ploughshares Fund, the Prospect Hill Foundation, the Scherman Foundation, the Smith Richardson Foundation, and the W. Alton Jones Foundation for their support of our respective organizations' NIS nonproliferation activities.

All the information in this report has been derived from open sources. Although every attempt has been made to achieve accuracy, timeliness, and comprehensiveness, the rapidly changing and sometimes classified nature of this topic creates the possibility that the report contains some inaccuracies or incomplete entries. The editors have made the final judgments as to the contents of this report, using Fall 2000 as their cutoff date, and bear full responsibility for it.

We hope that you will find this sixth edition of the *Status Report* a useful resource, and we encourage you to send your comments to either the Monterey Institute of International Studies or the Carnegie Non-Proliferation Project.

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CHAPTER 1

Russian Nuclear Weapons

RUSSIA MAINTAINS its strategic nuclear forces in a triad of land-based missiles, submarine-based missiles, and bombers. Within each leg of the triad are several different weapon systems, deployed at different times. This chapter provides a short description of all the former Soviet Union's strategic launchers, focusing on production details and service lives.[1] In sum, Russia's strategic nuclear arsenal is aging and shrinking. Strategic delivery vehicles have limited operational lives. Routine maintenance and replacement parts may prolong the operational life of subsystems such as guidance systems and aircraft engines, but replacing major components, such as intercontinental ballistic missile (ICBM) rocket motors, is both difficult and expensive. It is possible to prolong the operational life of deployed forces through careful maintenance and by lowering operational effectiveness requirements. Each instance of maintenance may extend the life of a weapon by several years, but this process cannot continue indefinitely.[2] These factors, in addition to START II limits, are particularly important in determining the future composition of Russia's nuclear forces.

Inventory levels for strategic nuclear forces are provided for 1990, at the end of the cold war; 1994, a midway point; July 2000, the latest official data on the number of START I "accountable" systems; and May 2000 estimates of the number of operationally deployed strategic nuclear weapons.[3] Projections for future levels are given for 2007, the START II reduction completion date; and for 2010 (except for those systems retired before 2007).

1. Data on the specifications and production of Russia's strategic nuclear forces are from START I Memorandum of Understanding (MOU), July 31, 2000; *Nuclear Weapons Database: Russian Federation Arsenal* (Center for Defense Information; online at <www.cdi.org/issues/nukef&f/database/rusnukes.html>); *Soviet/Russian Nuclear Forces Guide* (Federation of American Scientists; online at <www.fas.org/nuke/guide/ russia/index.html>); Pavel Podvig, ed., *Strategicheskoye yadernoye vooruzheniye Rossii* (Moscow, 1998); Dean Wilkening, "The Evolution of Russia's Strategic Nuclear Forces" (Center for International Security and Cooperation, Stanford University, July 1998; online at <cisac.stanford.edu/docs/russianforces.pdf>).

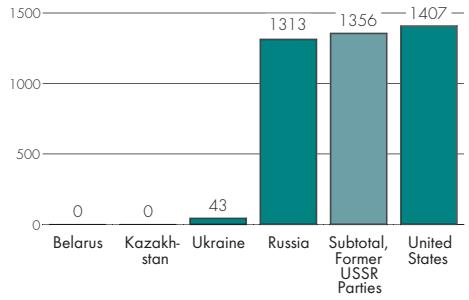
2. Wilkening, "Russia's Strategic Nuclear Forces," p. 3; Nikolai Sokov, *Russian Strategic Modernization* (Rowman and Littlefield: Maryland, 2000).

3. Data for September 1990, December 1994, and July 2000 are from the official START I Memorandum of Understanding (MOU), provided by the U.S. Department of State. In the charts, weapons systems for 1990 and 1994 include all accountable weapons controlled by the Soviet/Russian National Command Authority, even if deployed outside Russia. Data for May 2000 estimates of actual weapon deployments are from the Natural Resources Defense Council's (NRDC) reports, as published in the *Bulletin of the Atomic Scientists,* Nuclear Notebook, July/August 2000, no. 4, p. 70. Data for projected 2007 and 2010 forces are derived from Wilkening, "Russia's Strategic Nuclear Forces"; Joshua Handler, "Russia's Nuclear Strategic Forces in 2008–2013," *New Challenges in the Spread of Weapons of Mass Destruction* (conference, September 23–26, 1999), and from various other reports and current news stories.

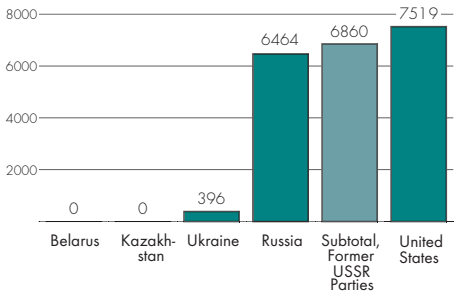
TABLE 1.1: START I PARTIES, STRATEGIC NUCLEAR WEAPONS, JULY 31, 2000

Category of Data	Belarus	Kazakh-stan	Ukraine[4]	Russia	Subtotal, Former USSR Parties	United States	Total, START I Parties
Deployed ICBM Launchers, SLBM Launchers, and Nuclear-capable Heavy Bombers	0	0	43	1,313	1,356	1,407	2,763
Deployed Warheads on ICBMs, SLBMs, and Heavy Bombers	0	0	396	6,464	6,860	7,519	14,379
Warheads attributed to Deployed Ballistic Missiles	0	0	260	5,812	6,072	5,941	12,013
Throw-weight of Deployed Ballistic Missiles (MT)	0	0	105.3	3,796.0	3,901.3	1,889.5	5,790.8

DEPLOYED LAUNCHERS



DEPLOYED WARHEADS



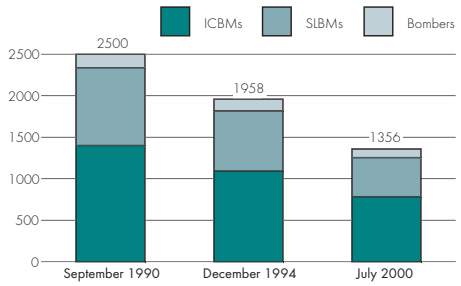
SOURCE: START I MOU Data

4. Although Ukraine has returned all its nuclear warheads to Russia, START I counting rules continue to include Ukraine's launchers (ICBMs and bombers) as deployed until they are destroyed or returned to Russia. Under START I counting rules, warheads are attributed to deployed launchers even when the warheads have been removed from the launchers. Thus, Ukraine has "attributed warheads" even though there are no warheads in the country.

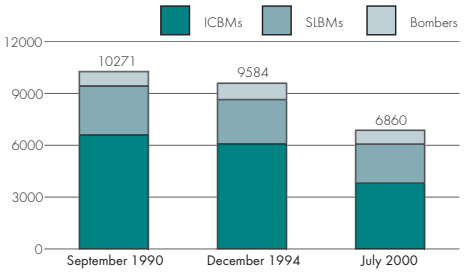
TABLE 1.2: SOVIET/NIS START-ACCOUNTABLE STRATEGIC NUCLEAR FORCES, 1990–2000

Type		September 1990	December 1994	July 2000
ICBMs	Launchers	1,398	1,089	782
	Warheads	6,612	6,078	3,800
SLBMs	Launchers	940	728	472
	Warheads	2,804	2,560	2,272
Bombers	Launchers	162	141	102
	Warheads	855	946	788
Total, Strategic Nuclear Forces	Launchers	2,500	1,958	1,356
	Warheads	10,271	9,584	6,860

LAUNCHERS



WARHEADS

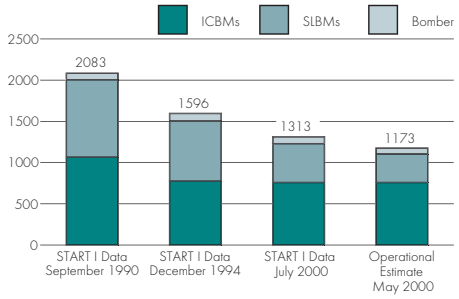


SOURCE: START I MOU Data

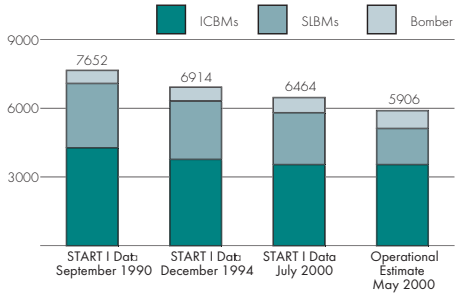
TABLE 1.3: START-ACCOUNTABLE AND OPERATIONAL STRATEGIC NUCLEAR FORCES IN RUSSIA, 1990–2000

Type		START I Data September 1990	START I Data December 1994	START I Data July 2000	Operational Estimate May 2000
ICBMs	Launchers	1,064	773	756	756
	Warheads	4,278	3,762	3,540	3,540
SLBMs	Launchers	940	728	472	348
	Warheads	2,804	2,560	2,272	1,576
Bombers*	Launchers	79	95	85	69
	Warheads	570	592	652	790
Total	Launchers	2,083	1,596	1,313	1,173
	Warheads	7,652	6,914	6,464	5,906

LAUNCHERS



WARHEADS



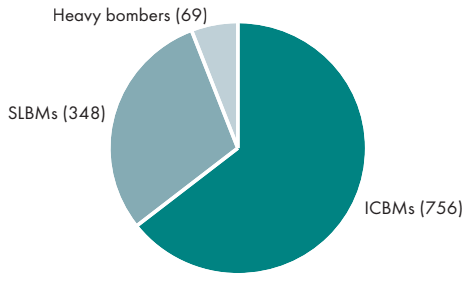
SOURCE: START I MOU Data and NRDC

* Under START I counting rules, Soviet/Russian cruise-missile-equipped bombers are counted as carrying a maximum of eight warheads, even if they are capable of carrying more. Bombers equipped to carry bombs are counted as carrying one warhead. The May 2000 operational estimates reflect the actual warhead-carrying capability of the bomber.

