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US - USSR
Strategic Offensive Nuclear Forces
1946 - 1989

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Introduction

A regular element of the debate about nuclear weapons and arms control is the presentation of data on the relative levels of US and USSR strategic forces, often in the form of tables or charts. Frequently, the data presented is unclear in terms of where it came from or what assumptions were used to construct it. Some tables present current "total" forces, others "on-line" forces, "alert" forces, "generated alert" forces, or "SALT accountable" forces. Each is important and more usable if detail about the sources and assumptions is provided. Historical tables compound the difficulties by not always being explicit about the time of the year (i.e. beginning Fiscal Year, beginning calendar year, or some other time).

There has long been a need for an accurate, comprehensive and consistent accounting of the growth and composition of US and Soviet strategic nuclear forces. Such an accounting can provide a context for policy decisions, allow for better assessments of current force levels and trends, and enrich historical accounts of the nuclear age.

This Working Paper reflects a preliminary attempt to assemble accurate numbers through the eight tables and seven figures presented below.[1] The tables depict US and USSR bomber forces, intercontinental ballistic missile forces, and submarine-launched ballistic missile forces and the weapons they carry year-by-year from 1946 through 1989. In order to avoid any confusion in the presentation of the information, tables 3 through 8 have extensive footnotes which identify and clarify the assumptions which have been made. In addition, seven figures represent the data in a visual and comparative way.

The tables and figures in this Working Paper depict strategic offensive "force levels," that is, "on-line" missile launchers as well as those in overhaul, repair, conversion, and modernization. They do not include non-operational test missiles or test launchers, or spare missiles (either maintenance spares or reloads). Bomber figures include US FB-111A medium bombers which, though are not accountable under the SALT treaties, are included in US strategic nuclear war plans. Soviet Backfire bombers are not included, because they are considered to have theater roles and are not included as strategic forces under the SALT treaties. US bomber figures do not include the several hundred SALT-accountable B-52 bombers which are not operational and in storage at Davis-Monthan Air Force Base, Arizona. The tables do not depict strategic defensive forces, which are anti-ballistic missile systems, surface-to-air missiles, interceptor aircraft and air-to-air missiles. The tables do not depict those weapons capable of striking the homelands of the US or USSR but are not included in strategic war plans or were the subject of SALT negotiations. These

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1 The material in this Working Paper is excerpted from sections of the *Nuclear Weapons Databook*, Volume I, *U.S. Forces and Capabilities*, 2nd edition (forthcoming) and Volume IV, *Soviet Nuclear Weapons* (1989). Reader's additions and corrections are appreciated.

would include such weapons as sea-launched and ground launched cruise missiles, IRBMs, and aircraft weapons aboard aircraft carriers which were a part of strategic nuclear war plans in the 1950s and of several Single Integrated Operational Plans (SIOP).

It is important to distinguish between force levels and alert forces. Alert forces are those missiles that could, under normal conditions, be fired within a matter of minutes or in the case of bombers could be airborne within approximately fifteen minutes. In peacetime the US keeps its strategic forces at much higher states of alert than the Soviet Union. For the US, alert forces comprise approximately two-thirds of on-line forces. These include virtually all on-line ICBMs, 60 percent of on-line strategic submarines and SLBMs, and 30 percent of the Primary Authorized Aircraft (PAA) bomber force. Currently US bomber weapons on alert constitute about 36 percent of the total weapons on alert, with 33 percent on strategic submarines and 31 percent on ICBMs. In the case of strategic submarines it is also important to distinguish between alert forces and modified alert forces. In the case of the 60-65 percent of the submarines that are at sea, about one-half of those constitute the alert force and could launch in a few minutes. The other half at sea are in a modified alert status, going to or coming from their designated areas, but still capable of launching missiles in a matter of hours.[2]

The Soviet strategic bomber force is not kept on alert. Instead the Soviets rely on the "generated alert" since they believe that there will be time to launch or disperse bombers. More than 80 percent of Soviet ICBMs are on alert,[3] and could be fired within minutes.[4] The Soviet Union keeps only about 15 to 20 percent of its strategic submarines and SLBM force at sea at any given time. Another 15 to 20 percent of the alert SSBN force are dockside with missiles capable of reaching targets in the U.S. from the Northern and Pacific Fleet bases. If time permitted a larger number of SSBNs could be flushed from their homeports.

As more strategic weapons have been deployed, the corresponding number on alert also has gone up. It is estimated that at the end of 1989 approximately 7250 US strategic weapons were on alert, an increase of over 2100 since 1981. In recent years the number of US ICBM warheads has remained fairly constant but has been a decreasing percentage of the total forces on alert. The most significant increases have come in bomber

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[2] SASC, FY 1984 DOD, Part 5, p. 2504; Donald R. Cotter, "Peacetime Operations: Safety and Security," in Ashton Carter, John D. Steinbruner, Charles A. Zraket, eds., *Managing Nuclear Operations* (Washington, D.C.: The Brookings Institution, 1987), p. 25.

[3] Stephen M. Meyer, "Soviet Nuclear Operations," in Carter, et al., *Managing Nuclear Operations*, p. 494.

[4] *Ibid.*, p. 495.

weapons with 1600 air-launched cruise missiles (ALCMs) deployed on B-52G/H bombers. Soviet strategic forces have also increased significantly as ICBMs and SLBMs have been MIRVed.

Sources of Information

US government documents provide most of the data in this Working Paper, both for the US and the USSR. It should be noted that different US departments and agencies often disagree and, therefore, variations in their estimates occur. The reasons for this has to do with security classification, different counting standards, and inter-agency politics.

The data on the USSR is, obviously, more tentative. The Soviet Union has traditionally provided virtually no information about its own strategic forces, a situation that is changing somewhat with the openness (glasnost) of the Gorbachev era. Using care and judgement some Soviet information can be used.

Within the US government, there is not an empirical "truth" about the composition and characteristics of Soviet forces. The information divulged by the Department of Defense or the agencies of the intelligence community—the intelligence components of each of the military services, the National Security Agency, the CIA, the Department of Energy—reflect *estimates* of Soviet forces, and as such often reflect different biases or quality of information. By necessity we have had to make judgments about what appears to be the most accurate information.

The Department of Defense's *Annual Report to Congress* between 1967 and 1981 provided a continuing source of information comparing US and Soviet strategic forces. The Reagan Administration did not include the tables in its 1982 to 1989 *Annual Reports*. Nor has the Bush Administration in its 1990 version. The earlier volumes included estimates of nuclear warheads in the bomber and missile forces of the two countries (see below).

It is worth noting that the Department of Defense's estimates and those included here are often at variance. Without exception, DOD's estimates for both the US and the USSR are lower than those presented here. There are several reasons for this.

The Department of Defense estimates of US and Soviet strategic forces are *unclassified* estimates. Classified estimates, most likely, have higher figures for both sides but are not divulged for the purported reason that they would compromise "sources and methods" of intelligence collection about the USSR or reveal features of US nuclear war plans that should not be made public.

US-Soviet Strategic Force Warheads

DATE	US	USSR
1 Oct 1967	4500	1000
1 Sep 1968	4200	1100
1 Sep 1969	4200	1350
30 Dec 1970	4000	1800
1 Nov 1971	4700	2100
mid - 1972	5700	2500
mid - 1973	6784	2200
mid - 1974	7650	2500
mid - 1975	8500	2500
mid - 1976	8900	3500
30 Sep 1977	8400	3300
1 Jan 1978	9000	4000+
1 Jan 1979	9200	5000
1 Jan 1980	9200	6000
1 Jan 1981	9000	7000

Based upon DOD *Annual Reports*, Fiscal Years 1969 through Fiscal Year 1982.

For example, the *Annual Report's* numbers for the US do not reflect the true total of strategic nuclear forces available to the national command authorities. The Department of Defense estimate of the number of US bomber weapons is less than our estimate. In fact the true number of bomber weapons in the inventory exceeds our estimate. Bomber weapons, of many types, with different weights, sizes, and explosive yields, have been assigned in great numbers to the bomber force since the mid-1950s. Individual bombers can and do carry a great variety of different kinds and numbers of weapons. Their exact loadings are determined by their role in executing the war plan. The loading of the entire force is extraordinarily complex. To reveal the true number of weapons available to the bomber force, thus, would in the Department of Defense's opinion, reveal too much about the war plans.

The US bomber force is broken into two categories: the approximately thirty percent on alert and the rest non-alert. Each alert bomber is estimated to be loaded with an average of approximately 22 nuclear weapons. The logic is to put as many weapons in the air as fast as possible so they would not be destroyed on the ground. Another reason why our estimates are larger than the unclassified DOD estimates has to do with the design characteristics of nuclear bombs/warheads. The design of early nuclear and thermonuclear bombs was such that they could only be exploded at one yield. Beginning in the 1960s bombs were developed that provided

"selectable" or variable yields. Because there were many different targeting options in the war plans there was a "need" for many bombs per bomber. The normal military practice of planning for every contingency resulted in a large bomb stockpile requiring many different types of single yield bombs. The introduction of variable yield bombs allowed for targeting flexibility with fewer numbers of bombs.