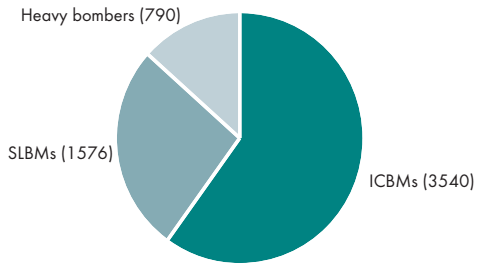
TABLE 1.4: ESTIMATE OF OPERATIONAL RUSSIAN STRATEGIC NUCLEAR FORCES, MAY 2000

Type (Russian/U.S. name)	Delivery Vehicles	Warheads
R-36M/RS-20/SS-18 Satan	180	1,800
UR-100N/RS-18/SS-19 Stiletto	150	900
RT-23/RS-22/SS-24 Scalpel, Silo-based	10	100
RT-23/RS-22/SS-24 Scalpel, Rail-based	36	360
RT-2PM/RS-12M/SS-25 Sickle	360	360
RT-2-PM2/RS-12M/Topol-M	20	20
Subtotal, ICBMs	**756**	**3,540**
Delta III/Project 667 BDR R-29R/RSM-50/SS-N-18	SSBNs: 11[5] SLBMs: 176	528
Typhoon/Project 941 R-39/RSM-52/SS-N-20	SSBNs: 3 SLBMs: 60	600
Delta IV/Project 667 BDRM R-29M/RSM-54/SS-N-23	SSBNs: 7 SLBMs: 112	448
Subtotal, SSBNs/SLBMs	**SSBNs: 21 SLBMs: 348**	**1,576**
Subtotal, Ballistic Missiles	**1,104**	**5,116**
Bear H16/Tu-95MS	34	544
Bear H6/Tu-95MS	29	174
Blackjack/Tu-160	6	72
Subtotal, Heavy Bombers	**69**	**790**
Total	**1,173**	**5,906**

DELIVERY VEHICLES



WARHEADS



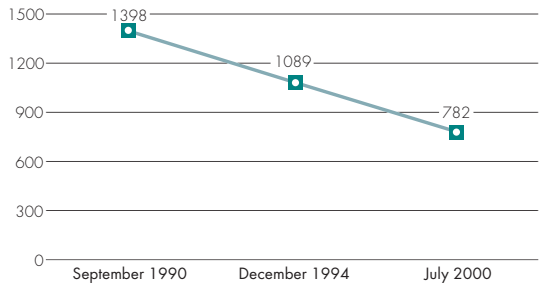
SOURCE: NRDC, "Nuclear Notebook," *Bulletin of the Atomic Scientists*, July/August 2000.

5. Alternative estimates from the Center for Nonproliferation Studies for operational Delta IIIs put this figure at five, lowering the SLBM total to 80 and the number of Delta III warheads to 240.

TABLE 1.5: SOVIET/NIS START-ACCOUNTABLE ICBMS, 1990–2000

Type (Russian/U.S. name)		September 1990	December 1994	July 2000
UR-100/RS-10/ SS-11 Sego	Launchers	326	20	0
	Warheads	326	20	0
RT-2/RS-12/ SS-13 Savage	Launchers	40	20	0
	Warheads	40	20	0
MR UR-100/RS-16/ SS-17 Spanker	Launchers	47	11	0
	Warheads	188	44	0
R-36M/RS-20/ SS-18 Satan	Launchers	308	292	180
	Warheads	3,080	2,920	1,800
UR-100N/RS-18/ SS-19 Stiletto	Launchers	300	300	150
	Warheads	1,800	1,800	900
RT-23/RS-22/ SS-24 Scalpel	Launchers	89	92	72
	Warheads	890	920	720
RT-2PM/RS-12M/ SS-25 Sickle	Launchers	288	354	360
	Warheads	288	354	360
RT-2-PM2/RS-12M/ SS-27 Topol-M	Launchers	Not in production	Not in production	20
	Warheads	N/A	N/A	20
Subtotal, ICBMs	Launchers	1,398	1,089	782
	Warheads	6,612	6,078	3,800

LAUNCHERS



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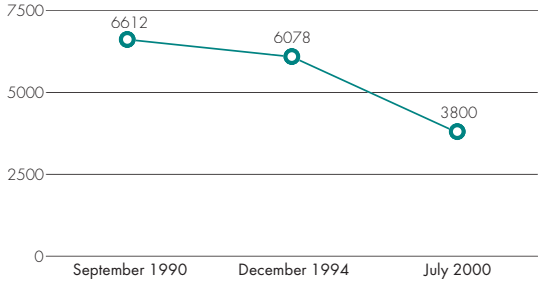
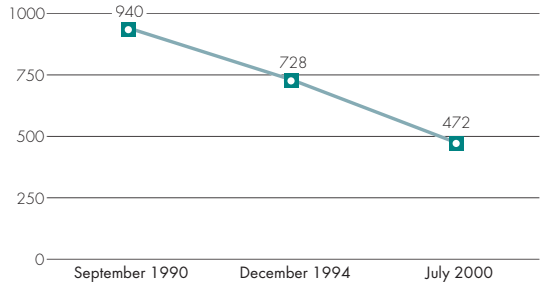


SOURCE: START I MOU Data

TABLE 1.6: SOVIET/RUSSIAN SEA-LAUNCHED BALLISTIC MISSILE (SLBM) LAUNCHERS AND WARHEADS, 1990–2000

Type (Russian/U.S. name)		September 1990	December 1994	July 2000
R-27/RSM-25/ SS-N-6 Serb	Launchers	192	32	0
	Warheads	192	32	0
R-29/RSM-40/ SS-N-8 Sawfly[6]	Launchers	280	256	48
	Warheads	280	256	48
R-31/RSM-45/ SS-N-17 Snipe	Launchers	12	0	0
	Warheads	12	0	0
R-29R/RSM-50/ SS-N-18 Stingray[7]	Launchers	224	208	192
	Warheads	672	624	576
R-39/RSM-52/ SS-N-20 Sturgeon[8]	Launchers	120	120	120
	Warheads	1,200	1,200	1,200
R-29M/RSM-54/ SS-N-23 Skiff[9]	Launchers	112	112	112
	Warheads	448	448	448
Subtotal SLBMs	Launchers	940	728	472
	Warheads	2,804	2,560	2,272

LAUNCHERS



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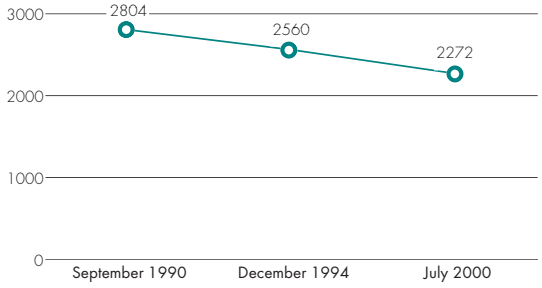


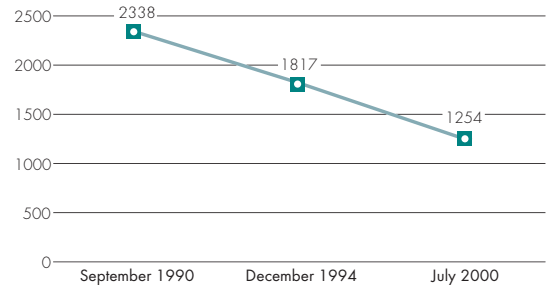
SOURCE: START I MOU Data

6. The SS–N–8 is carried on two classes of Russian SSBNs. The Delta I SSBN carries up to 12 SS–N–8 launchers, and the Delta II SSBN carries up to 16 SS–N–8 launchers.
7. The SS–N–18 is carried on Delta III SSBNs. Each Delta III carries up to 16 SS–N–18 launchers (48 warheads per submarine).
8. The SS–N–20 is carried on Typhoon SSBNs. Each Typhoon carries up to 20 SS–N–20s launchers (200 warheads per submarine).
9. The SS–N–23 is carried on Delta IV SSBNs. Each Delta IV carries up to 16 SS–N–23s launchers (64 warheads per submarine).

TABLE 1.7: SOVIET/NIS START-ACCOUNTABLE BALLISTIC MISSILE (ICBM AND SLBM) LAUNCHERS AND WARHEADS, 1990–2000

	September 1990	December 1994	July 2000
Launchers	2,338	1,817	1,254
Warheads	9,416	8,638	6,072

LAUNCHERS



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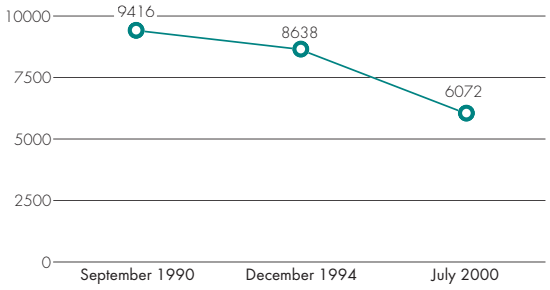
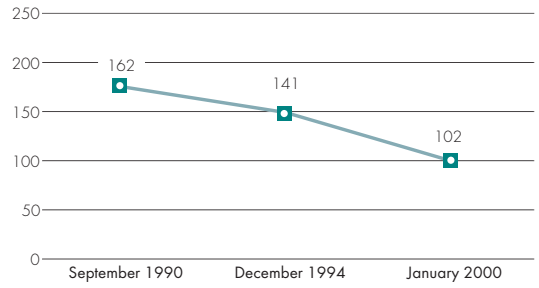


SOURCE: START I MOU Data

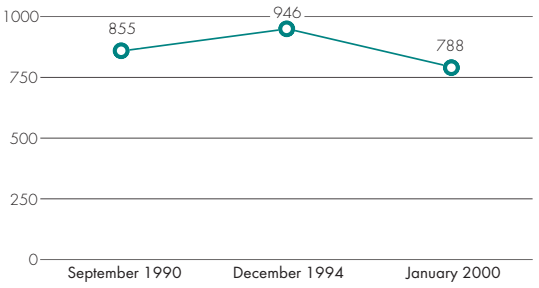
TABLE 1.8: SOVIET/NIS START-ACCOUNTABLE STRATEGIC BOMBERS, 1990–2000

Type		September 1990	December 1994	July 2000
Tu-95/Bear A, B	Launchers	17	2	0
	Warheads	17	2	0
Tu-95MS/Bear H	Launchers	84	90	79
	Warheads	672	720	632
Tu-95 Bear G	Launchers	46	24	4
	Warheads	46	24	4
Tu-160	Launchers	15	25	19
	Warheads	120	200	152
Subtotal Bombers	Launchers	162	141	102
	Warheads	855	946	788

LAUNCHERS



WARHEADS



SOURCE: START I MOU Data

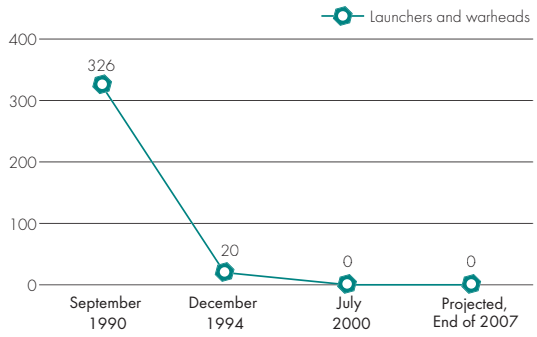
Intercontinental Ballistic Missiles (ICBMs)

Retired Systems

TABLE 1.9: **UR–100/RS–10/SS–11 SEGO**[10]

	September 1990	December 1994	July 2000	Projected, End of 2007
Launchers	326	20	0	0
Warheads	326	20	0	0

LAUNCHERS AND WARHEADS

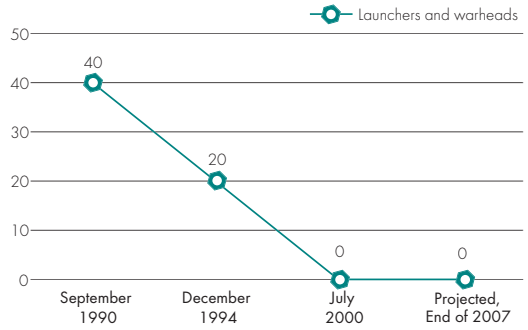


The SS–11 ICBM was a two-stage, storable-liquid-propellant missile with a maximum throw-weight of 1,500 kg and a maximum range of 12,000 km. Early variants carried a single 1-MT warhead, while a later variant carried three warheads. It was manufactured at the Khrunichev Plant in Moscow and the Omsk Aviation Factory.[11] The most recent variant was 19.5 m long and 2.0 m in diameter.[12] The first flight-test occurred on April 19, 1965, and the initial operational capability of variants 2 and 3 was reached in 1973 and 1975, respectively. The SS–11 is no longer a part of the Russian nuclear arsenal.

10. For each of Russia's strategic delivery systems, this report provides the three most common designations for that system. The first is the Russian military designation, the second the bilateral (START I) designation, and the third the NATO designation.
11. Podvig, *Strategicheskoye yadernoye vooruzheniye Rossii,* p. 178.
12. START I MOU, January 2000, p. 88.

TABLE 1.10: **RT–2/RS–12/SS–13 SAVAGE**				
	September 1990	**December 1994**	**July 2000**	**Projected, End of 2007**
Launchers	40	20	0	0
Warheads	40	20	0	0

LAUNCHERS AND WARHEADS

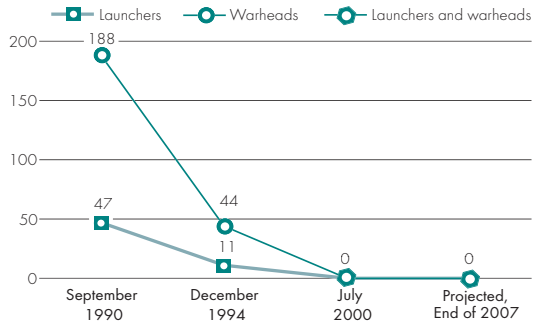


The SS–13 ICBM was a three-stage, solid-propellant missile with a maximum throw-weight of 600 kg and a maximum range of 9,500 km. It was deployed with a single 750-kT warhead.[13] It was 19.7 m long and 1.8 m in diameter.[14] Initial operational capability was achieved in 1969, and deployment was completed in 1972.[15] The SS–13 is no longer a part of the Russian nuclear arsenal.

13. Podvig, *Strategicheskoye yadernoye vooruzheniye Rossii,* p. 181.
14. START I MOU, January 2000, p. 88.
15. Federation of American Scientists web site: <www.fas.org/nuke/guide/russia/icbm>.

TABLE 1.11: **MR UR–100/RS–16/SS–17 SPANKER**				
	September 1990	**December 1994**	**July 2000**	**Projected, End of 2007**
Launchers	47	11	0	0
Warheads	188	44	0	0

LAUNCHERS AND WARHEADS



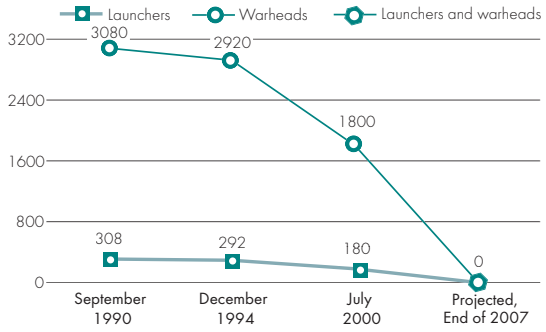
The SS–17 ICBM was a two-stage, storable-liquid-propellant missile with a maximum throw-weight of 2,550 kg and a maximum range of 10,300 km. It was manufactured at the Yuzhmash Machine-Building Plant in Dnipropetrovsk, Ukraine.[16] It was 21.6 m long and 2.25 m in diameter.[17] The missile carried four 550–750 kT warheads. Initial operational capability was reached between 1976 and 1982, depending on the particular modification of the ICBM.[18] The SS–17 is no longer a part of the Russian nuclear arsenal.

16. Podvig, *Strategicheskoye yadernoye vooruzhiniye Rossii,* p. 187.
17. START I MOU, January 2000, p. 90.
18. Wilkening, "Russia's Strategic Nuclear Forces," p. 6.

Current Systems

TABLE 1.12: **R–36M/RS–20/SS–18 SATAN**				
	September 1990	**December 1994**	**July 2000**	**Projected, End of 2007**
Launchers	308	292	180	0
Warheads	3,080	2,920	1,800	0

LAUNCHERS AND WARHEADS



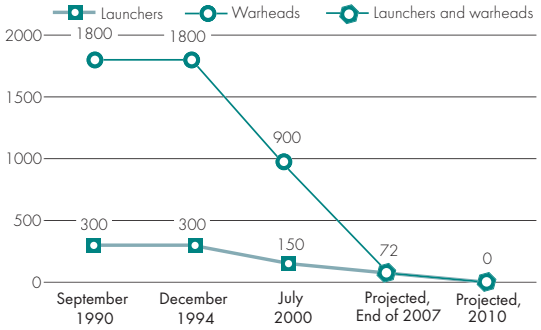
The SS–18 ICBM is a large, two-stage, storable-liquid-propellant missile. It is 35.7–38.9 m long (depending on modification type) and 3.0 m in diameter.[19] The currently deployed modification of this heavy Russian ICBM carries ten 500–750 kT multiple independently targeted reentry vehicles (MIRVs), has a throw-weight of 8,800 kg, and a range of 10,000–16,000 km, depending on the number of warheads.[20] The SS–18 has six modifications, the first of which reached initial operational capability in 1975, and the latest reached initial operational capability in 1988. The last SS–18s were deployed in 1991.[21] SS–18 ICBMs are deployed at four locations in Russia: 52 missiles at Dombarovskiy, 46 missiles at Kartaly, 30 missiles at Aleysk, and 52 missiles at Uzhur.[22]

The SS–18 was designed at the Yuzhnoye Design Bureau and manufactured at the Yuzhmash Machine-Building Plant, both located in Ukraine, although Russian enterprises provide maintenance for SS–18s that are currently in the inventory.[23] Under START II, all SS–18s would be eliminated by 2007. Without START II, however, Russia might be able to extend the life of the SS–18 from the original 15 years to 20 years, leaving approximately 90 SS–18s by the end of 2007. Furthermore, all would be able to carry their maximum payload of ten warheads.[24] Few if any SS–18s would remain by the end of 2010.