Another reason why the estimates here are larger than unclassified DOD estimates has to do with "reserve" weapons, for bombers and possibly missiles. Reserve weapons would be for restrike operations. Bombers would return to recovery bases after dropping their initial loads, and theoretically would be loaded for another sortie. According to one report this secret plan goes by the code name "Operation Buggywhip."[5] The US may even have contingency plans for strategic submarines to rendezvous with submarine tenders at prearranged places to reload missiles and warheads.

While the true number of weapons that exist to cover every contingency is larger than most estimates the true number available at any given time is usually smaller. For example in the early 1960s, the US introduced a communications system, called the Emergency Rocket Communications System (ERCS), which placed a radio transmitter, rather than a nuclear warhead atop ten Minuteman II missiles. These missiles could be fired and used as emergency broadcast systems during a nuclear war to transmit launch orders to US forces. The ten ERCS missiles remain deployed today at Whiteman Air Force Base, Missouri. Our Table reflects ten fewer Minuteman II warheads than missiles.

On the other hand we have not reduced the numbers to reflect the true operational status of the forces. At any given time some percentage of US and Soviet ICBMs are undergoing maintenance, modifications or conversion and are not operational, i.e. off-line. The number may range from less than a dozen to several dozen at any one time. The real number available to launch is constantly changing and is less than the numbers reflected in the tables below. Similarly at any given time some number of US and Soviet strategic submarines are in overhaul or undergoing modifications or retrofitting which take them out of service for some period of time. For the US this number is normally about four or five submarines on average, for the Soviets the number is approximately eight to ten submarines.

Other unknown operational factors would give lesser warhead totals. Because we are not certain, (nor is the US intelligence community), of exactly how many warheads are carried on the Soviet MIRVed ICBM force we assume the number of warheads the missile could carry or use the SALT

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[5] R. Jeffrey Smith, "START Treaty Will Impose First Numerical Limits on Warheads," *Washington Post*, 3 April 1990, p. A8.

or START limit. It is unlikely that every Soviet ICBM carries the maximum number of reentry vehicles for which it is capable.

Soviet reserve warheads are another area of uncertainty. Some unknown number of reserve warheads and bombs undoubtedly exist for Soviet forces, as they do for US forces. The Soviet Union has apparently practiced and has some capability to reload ICBMs into cold launched silos,[6] though the possibility of it doing so in the midst of a nuclear war seems low. The Department of Defense also says that Soviet "Resupply systems are available to reload SSBNs [strategic missile launching submarines] in protected waters."[7] It is unknown whether the Soviet Union has any reload or restrike bombs for its strategic bombers.

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6 "For their ICBM, LRINF, SRINF, SNF, SLBM, and air defense forces, the Soviets have stocked extra missiles, propellants and warheads throughout the USSR. Some ICBM silo launchers could be reloaded, and provision has been made for the decontamination of those launchers. Plans for the survival of necessary equipment and personnel have been developed and practiced;" *Soviet Military Power*, 1987, p. 28. Similar statements can be found in earlier editions: *Soviet Military Power*, 1984, p. 21; *Soviet Military Power*, 1985, p. 28; and *Soviet Military Power*, 1986, p. 24.

7 *SMP*, 1987, p. 28. Missile Transport and Submarine Support Ships would probably be used. See Norman Polmar, *Guide to the Soviet Navy*, fourth edition (Annapolis, Maryland: Naval Institute Press, 1986) pp. 273-77, 293-97.

Definitions

Alert Forces: "On-line" strategic weapons which have a day-to-day readiness to launch within a short period of time (see also Generated Alert).

Bomber: Strategic airplane capable of long-range, intercontinental missions (designed for a tactical operating radius of over 2,500 nautical miles at design gross weight and design bomb load).

Force loadings: Those independently targetable weapons associated with the total operational ICBMs, SLBMs, and long-range bombers.

Generated Alert: Strategic weapons brought to a higher level of readiness than day-to-day alert forces.

Intercontinental Ballistic Missile (ICBM): Strategic missile with a range capability from about 3,000 to 8,000 nautical miles.

On-line: Those nuclear weapons which are operational, that is, not undergoing maintenance, modifications or conversions which remove them from the operational force for any period of time.

Strategic Nuclear Powered Ballistic Missile Submarine (SSBN): Fleet ballistic missile submarine capable of launching long-range missiles from either a submerged or surfaced conditions.

Strategic Offensive Forces: Bombers, Intercontinental Ballistic Missiles, and Submarine Launched Ballistic Missiles accountable under the SALT Agreements.

Submarine-launched Ballistic Missile (SLBM): Ballistic missile capable of being launched from fleet ballistic missile submarines.

Sources

The following sources were used for Tables 1-8 and Figures 1-7:

TABLES 3,5,7: J.C. Hopkins and Sheldon A. Goldberg, *The Development of Strategic Air Command 1946-1986* (Offutt AFB, NE: Office of the Historian, Strategic Air Command, 1986); E. Michael Del Papa, "From Snark to SRAM: A Pictorial History of Strategic Air Command Missiles," Office of the Historian, Headquarters Strategic Air Command, Offutt AFB, NE, 21 March 1976; DOD, OSD, "Appendix I to the Memorandum for the President, Recommended Long Range Nuclear Delivery Forces 1963-1967," 23 September 1961 (partially declassified); DOD, OSD, "Memorandum for the President, Recommended FY 1964-FY 1968 Strategic Retaliatory Forces," 21 November 1962 (partially declassified); DOD, OSD, "Memorandum for the President, Recommended FY 1965-FY 1969 Strategic Retaliatory Forces," 6 December 1963 (partially declassified); DOD, OSD, "Memorandum for the President, Recommended FY 1966-1970 Programs for Strategic Offensive Forces, Continental Air and Missile Defense Forces, Civil Defense," 3 December 1964 (partially declassified); DOD "Memo [Deputy Secretary of Defense Cyrus R.] Vance to President, Military Strength Increases since FY 61, 3 October 1964, Annex G, SIOP" (partially declassified) (located at Lyndon Baines Johnson Library); USAF Historical Division Liaison Office, The Air Force Response to the Cuban Crisis, mid-December 1962; Thomas B. Cochran, William M. Arkin, Robert S. Norris, *Nuclear Weapons Databook: U.S. Nuclear Forces and Capabilities: Volume I*, 2nd ed. (New York: forthcoming); Warhead first production unit (FPU) dates from Thomas B. Cochran, William M. Arkin, Robert S. Norris, Milton M. Hoenig, *Nuclear Weapons Databook: U.S. Nuclear Warhead Production: Volume II* (Cambridge, MA: Ballinger Publishing Company, 1987), pp. 10-11; Department of the Navy, Strategic Systems Program Office, *FBM Facts/Chronology: Polaris, Poseidon, Trident*, 1986; Marcelle Size Knaack, *Post-World War II Bombers: 1945-1973*, Volume II, *Encyclopedia of U.S. Air Force Aircraft and Missile Systems* (Washington, DC, Office of Air Force History, 1988); William M. Arkin, Joshua M. Handler, Julia A. Morrissey, Jacquelyn M. Walsh, *Encyclopedia of the U.S. Military* (New York: Harper & Row, Ballinger Division, 1990).

TABLES 4,6,8: Thomas B. Cochran, William M. Arkin, Robert S. Norris, Jeffrey I. Sands, *Nuclear Weapons Databook: Soviet Nuclear Weapons Volume IV* (New York: 1989); Defense Intelligence Agency, "Force Structure Summary - USSR, Eastern Europe, and Mongolia" DDB-2680-170-90, February 1990; *Soviet Military Power*, editions 1981, 1983, 1984, 1985, 1986, 1987, 1988, 1989; USAF, ACS/Intelligence, *Trends in U.S. & Soviet Military Forces*, June 1976; USAF, ACS/Intelligence, *Summary Review of Selected U.S. & Soviet Military Forces*, 15 April 1975; SASC/SAC, Soviet Strategic Force Developments; John Prados, *The Soviet Estimate* (New York: The Dial Press, 1982); Raymond L. Garthoff, "The Meaning of the Missiles," *Washington Quarterly* (Autumn 1982), pp. 76-82; Desmond Ball, *Politics and Force Levels: The Strategic Missile Program of the Kennedy Administration* (Berkeley, California: University of California Press, 1980); Richard K. Betts,