19. START I MOU, January 2000, p. 90.
20. Podvig, *Strategicheskoye yadernoye vooruzheniye Rossii,* p. 190.
21. Wilkening, "Russia's Strategic Nuclear Forces," p. 6.
22. START I MOU, July 1, 2000, pp. 14–29.
23. Federation of American Scientists web site: <www.fas.org/nuke/guide/russia/icbm>.
24. Wilkening, "Russia's Strategic Nuclear Forces," p. 9.

TABLE 1.13: **UR–100N/RS–18/SS–19 STILETTO**					
	September 1990	**December 1994**	**July 2000**	**Projected, End of 2007**	**Projected, 2010**
Launchers	300	300	150	72	0
Warheads	1,800	1,800	900	72	0

LAUNCHERS AND WARHEADS



The SS–19 ICBM is a two-stage, storable-liquid-propellant MIRVed missile carrying six warheads. The SS–19 is 24.3 m long, 2.5 m in diameter, has a throw-weight of 3,600 kg, and a range of 10,000 km.[25] There are three modifications of the SS–19, the first of which reached initial operational capability in 1975, and the latest reached initial operational capability in 1980. The last SS–19s were deployed in 1984. SS–19 ICBMs are currently deployed at two locations in Russia: 60 missiles at Kozelsk, and 90 missiles at Tatishchevo.[26]

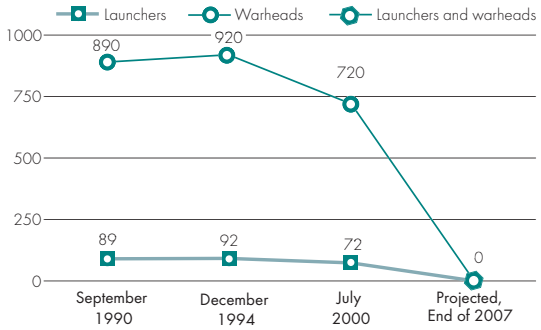
The SS–19 was designed at the TsKBM Design Bureau located near Moscow and manufactured at the Khrunichev Plant in Moscow. Russia has already successfully extended the life of the ICBM to 21 years. It might be able to extend the life further, to 25 years, by using parts from undeployed SS–19s received from Ukraine in 1995. Under the START II treaty, Russia is allowed to download 105 SS–19s to one warhead by December 2007. However, if the maximum life of 25 years holds, it is probable that only the 72 SS–19s deployed in 1984 would still remain operational by the end of 2007. After 2007, all SS–19s would rapidly reach the end of their operational lives. Few if any would remain in service by 2010.[27] Without START II, Russia would be able to maintain the same number of SS–19s and could continue to deploy them with six warheads each.[28]

25. START I MOU, January 2000, p. 90.
26. START I MOU, July 2000, pp. 29–39.
27. Russia received 30 "unfueled" SS–19s from Ukraine in 1995 whose operational lifetime had not yet started. If Russia were to extend the operational life of other more recently deployed SS–19s, it is possible that the SS–19 force could be maintained until 2009–2012. Handler, "Russia's Nuclear and Strategic Forces."
28. Wilkening, "Russia's Strategic Nuclear Forces," p. 11.

TABLE 1.14: **RT–23/RS–22/SS–24 SCALPEL**

	September 1990	December 1994	July 2000	Projected, End of 2007
Launchers	89	92	72	0
Warheads	890	920	720	0

LAUNCHERS AND WARHEADS



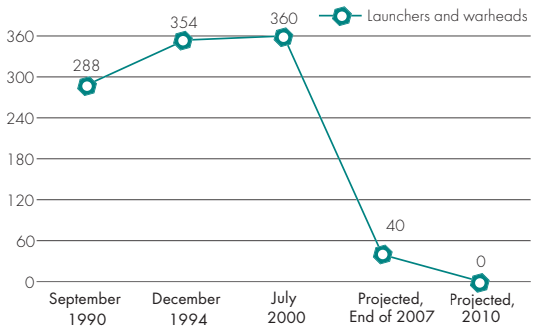
The SS–24 ICBM is a three-stage, solid-propellant missile carrying 10 MIRVed warheads. It is 22.4 m long and 2.4 m in diameter. It has a throw-weight of 4,050 kg and a range of 10,000 km.[29] The SS–24 reached initial operational capability in 1988, and the last SS–24s were deployed in 1990. It has both rail-mobile and silo-based variants, although only the rail-based versions are operational.[30] SS–24 rail-mobile ICBMs are deployed at three locations in Russia: 12 missiles at Kostroma, 12 missiles at Bershet, and 12 missiles at Krasnoyarsk.[31] In addition to the rail-based systems, there are 10 SS–24 silo launchers at Tatishchevo that remain START I–accountable and 26 SS–24 silo launchers in Ukraine at Pervomaysk.[32]

Production of the SS–24 ceased in 1991, and Russia would have difficulty restarting production of the SS–24 even if it wanted to, since the missile was designed at the Yuzhmash Design Bureau and manufactured at the Pavlohrad Mechanical Plant, both in Ukraine.[33] This ICBM has a short, ten-year life, although Russia has successfully extended the life by five years. It is generally assumed that the SS–24 will be phased out by 2007 regardless of START II.[34]

29. START I MOU, January 2000, p. 91; Podvig, *Strategicheskoye yadernoye vooruzheniye Rossii,* p. 197.
30. Federation of American Scientists web site: <www.fas.org/nuke/guide/russia/icbm>.
31. Operational numbers vary slightly from START I MOU data. The July 31, 2000, MOU lists 46 deployed SS–24 launchers but only 36 deployed SS–24 ICBMs; the 10 silo-based SS–24s are not considered operational. START I MOU, July 2000, pp. 61–64.
32. Start I MOU, July 2000, p. 37 (Russia) and p. 11 (Ukraine).
33. Center for Defense Information web site: <www.cdi.org/issues/nukef&f/database>.
34. Wilkening, "Russia's Strategic Nuclear Forces," p. 12.

TABLE 1.15: **RT–2PM/RS–12M TOPOL/SS–25 SICKLE**					
	September 1990	**December 1994**	**July 2000**	**Projected, End of 2007**	**Projected, 2010**
Launchers	288	354	360	40	0
Warheads	288	354	360	40	0

LAUNCHERS AND WARHEADS



The SS–25 ICBM is a three-stage, solid-propellant missile that carries one warhead. It is 22.3 m long and 1.8 m in diameter.[35] It has a throw-weight of 1,000 kg and a range of 10,500 km. Initial operational capability was reached in 1988.[36] The SS–25 is deployed on road-mobile launchers. SS–25 ICBMs are deployed at ten sites in Russia: 36 at Teykovo, 36 at Yoshkar-Ola, 45 at Yurya, 45 at Nizhniy Tagil, 45 at Novosibirsk, 45 at Kansk, 36 at Irkutsk, 36 at Barnaul, 18 at Drovyanaya, and 18 at Vypolzovo.[37]

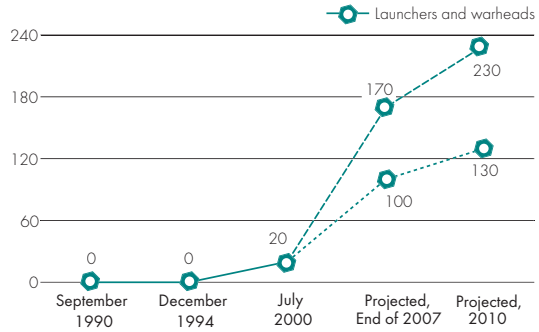
Although the SS–25 was designed at the Moscow Institute of Thermal Technology and manufactured at the Votkinsk Machine-Building Plant in Russia, the breakup of the Soviet Union had a significant impact on the program. Belarus manufactured the missiles' transporter-erector-launchers, and some 90% of the components of the guidance system were manufactured in Ukraine. Nevertheless, Russia might be able to extend the current life of 10 years by five years, leaving at the most 40 SS–25s deployed by the end of 2007.[38] Even with the extended life of 15 years, few, if any, SS–25s will remain in service by 2010.

35. START I MOU, January 2000, p. 88.
36. Podvig, *Strategicheskoye yadernoye vooruzheniye Rossii,* p. 200.
37. START I MOU, July 2000, pp. 40–61.
38. Wilkening, "Russia's Strategic Nuclear Forces," p. 13.

TABLE 1.16: RT–2PM2/RS–12M, VARIANT 2/SS–27 TOPOL-M

	September 1990	December 1994	July 2000	Projected, End of 2007[39]	Projected, 2010[40]
Launchers	0	0	20	100-170	130-230
Warheads	0	0	20	100-170	130-230

LAUNCHERS AND WARHEADS



The SS–27 ICBM was developed on the basis of the SS–25. It is a three-stage, solid-propellant missile carrying a single warhead. The SS–27 is 22.7 m long, is 1.86 m in diameter, has a throw-weight of 1,200 kg, and a range of 11,000 km.[41] Initial operational capability was reached in 1999. All 20 SS–27 ICBMs are currently deployed at Tatishchevo in Russia.[42]

The SS–27 was designed at the Moscow Institute of Thermal Technology and is produced at the Votkinsk Machine Building Plant, both of which are in Russia.[43] Although all currently deployed SS–27s are silo-based, Russia plans to accommodate the system on road-mobile launchers as well. The estimated service life is 20 years for silo-based missiles, and 15 years for road-mobile missiles. Although the SS–27 represents the backbone of the future Russian ICBM force, production is greatly lagging behind projections (fewer than 10 missiles per year instead of the planned 30–40). The future of Russia's strategic rocket forces largely depends on the production rate of the SS–27. If current levels of production continue, Russia will have 100 SS–27s by the end of 2007. Russia could substantially increase funding for the program and produce 20 missiles a year to reach a total of 170 by the end of 2007, or 230 by the end of 2010.

Given the lack of funding for Russia's strategic forces, low-to-medium SS–27 production rates are likely.[44] If START II does not enter into effect, Russia could easily modify the SS–27 to carry three or four warheads. In that case, Russia could field 600–800 warheads on 200 land-based ICBMs. In any case, by 2010, the SS–27 will likely be the only ICBM Russia deploys in significant numbers.

39. The first number is based on current production levels, while the second assumes production of 20 missiles per year, beginning in 2001.
40. The first number is based on current production levels, while the second assumes production of 20 missiles per year, beginning in 2001.
41. START I MOU, July 2000, p. 88.
42. Ibid., p. 33.
43. William Arkin and Robert Norris, "Nuclear Notebook: Russian Strategic Nuclear Forces, End of 1998," *Bulletin of the Atomic Scientists,* March/April 1999. Online at <www.bullatomsci.org/issues/nukenotes/ma99nukenote. html>
44. Wilkening, "Russia's Strategic Nuclear Forces," p. 13.

Nuclear Ballistic Missile Submarines and Sea-launched Ballistic Missiles (SSBNs/SLBMs)

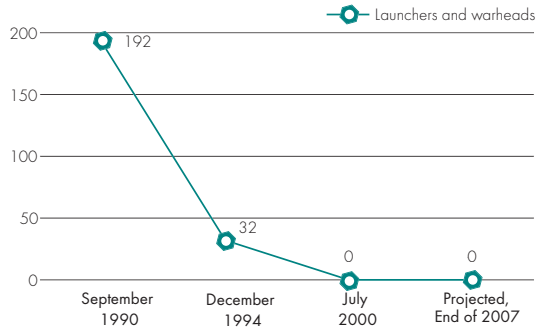
Sea-launched ballistic missiles are usually developed specifically for a particular class of ballistic missile–carrying nuclear submarine. It is therefore easier to understand Russia's sea-based nuclear forces if one examines together the SSBN and its corresponding SLBM. Currently, Russia has only three classes of operational SSBN: the Delta III, the Typhoon, and the Delta IV.[45] These boats carry, respectively, SS–N–18, SS–N–20, and SS–N–23 ballistic missiles. The number of SLBMs shown in Table 1.3 is lower than the number given by the START I MOU, which includes SSBNs and SLBMs that are no longer deployed and are awaiting dismantlement. The number of operational SLBMs may drop precipitously over the next decade as Russian SSBNs reach the end of their service lives.

45. Ibid., p. 20.

Retired Systems

TABLE 1.17: **R–27/RSM–25/SS–N–6 SERB**				
	September 1990	**December 1994**	**July 2000**	**Projected, End of 2007**
Launchers	192	32	0	0
Warheads	192	32	0	0

LAUNCHERS AND WARHEADS

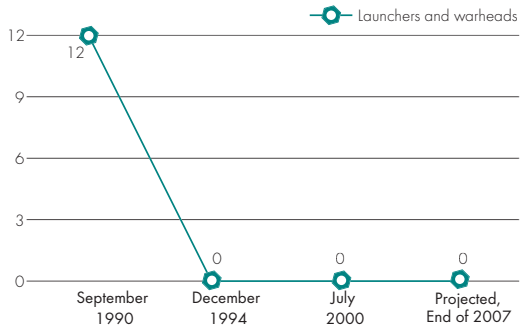


The SS–N–6 SLBM was a single-stage, storable-liquid-propellant missile with a throw-weight of 650 kg and a maximum operational range of 3,000 km. Early variants carried a single 1-MT warhead, while a later variant carried three warheads. The SS–N–6 was manufactured at the Zlatoust Machine Construction Factory and the Krasnoyarsk Machine Building Plant,[46] and it is 7.1 m long and 1.5 m in diameter.[47] The SS–N–6 was deployed on Yankee-class nuclear submarines, which carried 16 of these missiles each. All three variants of this missile reached operational capability in 1975.[48] The SS–N–6 is no longer a part of the Russian nuclear arsenal.

46. Podvig, *Strategicheskoye yadernoye vooruzheniye Rossii,* p. 277.
47. START I MOU, January 2000, p. 95.
48. Federation of American Scientists web site <www.fas.org/nukes/guide/russia/slbm>.

TABLE 1.18: **R–31/RSM–45/SS–N–17 SNIPE**				
	September 1990	**December 1994**	**July 2000**	**Projected, End of 2007**
Launchers	12	0	0	0
Warheads	12	0	0	0

LAUNCHERS AND WARHEADS



The SS–N–17 was a single-warhead SLBM with a maximum throw-weight of 450 kg and a maximum range of 3,900 km. It carried a single 500-kT warhead and was 11 m long and 1.5 m in diameter.[49] It was deployed on Yankee II–class submarines. Each submarine carried up to 12 SS–N–17 SLBMs. The Yankee II submarines reached initial operational capability in 1977.[50] The SS–N–17 is no longer a part of the Russian nuclear arsenal.

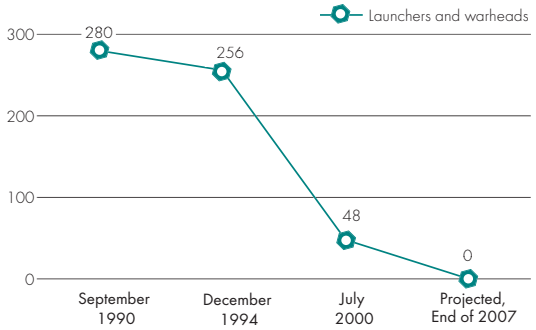
49. Podvig, *Strategicheskoye yadernoye vooruzheniye Rossii,* p. 283.

50. Wilkening, "Russia's Strategic Nuclear Forces," p. 43.

Current Systems

TABLE 1.19: R–29/RSM–40/SS–N–8 SAWFLY				
	September 1990	**December 1994**	**July 2000**	**Projected, End of 2007**
Launchers	280	256	48	0
Warheads	280	256	48	0

LAUNCHERS AND WARHEADS



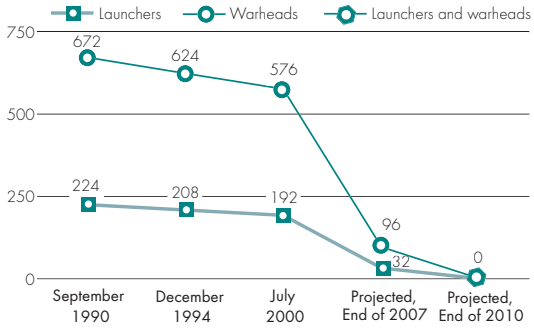
The SS–N–8 SLBM is a two-stage, storable-liquid-propellant missile with a maximum throw-weight of 1,110 kg and a maximum range of 9,100 km. It carries a single 500 kT–1 MT warhead.[51] It is 12.1 m long and 1.8 m in diameter.[52] Initial operational capability was reached in 1973.[53] Delta I–class nuclear submarines can each carry 12 SS–N–8 SLBMs, and Delta II–class submarines can each carry up to 16 SS–N–8s.

As of July 2000, SS–N–8 SLBMs were deployed on four boats at three locations in Russia: two Delta Is at Gadzhiyevo, one Delta I at Rybachiy, and one Delta I at Pavlovskoye. In addition, there were 16 SS–N–8 START I–accountable SLBM launchers awaiting elimination at a facility in Murmansk.[54] These four Delta Is are still listed under START I counting rules, even though they are awaiting retirement and are not thought to be operational.

51. Podvig, *Strategicheskoye yadernoye vooruzhiniye Rossii,* p. 281.
52. START I MOU, January 2000, p. 95.
53. Federation of American Scientists web site <www.fas.org/nukes/guide/russia/slbm>.
54. START I MOU, July 2000, pp. 73–74, 78.