Nuclear Blackmail and Nuclear Balance (Washington,: The Brookings Institution, 1987), esp. pp. 144-172. pp. 3-32: USN, *Understanding Soviet Naval Developments*, (Rev 1/81); USN, *Understanding Soviet Naval Developments*, (Rev 4/85); Norman Polmar, *Guide to the Soviet Navy* (Annapolis, MD: Naval Institute Press, 1986; Norman Polmar, *Guide to the Soviet Navy*, (Annapolis, MD: Naval Institute Press, 1983; Robert P. Berman and John C. Baker, *Soviet Strategic Forces* (Washington: The Brookings Institution, 1982); Michael MccGwire, *Military Objectives in Soviet Foreign Policy* (Washington, The Brookings Institution, 1987); Lawrence Freedman, *U.S. Intelligence and the Soviet Strategic Threat*, 2d Ed. (Princeton, NJ: Princeton University Press, 1986).

Table 1
U.S. Strategic Offensive Force Loadings, 1946-1989

End-Year	ICBMS		SLBMs		Bombers		Totals	
	Launchers	Warheads	Launchers	Warheads	Launchers	Warheads	Launchers	Warheads
1946					125	9	125	9
1947					270	13	270	13
1948					473	50	473	50
1949					447	200	447	200
1950					462	400	462	400
1951					569	569	569	569
1952					660	660	660	660
1953					720	878	720	878
1954					1035	1418	1035	1418
1955					1260	1755	1260	1755
1956					1470	2123	1470	2123
1957					1605	2460	1605	2460
1958					1620	2610	1620	2610
1959	6	6			1545	2490	1551	2496
1960	12	12	32	32	1515	3083	1559	3127
1961	57	57	80	80	1395	3016	1532	3153
1962	203	203	144	144	1306	3104	1653	3451
1963	597	597	160	160	1055	3293	1812	4050
1964	907	907	320	320	785	3427	2012	4654
1965	854	854	384	384	650	3465	1888	4703
1966	1004	1004	560	560	575	3476	2139	5040
1967	1054	1044	656	656	558	3630	2268	5330
1968	1054	1044	656	656	481	3521	2191	5221
1969	1054	1044	656	656	399	3286	2109	4986
1970	1054	1244	656	656	390	3339	2100	5239
1971	1054	1444	656	1664	377	3232	2087	6340
1972	1054	1644	656	2384	457	3845	2167	7873
1973	1054	1844	656	3536	423	3776	2133	9156
1974	1054	1944	656	3824	396	3819	2106	9587
1975	1054	2144	656	3968	396	3978	2106	10090
1976	1054	2144	656	4688	382	3850	2092	10682
1977	1054	2144	656	4832	382	3834	2092	10810
1978	1054	2144	656	5120	376	3767	2086	11031
1979	1054	2144	656	5088	376	3568	2086	10800
1980	1054	2144	592	4896	376	3568	2022	10608
1981	1054	2144	536	4976	376	3568	1966	10688
1982	1049	2139	544	4992	328	3384	1921	10515
1983	1040	2130	568	5152	297	3520	1905	10802
1984	1030	2120	616	5536	297	3844	1943	11500
1985	1020	2110	648	5760	297	4104	1965	11974
1986	1005	2165	640	5632	312	4589	1957	12386
1987	1000	2300	640	5632	361	5241	2001	13173
1988	1000	2440	608	5312	318	4982	1926	12734
1989	1000	2440	592	5152	311	4885	1903	12477

Table 2
USSR Strategic Offensive Forces, 1956-1989

End-Year	ICBMS		SLBMs		Bombers		Totals	
	Launchers	Warheads	Launchers	Warheads	Launchers	Warheads	Launchers	Warheads
1956					22	84	22	84
1957					28	102	28	102
1958			6	6	50	180	56	186
1959			33	33	75	250	108	283
1960	4	4	30	30	104	320	144	354
1961	10	10	57	57	120	356	207	423
1962	30	30	72	69	133	382	285	481
1963	80	80	72	69	150	440	402	589
1964	180	180	72	69	173	522	470	771
1965	225	225	75	72	163	532	571	829
1966	333	333	78	75	159	546	938	954
1967	701	701	87	72	159	576	1155	1349
1968	909	909	138	120	159	576	1350	1605
1969	1053	1053	221	194	157	568	1739	1815
1970	1361	1361	317	287	157	568	1985	2216
1971	1511	1511	407	362	157	568	2111	2441
1972	1547	1547	503	458	157	568	2247	2573
1973	1587	1587	595	556	157	568	2339	2711
1974	1587	1587	679	640	157	568	2423	2795
1975	1587	1917	771	732	157	568	2467	3217
1976	1539	2099	849	810	157	568	2439	3477
1977	1433	2363	972	1311	157	568	2527	4242
1978	1398	3218	1002	1730	157	568	2557	5516
1979	1398	4186	993	1817	157	568	2548	6571
1980	1398	5002	990	1910	157	568	2545	7480
1981	1398	5302	1038	2426	157	568	2593	8296
1982	1398	5862	990	2474	157	568	2545	8904
1983	1398	6270	978	2462	167	568	2543	9300
1984	1398	6420	982	2646	160	560	2540	9626
1985	1398	6420	980	2872	160	720	2538	10012
1986	1398	6420	948	2888	160	800	2526	10108
1987	1418	6452	962	3130	155	860	2495	10442
1988	1378	6440	963	3362	170	1050	2489	10852
1989	1356	6450	949	3642	162	1228	1111	11320