TABLE 1.20: **R–29R/RSM–50/SS–N–18 STINGRAY**					
	September 1990	**December 1994**	**July 2000**	**Projected, End of 2007**	**Projected, 2010**
Delta III SSBNs	14	13	11	2	0
Launchers	224	208	192	32	0
Warheads	672	624	576	96	0

LAUNCHERS AND WARHEADS



The SS–N–18 SLBM is a two-stage, liquid-propellant missile with a throw-weight of 1,650 kg. The SS–N–18 is 14.1 m long and 1.8 m in diameter.[55] It was the first MIRVed Soviet SLBM and can carry three warheads to a maximum operational range of 6,500 km or a single warhead up to 8,000 km.[56] The SS–N–18 was first deployed in 1979.[57]

It was manufactured in Krasnoyarsk, Russia. As of July 2000, SS–N–18 SLBMs were deployed on 11 Delta III SSBNs at two locations in Russia: two Delta IIIs at Gadzhiyevo, and nine Delta IIIs at Rybachiy. In addition, there were 16 SS–N–18 launchers awaiting elimination at a facility in Severodvinsk.[58]

55. Ibid., p. 95.
56. Federation of American Scientists web site <www.fas.org/nukes/guide/russia/slbm>.
57. Ibid.
58. START I MOU, July 2000, p. 78.

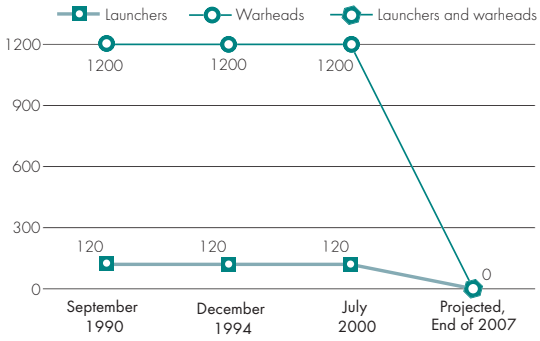
Delta III Kalmar SSBN

The Project 667 BDR/Delta III–class SSBN reached initial operational capability in 1977. The last boat was deployed in 1982.[59] Each Delta III is capable of carrying 16 SS–N–18 SLBMs for a total of 48 warheads per boat. In April 1999, the Russian navy decided to overhaul a number of Delta III SSBNs, thereby extending the service lives of those boats.[60] It is unclear how many years that maintenance will add to the Delta III's current service life of roughly 21 years, particularly because, in the absence of such maintenance, all Delta III SSBNs would have to be retired in the next few years.[61] Even a five-year-life extension, however, would allow Russia to keep some Delta IIIs in service through 2007.

59. Wilkening, "Russia's Strategic Nuclear Forces," p. 6.
60. Sokov, *Russian Strategic Modernization,* p. 135.
61. Wilkening, "Russia's Strategic Nuclear Forces," p. 20.

TABLE 1.21: **R–39/RSM–52/SS–N–20 STURGEON**				
	September 1990	**December 1994**	**July 2000**	**Projected, End of 2007**
Typhoon SSBNs	6	6	5	0
Launchers	120	120	120	0
Warheads	1,200	1,200	1,200	0

LAUNCHERS AND WARHEADS



The SS–N–20 SLBM is a three-stage, solid-fuel missile with a throw-weight of 2,500 kg. The SS–N–20 is 16.1 m long and 2.4 m in diameter.[62] It is capable of carrying ten warheads to a maximum operational range of 8,300 km. The SS–N–20 was first deployed in 1981 on Typhoon-class SSBNs. One hundred SS–N–20 SLBM launchers are currently deployed on five Typhoon SSBNs at Nerpichya in Russia, although not all these boats are operational. Twenty SS–N–20 launchers are also awaiting elimination at a facility in Severodvinsk.[63]

Production of the SS–N–20 ceased during the Soviet era amid plans to deploy an updated version (R–39U), but the fall of the Soviet Union in 1991 led to the cancellation of the upgrade. In the early 1990s, Russia began developing another upgraded SLBM, the Bark, but in 1997, after three successive test failures, the navy canceled the program.[64] It is not clear if Russia is developing a replacement SLBM for its aging SS–N–20s, which are reaching the end of their service lives. Most SS–N–20s will be retired by 2003 barring extensive—and very expensive—efforts to prolong their operational lives. This suggests that even if there are operational Typhoons by the end of 2007, there may not be any operational ballistic missiles on board.

62. START I MOU, July 2000, p. 95.
63. Ibid., pp. 72, 78.
64. Sokov, *Russian Strategic Modernization,* p. 137.

Typhoon Akula SSBN

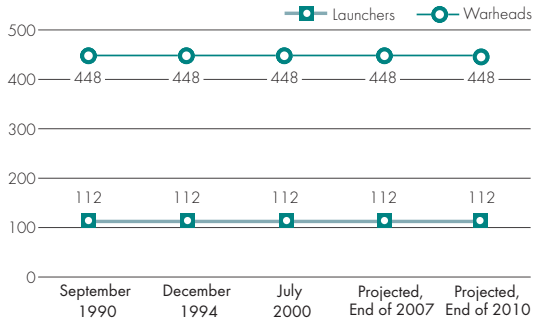
The Project 941/Typhoon-class SSBN reached initial operational capability in 1981. The last boat was deployed in 1989.[65] It is capable of carrying 20 SS–N–20 MIRVed SLBMs, for a total of 200 warheads per boat. As of July 2000, only three Typhoons were both deployed and operational in Russia. In addition to difficulties with their SLBMs, the submarines themselves have had numerous maintenance problems, which suggests that the boat's lifetime is probably shorter than for other SSBNs. Assuming a 16-year life, the remainder of the Typhoon SSBNs will likely be retired by the end of 2007.[66]

65. Wilkening, "Russia's Strategic Nuclear Forces," p. 6.

66. Ibid., p. 22.

TABLE 1.22: **R–29RM/RSM–54/SS–N–23 SKIFF**					
	September 1990	**December 1994**	**July 2000**	**Projected, End of 2007**	**Projected, End of 2010**
Delta IV SSBNs	*7*	*7*	*7*	*7*	*7*
Launchers	112	112	112	112	112
Warheads	448	448	448	448	448

LAUNCHERS AND WARHEADS



The SS–N–23 SLBM is a three-stage, liquid-propellant missile. It is capable of carrying ten warheads to a maximum operational range of 8,300 km. It is 14.8 m long, 1.9 m in diameter, and was first deployed in 1985.[67] All deployed SS–N–23s carry four warheads. As of July 2000, all 112 SS–N–23 SLBMs were deployed on seven Delta IV SSBNs at Gadzhiyevo in Russia.[68]

Although Russia has resumed manufacturing the SS–N–23 at the Krasnoyarsk Machine Building Plant, it also has at least two SLBM development programs under way, either of which could eventually replace the SS–N–23.

67. START I MOU, July 2000, p. 96.

68. Ibid., p. 73.

Delta IV Delfin SSBN

The Project 667 BDRM/Delta IV–class SSBN reached initial operational capability in 1986. The last boat was deployed in 1991.[69] It is capable of carrying 16 SS–N–23 SLBMs, or a total of 64 warheads per boat. Given the aging Delta III class and the problem-ridden Typhoon class, Russia's Delta IV fleet may represent the mainstay of the country's sea-based strategic forces until the newest class of nuclear submarines—the Borey class (Project 955)—is deployed. As of May 2000, Russia had seven operational Delta IVs. The standard life of a Delta IV SSBN is approximately 21 years, but Russia has already upgraded one Delta IV and will likely do the same for the rest of them. Assuming that all seven receive service lifetime extensions, Russia may be able to maintain its Delta IV fleet through 2010.[70]

Borey SSBN

The Project 955/Borey-class submarine is a nuclear, ballistic-missile submarine currently under development in Russia. The initial model appears to have 12 SLBM tubes, but experts suggest that later modifications may hold up to 16 SLBM launchers. Although construction of the first boat, the *Yuriy Dolgorukiy,* began in November 1996, it was halted two years later because of a lack of funding and difficulties in developing a new SLBM. Specifically, Borey-class SSBNs were initially designed to carry the Bark SLBM, but that program was canceled in 1997. After cancellation of the Bark project, Russia resumed production of an updated version of the liquid-fueled SS–N–23 code-named *Sineva.* Simultaneously, the Moscow Institute of Thermal Technology was given a contract for a more long-term project to design a solid-fuel missile—code-named *Bulava*—suitable for both land and sea-based deployment.

The type of SLBM deployed on these boats will determine the number of warheads that a Borey-class SSBN can carry. A sea-based solid-fuel SLBM will probably have at most three to four MIRVed warheads (36–48 warheads per boat), but an SLBM based on the SS–N–23 would likely have six warheads (72 warheads per boat). In addition, future Borey-class SSBNs may have 16 missile tubes, further increasing the number of warheads per boat.

Nevertheless, unless production resumes immediately on both the Borey-class SSBN and its accompanying SLBM, Russia will not have any new SSBNs deployed by the end of 2007. Even under the best-case scenario, Russia will have no more than one to two Borey-class SSBNs deployed by that time. By 2010, Russia could have two to three Borey SSBNs.