Table 3
U.S. ICBM Forces, 1959-1989

	End-1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
ICBM Launchers																															
ATLAS D [1]	6	12	30	30	30	0																									
ATLAS E [2]			27	27	27	27	0																								
ATLAS F [3]				72	72	72	0																								
TITAN I [4]				54	54	54	0																								
TITAN II [5]					54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	49	40	30	20	5	0		
MINUTEMAN I [6]				20	360	700	800	800	800	800	500	400	300	200	100	50	0														
MINUTEMAN II [7]								150	200	200	500	500	500	500	500	500	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450
MINUTEMAN III [8]												100	200	300	400	450	550	550	550	550	550	550	550	550	550	550	550	540	520	500	500
MX (PEACEKEEPER) [9]																												10	30	50	50
TOTAL	**6**	**12**	**57**	**203**	**597**	**907**	**854**	**1004**	**1054**	**1054**	**1054**	**1054**	**1054**	**1054**	**1054**	**1054**	**1054**	**1054**	**1054**	**1054**	**1054**	**1054**	**1049**	**1040**	**1030**	**1020**	**1005**	**1000**	**1000**	**1000**
ICBM Warheads																															
W49 (ATLAS D) [10]	6	12	30	30	30	0																									
W38 (ATLAS E) [11]			27	27	27	27	0																								
W38 (ATLAS F)				72	72	72	0																								
W38 (TITAN I)				54	54	54	0																								
W53 (TITAN II) [12]					54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	49	40	30	20	5	0		
W59 (MM I) [13]				20	150	150	150	150	150	150	150	150	150	150	100	50	0														
W56 (MM I) [14]					210	550	650	650	650	650	350	250	150	50																	
W56 (MM II) [15]								150	190	190	490	490	490	490	490	490	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440
W62 (MM III) [16]												300	600	900	1200	1350	1650	1650	1650	1650	1650	1410	1080	795	750	750	750	720	660	600	600
W78 (MM III) [17]																						240	570	855	900	900	900	900	900	900	900
W87 (MX) [18]																												100	300	500	500
TOTAL	**6**	**12**	**57**	**203**	**597**	**907**	**854**	**1004**	**1044**	**1044**	**1044**	**1244**	**1444**	**1644**	**1844**	**1944**	**2144**	**2144**	**2144**	**2144**	**2144**	**2144**	**2144**	**2139**	**2130**	**2120**	**2110**	**2165**	**2300**	**2440**	**2440**