69. Federation of American Scientists web site: <www.fas.org/nukes/guide/russia/slbm>.

70. Wilkening, "Russia's Strategic Nuclear Forces," p. 22.

Strategic Bombers

TABLE 1.23: **TU–95MS BEAR H**					
	September 1990	**December 1994**	**July 2000**	**Projected, End of 2007**	**Projected, End of 2010**
Launchers	84	90	79	10–50	10
START Warheads	672	720	632	80–400	80

LAUNCHERS AND WARHEADS

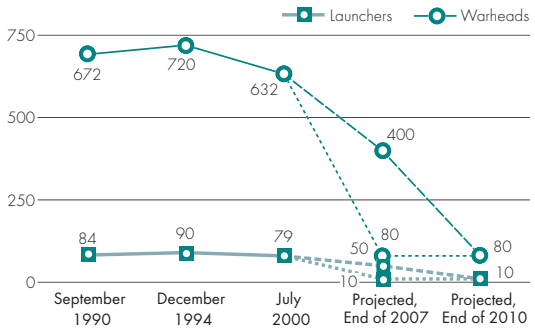
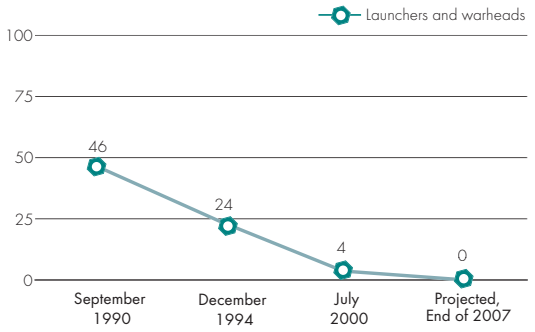


TABLE 1.24: **TU–95 BEAR G**				
	September 1990	**December 1994**	**July 2000**	**Projected, End of 2007**
Launchers	46	24	4	0
START Warheads	46	24	4	0

LAUNCHERS AND WARHEADS



The Tu–95 Bear is a turboprop-driven strategic bomber with a range of 8,300 km (greater with midair refueling), capable of carrying air-launched cruise missiles (ALCMs) or short-range attack missiles (SRAMs). First deployed in 1956, two variants of the more modern Tu–95MS are still deployed (with the exception of some aging Bear Gs that are disabled beyond repair). One deployed variant of the Bear carries six AS–15A Kent ALCMs or six AS–16 Kickback SRAMs and reached initial operational capability in 1987. The other variant carries 16 AS–15 Kent

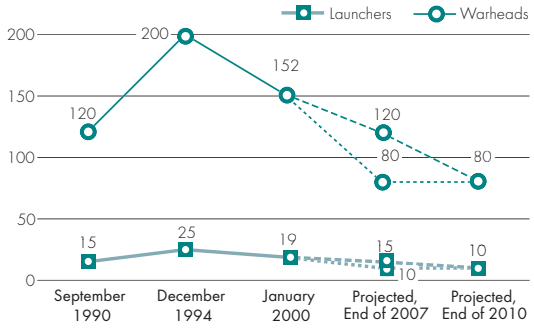
ALCMs or 16 AS–16 Kickback SRAMs and reached initial operational capability in 1983.[71] Tu–95MS bombers are currently deployed at two locations in Russia: 48 at Ukrainka, and 18 at Engels.[72]

Production of the Tu–95MS ceased in 1991, and if one assumes a 30-year service life, then the newer Bear bombers will not be retired by the end of 2007.[73] Of the legs of the Russian nuclear triad, however, the bomber force has received the least attention and funding, which may severely affect the lives of these aircraft. Some experts even suggest that by the end of 2007, almost all Bear bombers will face early retirement.[74] In late 1999, Ukraine transferred three Tu–95MS bombers to Russia in partial payment of gas debts to Russia. The deal also provided for the transfer of 575 ALCMs (presumably AS–15A Kent ALCMs) to Russia.[75]

71. Federation of American Scientists web site: <www.fas.org/nukes/russia/bomber>.
72. START I MOU, July 2000, p. 80.
73. Wilkening, "Russia's Strategic Nuclear Forces," p. 26.
74. William Arkin, Robert Norris, and Joshua Handler, *Taking Stock: Worldwide Nuclear Deployments, 1998,* online at <www.igc.apc.org/nrdc/nrdcpro/fpprog.html>.
75. Ilya Kedrov, "Oruzhiye natsii vernulos na rodinu," *Nezavisimoye voennoye obozreniye,* no. 44, November 12–18, 1999.

TABLE 1.25: **TU–160 BLACKJACK**					
	September 1990	**December 1994**	**July 2000**	**Projected, End of 2007**	**Projected, End of 2010**
Launchers	15	25	19	10-15	10
START Warheads	120	200	152	80-120	80

LAUNCHERS AND WARHEADS



The Tu–160 Blackjack is a jet-propelled strategic bomber with a range of 7,300 km, capable of carrying ALCMs or SRAMs.[76] Initial operational capability was reached in 1987. It can carry 12 AS–15A Kent ALCMs or 24 AS–16 Kickback SRAMs and has a service life of approximately 30 years.[77] Tu–160 bombers are deployed only at Engels air base in Russia.[78]

Russia's Tu–160 force more than doubled owing to a bomber-for-debt deal between Russia and Ukraine in late 1999 and early 2000. Russia acquired eight Tu–160 bombers and three Tu–95MS bombers.[79] In early May 2000, the Kazan Manufacturing Plant delivered to the air force a completed Tu–160. This aircraft was one of seven Tu–160 bombers that had been sitting partially completed on the production line for almost twelve years.[80] It is still unclear whether or not Russia will complete the construction of the remaining bombers. With proper maintenance, Russia's Tu–160 bomber force should remain in service through 2007.

76. Federation of American Scientists web site: <www.fas.org/nukes/russia/bomber>.
77. Wilkening, "Russia's Strategic Nuclear Forces," p. 27.
78. START I MOU, July 2000, p. 80.
79. "Ukraine Transfers Bombers to Russia as Pay for Gas," *ITAR–TASS,* January 19, 2000.
80. "Russia Adds Strategic Bomber to Fleet," *RFE/RL,* May 4, 2000.

Russian Substrategic Nuclear Weapons

Nuclear weapons associated with delivery vehicles without intercontinental ranges are often referred to as tactical nuclear weapons. This class of weapons incorporates everything from nuclear land mines to nuclear-tipped torpedoes to bombs carried by tactical aircraft. Given that these weapons may have ranges of up to several thousand kilometers, and that yields may be equal to those of strategic weapons, the term *tactical* is a misnomer and so has been gradually replaced by *substrategic*. While strategic nuclear weapons may garner more attention, the Soviet Union may have possessed approximately 22,000 substrategic nuclear warheads in 1991, a far larger number than those deployed on strategic weapons.

The only arms control treaty that currently limits substrategic nuclear forces is the Intermediate-Range Nuclear Forces (INF) Treaty, signed in December 1987 by Soviet President Mikhail Gorbachev and U.S. President Ronald Reagan. The INF Treaty banned ground-launched cruise missiles (GLCMs) and ballistic missiles with ranges of between 500 and 5,500 kilometers, making it the first arms control treaty to eliminate an entire class of nuclear forces. In addition, it broke new ground by incorporating extensive on-site inspection and monitoring provisions, setting an important precedent for similar provisions in the START treaties. The INF Treaty entered into force in June 1988, and by May 1991 the Soviet Union completed the dismantling of all forces covered by the treaty, a total of 1,846 SS–20, SS–4, SS–5, and SS–21 ballistic missiles. The United States dismantled 846 missiles, including all Pershing IA and Pershing II ballistic missiles, and all land-based Tomahawk GLCMs. The treaty provided for the on-site inspection of missile deployment and storage areas, as well as the continuous monitoring of missile production facilities in Russia and the United States.[81] While the INF Treaty is of unlimited duration, the inspection and monitoring regime was to end by May 31, 2001, ten years after the completion of missile elimination.[82]

The success of the INF Treaty paved the way for the START I treaty. Implementation of the INF Treaty also created a new relationship between the United States and the Soviet Union that facilitated subsequent initiatives to reduce substrategic weapons. After the attempted coup in Moscow in August 1991, Western analysts raised concerns about the security of substrategic nuclear weapons, which were numerous and widely dispersed throughout the Soviet Union. On September 27, 1991, prompted by fears that the crumbling Soviet regime might lose control of its nuclear weapons, U.S. President George Bush announced a series of unilateral reductions and redeployments of U.S. substrategic nuclear weapons and invited the Soviet Union to follow suit.

Nine days later, President Gorbachev announced a similar set of unilateral measures on reducing substrategic nuclear weapons. These initiatives were confirmed and expanded by Russian President Boris Yeltsin in January 1992. Combined, the Soviet/Russian measures provide for the following:

- The complete elimination of warheads for tactical land-based missiles, artillery shells, and mines
- The elimination of one-half of the warheads for anti-ballistic and anti-aircraft missiles, the remaining warheads to be stored at central warhead storage facilities
- The removal of all substrategic nuclear weapons from naval vessels and elimination of one-third of the warheads, the remaining warheads to be stored at central warhead storage facilities
- The partial elimination of warheads for naval aircraft, the remaining warheads to be stored at central warhead storage facilities
- The elimination of half of the warheads for tactical aircraft

81. "Intermediate-Range Nuclear Forces (INF) Treaty," Defense Threat Reduction Agency Fact Sheet, <www.dtra.mil/news/fact/nw_infosi.html>.

82. *Reuters*, December 14, 2000.

The process of disassembling the nuclear warheads slated for elimination was to be completed by the end of 2000.[83]

The process of removing substrategic nuclear weapons from ships and bases may have begun in 1991, but it was not completed before the Soviet Union collapsed in late December 1991. As a result, in early 1992 there were an estimated 4,000 substrategic nuclear weapons still in Belarus, Kazakhstan, and Ukraine. Under the terms of the Almaty agreement of December 1991, these weapons were rapidly withdrawn to Russia, with the pullout completed by May 1992.[84] These weapons were included in the warheads to be reduced under the terms of the Russian unilateral statement.

Substrategic nuclear weapons remain the area of greatest uncertainty in the Russian nuclear stockpile. Apart from the INF Treaty, there are no arms control treaties requiring an exchange of information on substrategic nuclear weapons. (The Conventional Forces in Europe Treaty does cover some dual-use launchers, but not their nuclear components.) Furthermore, in contrast to strategic weapons, there is no direct correlation between the number of launchers and the number of nuclear warheads. Thus, one cannot simply count launchers, multiply by warhead loadings, and produce an approximate total number of warheads. The problem is compounded by the difficulty of estimating how many warheads are actually deployed, how many are in central storage facilities, and how many have been dismantled. This has led to widely varying estimates of the number of deployed or stockpiled nuclear warheads.

The calculation of the total number of substrategic warheads in the Russian stockpile depends upon the types and numbers of warheads existing in 1991 and the progress made in eliminating warheads. Alexei Arbatov, a leading Russian international security expert and State Duma member, has estimated that there were approximately 21,700 substrategic nuclear warheads in the Soviet stockpile in 1991. In 1998, at a meeting of the Russia-NATO Permanent Joint Council, Russian officials reported that the number of substrategic nuclear weapons had been cut in half, but NATO officials continued to express concern at the pace of dismantlement and its lack of transparency.[85] At the April 2000 Non-Proliferation Treaty Review Conference, Russian Foreign Minister Igor Ivanov stated that Russia had eliminated one-third of its naval substrategic nuclear warheads, one-half of its warheads for anti-aircraft missiles and gravity bombs, and was "about to complete" the elimination of warheads from its tactical missiles, artillery shells, and nuclear mines.[86] Based on this statement, and using Arbatov's estimate for the number and types of warheads extant in 1991, this would leave approximately 8,400 warheads in the Russian arsenal as of early 2000. When the reduction process is completed, the stockpile total will be reduced to approximately 8,000 warheads. The number of deployed nuclear warheads, which would include only nuclear bombs deployed near tactical air bases, would be smaller—no more than 3,500. Although the reductions were to be finished by the end of 2000, as of mid-January 2001 the Russian government had made no statement indicating that the reduction process had been completed.

Other estimates suggest that Russia has roughly 4,000 substrategic nuclear warheads on active duty. In 1998, analysts William Arkin, Robert Norris, and Joshua Handler estimated that Russia had approximately 4,000 deployed warheads.[87] Their estimate, however, included delivery vehicles whose warheads should have

83. "Gorbachev Pledges Wide-ranging Nuclear Cuts," *Washington Post,* October 5, 1991, p. A1.

84. Mitchell Reiss, *Bridled Ambition: Why Countries Constrain Their Nuclear Capabilities* (Baltimore: Johns Hopkins University Press, 1995), pp. 89–97.

85. Linda D. Kozaryn, "Russians Say Yeltsin's Nuclear Pledge Fulfilled," *American Forces Press Service*, May 8, 1998, <www.defenselink.mil/news/May1998/n05081998_9805086.html>.

86. Statement by Russian Minister for Foreign Affairs Igor Ivanov before the Non-Proliferation Treaty Review Conference, New York, April 25, 2000.

87. They do note, however, that there might be as many as 12,000 weapons in reserve or awaiting dismantlement (William Arkin, Robert S. Norris, and Joshua Handler, *Taking Stock: Worldwide Nuclear Deployments, 1998* [Natural Resources Defense Council; Washington, D.C., 1998], p. 27).

either been eliminated or stored at central storage sites. Similarly, in 1998 Alexei Arbatov estimated that Russia had 3,800 substrategic nuclear weapons, all of which are stored in weapon depots of the armed forces or in central storage facilities of the Ministry of Defense.[88] Table 1.26 summarizes the status of Russia's substrategic nuclear weapons.

Much higher estimates of the total Russian tactical stockpile are sometimes given by U.S. government officials. In response to a question at a Senate hearing, for example, Gen. Eugene Habiger, former commander-in-chief of the U.S. Strategic Command, estimated that "the gross number of tactical nuclear weapons in Russia today . . . [is] between 17,000 [and] 22,000."[89] Habiger's comment, which was not part of his formal briefing, was not a formal U.S. government estimate of Russia's stockpile size. Official U.S. government estimates from 1997 suggest a total Russian strategic and substrategic nuclear stockpile of up to 23,000 warheads, with a substrategic stockpile of perhaps 14,000 to 15,000 warheads.[90] This wide variation in estimates of stockpile size suggests that the United States believes that the pace of warhead reductions is slower than Russian reports indicate.

TABLE 1.26: **RUSSIAN SUBSTRATEGIC NUCLEAR WEAPONS, 1991 AND 2000**

Substrategic Weapon Type	Totals in 1991[91]	Total To Remain under 1991 Bush-Gorbachev Agreements	Total Substrategic Nuclear Weapons Stockpile, 2000[92]
Land-based Missiles	4,000	0	0
Artillery	2,000	0	0
Mines	700	0	0
Air Defense	3,000	1,500	1,500
Air Force	7,000	3,500	3,500
Navy	5,000	3,000	3,400
Total	**21,700**	**8,000**	**8,400**

88. Alexei Arbatov, "Deep Cuts and De-alerting: A Russian Perspective," *The Nuclear Turning Point* (Brookings Institution Press: Washington, D.C., 1999), p. 320; also, Assistant Secretary of Defense Ashton Carter's testimony before the Senate Armed Service Committee in which he said that Russia had removed all tactical nuclear weapons from naval vessels (April 28, 1994).

89. Testimony by General Eugene Habiger before the Senate Armed Services Committee, March 31, 1998.

90. For a contemporaneous estimate, see William S. Cohen, *Annual Report to the President and Congress,* chap. 20, at <www.dtic.mil/execsec/adr97/chap20.html>.

91. Alexei Arbatov, ed., *Yadernye Vooruzheniya Rossii* (Moscow: IMEMO, 1997), p. 56.

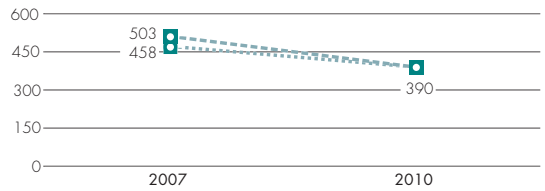
92. Statement by Russian Minister for Foreign Affairs Igor Ivanov before the Non-Proliferation Treaty Review Conference. New York, April 25, 2000. Text of statement is on the Carnegie Non-Proliferation Project's web site: <www.ceip.org/programs/npp/npt2000.htm>.

Future Russian Nuclear Forces

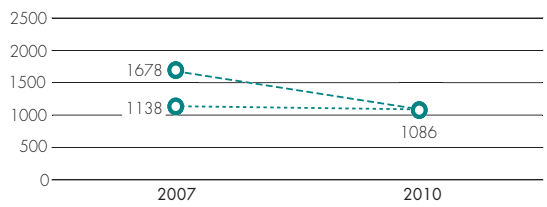
TABLE 1.27: PROJECTED RUSSIAN STRATEGIC NUCLEAR FORCES, 2007 AND 2010

	Type	2007 Launchers/Warheads	2010 Launchers/Warheads
ICBMs	SS-19 SS-25 SS-27	72/72 (432*) 40/40 170/170 (510*)	0 0 230/230 (690*)
SSBNs/SLBMs	Delta III/SS-N-18 Delta IV/SS-N-23 Borey/??	~32/~96[94] 112/448[95] 12/72[96]	0 112/448 28/168[97]
Bombers	Tu-95MS Bear Tu-160 Blackjack	10-50/120-600 10-15/120-180	~10/~120 ~10/~120
	Total, Strategic Nuclear Forces	458-503/1138-2378	390/1086-1546

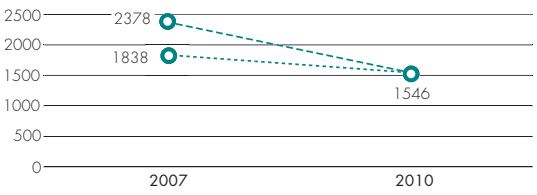
LAUNCHERS



WARHEADS WITH START II PROVISIONS



WARHEADS WITHOUT START II PROVISIONS



* Without a START II ban on MIRVed ICBMs

94. Deployed on two Delta III SSBNs.
95. Deployed on seven Delta IV SSBNs.
96. Deployed on one Borey SSBN.
97. Deployed on two Borey SSBNs. This table projects that the second Borey will have 16 launch tubes rather than 12.