Table 3
U.S. ICBM Forces, 1959-1989

1. The first ATLAS D ICBM was placed on alert at Vandenberg Air Force Base (AFB), CA on 31 October 1959. The first ATLAS Ds were taken off alert at Vandenberg beginning on 1 May 1964, the last was removed from alert on 1 October 1964. At full strength there were six ATLAS D ICBMs at Vandenberg, 15 at F.E. Warren AFB, WY and nine at Offutt AFB, NE.
2. Three nine missile squadrons of ATLAS E ICBMs were accepted by SAC in 1961 at Fairchild AFB, WA (operational 3 October 1961); Forbes AFB, KS; and F.E. Warren AFB, WY (operational 7 March 1961). The first ATLAS E was taken off alert on 4 January 1965 and the last was removed from alert on 31 March 1965.
3. Six 12 missile ATLAS F ICBM squadrons became operational between 9 September and 20 December 1962 at Schilling AFB, KS; Lincoln AFB, NE; Altus AFB, OK; Dyess AFB, TX; Walker AFB, NM; Plattsburgh AFB, NY. The first ATLAS F was removed from alert on 1 December 1964 and the last on 12 April 1965.
4. On 20 April and 10 May 1962 the first two TITAN I ICBM squadrons (9 missiles each, both at Lowry AFB, CO) became operational. Four more nine missile squadrons became operational at Ellsworth AFB, SD; Beale AFB, CA; Mountain Home AFB, ID; and lastly on 28 September 1962 at Larson AFB, WA. The first TITAN I was taken off alert on 4 January 1965 and the last on 1 April 1965.
5. Six nine missile squadrons of TITAN II ICBMs were deployed equally at Davis-Monthan AFB, AZ; McConnell AFB KS; and Little Rock AFB, AK between 8 June and 31 December 1963. Accidents occurred at silos at Rock, KS on 24 August 1978 and Damascus, AK on 19 September 1980. The missiles were not returned to operational service. The first of the remaining 52 TITAN IIs was deactivated at Davis Monthan in early 1982. Every 45-60 days a TITAN II was deactivated with the last accomplished on 5 May 1987.
6. The first MINUTEMAN missile went on alert on 27 October 1962 during the Cuban Missile Crisis. A total of nine were on alert on 30 October and the first two flights of MINUTEMAN I ICBMs (20 missiles) were operational on 11 December 1962 at Malmstrom AFB, MT. Eventually there were 150 MINUTEMAN IA ICBMs at Malmstrom and 650 MINUTEMAN IB ICBMs at Ellsworth AFB, SD; Minot AFB, ND; Whiteman AFB, MO; and F.E. Warren AFB, WY. The last MINUTEMAN IA was removed from alert on 15 January 1969 at Malmstrom.
7. The first MINUTEMAN II ICBMs went on alert in January 1966. The first three MINUTEMAN II ICBM squadrons became operational between 2 April and 22 November 1966. On 21 April 1967 SAC reached the level of 1000 operational MINUTEMAN I and II ICBMs.
8. The first MINUTEMAN IIIs went on alert 19 August 1970 at Minot AFB, ND. On 29 December 1970 the first squadron of MINUTEMAN III ICBMs became operational at Minot AFB. By 12 July 1975 the MINUTEMAN ICBM force consisted of 450 MINUTEMAN IIs and 550 Minuteman IIIs.
9. On 22 December 1986 the first ten MX missiles became operational at F.E. Warren AFB, WY, replacing MINUTEMAN III ICBMs.
10. Single Mk-1 reentry vehicle. The W49 nuclear warhead entered Phase 5 (First Production Unit, or FPU) in September 1958, the date the first warhead was produced by the Atomic Energy Commission.
11. Single Mk-2 reentry vehicle (also used on the ATLAS F and TITAN I ICBMs). The W38 nuclear warhead entered Phase 5 (FPU) in May 1961, the date the first warhead was produced by the Atomic Energy Commission.
12. Single Mk-6 reentry vehicle. The W53 nuclear warhead entered Phase 5 (FPU) in December 1962, the date the first warhead was produced by the Atomic Energy Commission.
13. Single Mk-5 reentry vehicle on the MINUTEMAN IA. The W59 nuclear warhead entered Phase 5 (FPU) in June 1962, the date the first warhead was produced by the Atomic Energy Commission.
14. The MINUTEMAN IB used a single warhead Mk-11 reentry vehicle. The W56 nuclear warhead entered Phase 5 (FPU) in March 1963, the date the first warhead was produced by the Atomic Energy Commission.
15. Single Mk-11C reentry vehicle. On 10 October 1967 the first Emergency Rocket Communications System (ERCS) was installed on ten Minuteman II ICBMs at Whiteman AFB, Missouri. ERCS, an emergency communications transmitter placed on the missile instead of a nuclear warhead, is still deployed on ten MINUTEMAN II ICBMs at Whiteman.
16. Up to three warheads on the Mk-12 MIRV. The W62 nuclear warhead entered Phase 5 (FPU) in March 1970, the date the first warhead was produced by the Atomic Energy Commission.
17. Up to three warheads on the MK-12A MIRV. The W78 nuclear warhead entered Phase 5 (FPU) in August 1979, the date the first warhead was produced by the Department of Energy. Between December 1979 and February 1983 300 MINUTEMAN III ICBMs were retrofitted with Mk-12A reentry vehicles with the W78 warhead.
18. Up to ten warheads on the MK-21 MIRV. The W87-0 nuclear warhead entered Phase 5 (FPU) in April 1986, the date the first warhead was produced by the Department of Energy.

Table 4
USSR ICBM Forces, 1960-1989

	End-1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
ICBM Launchers[1]																														
SS-6 Sapwood	4	4	4	4	4	4	4	4	4	0																				
SS-7 Saddler		6	26	64	153	186	186	186	186	186	186	186	186	186	186	186	138	78	0											
SS-8 Sasin				12	23	23	23	23	23	23	23	23	23	23	23	23	23	9	0											
SS-9 Scarp M1, M2, & M3						12	30	108	156	204	252	257	238	188	188	178	152	90	82	43	0									
SS-9 M4											0	25	50	100	100	100	100	100	50	25	0									
SS-11 Sego M1							90	380	540	600	840	960	990	955	830	610	490	430	330	230	220	160	130	130	100	55	28	0		
SS 11 M2 & M3													0	75	200	350	420	420	420	420	420	420	420	420	420	420	420	420	370	360
SS-13 Savage										40	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
SS-17 Spanker M1																10	20	50	80	120	130	130	30	0						
SS-17 M2																			20	20	20	20	10	0						
SS-17 M3																							110	150	150	150	150	139	120	100
SS-18 Satan M1 & M3																10	36	36	36	36	26	26	16	0						
SS-18 M2																		40	140	154	162	162	92	0						
SS-18 M4 & M5																				50	120	120	200	308	308	308	308	308	308	308
SS-19 Stiletto M1																60	100	100	120	180	180	180	80	0						
SS-19 M2																		20	60	60	40	40	10	0						
SS-19 M3																					20	80	240	330	360	360	360	360	350	300
SS-24 Scalpel M1 & M2																												5	20	58
SS-25 Sickle																										45	72	126	150	170
TOTAL	**4**	**10**	**30**	**80**	**180**	**225**	**333**	**701**	**909**	**1053**	**1361**	**1511**	**1547**	**1587**	**1587**	**1587**	**1539**	**1433**	**1398**	**1398**	**1398**	**1398**	**1398**	**1398**	**1398**	**1398**	**1398**	**1418**	**1378**	**1356**
ICBM Warheads																														
SS-6	4	4	4	4	4	4	4	4	4	0																				
SS-7		6	26	64	153	186	186	186	186	186	186	186	186	186	186	186	138	78	0											
SS-8				12	23	23	23	23	23	23	23	23	23	23	23	23	23	9	0											
SS-9 M1, M2, & M3[2]						12	30	108	156	204	252	257	238	188	188	178	152	90	82	43	0									
SS-9 M4 [3]											0	25	50	100	100	100	100	100	50	25	0									
SS-11 M1 [4]							90	380	540	600	840	960	990	955	830	610	490	430	330	230	220	160	130	130	100	55	28	0		
SS-11 M2 & M3[5]													0	75	200	350	420	420	420	420	420	420	420	420	420	420	420	420	370	360
SS-13										40	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
SS-17 M1 [6]																40	80	200	320	480	520	520	120	0						
SS-17 M2 [7]																			20	20	20	20	10	0						
SS-17 M3 [8]																							440	600	600	600	600	556	480	400
SS-18 M1 & M3[9]																10	36	36	36	36	26	26	16	0						
SS-18 M2 [10]																		320	1120	1232	1296	1296	736	0						
SS-18 M4 [11]																				500	1200	1200	2000	3080	3080	3080	3080	3080	3080	3080
SS-19 M1 [12]																360	600	600	720	1080	1080	1080	480	0						
SS-19 M2 [13]																		20	60	60	40	40	10	0						
SS-19 M3 [14]																					120	480	1440	1980	2160	2160	2160	2160	2100	1800
SS-24 [15]																												50	200	580
SS-25 [16]																										45	72	126	150	170
TOTAL (MRV=1)	**4**	**10**	**30**	**80**	**180**	**225**	**333**	**701**	**909**	**1053**	**1361**	**1511**	**1547**	**1587**	**1587**	**1917**	**2099**	**2363**	**3218**	**4186**	**5002**	**5302**	**5862**	**6270**	**6420**	**6420**	**6420**	**6452**	**6440**	**6450**
TOTAL (MRV=3)	**4**	**10**	**30**	**80**	**180**	**225**	**333**	**701**	**909**	**1053**	**1361**	**1561**	**1647**	**1862**	**1987**	**2467**	**2719**	**2983**	**3738**	**4656**	**5422**	**5722**	**6282**	**6690**	**6840**	**6840**	**6840**	**6872**	**6860**	**6870**

Table 4
USSR ICBM Forces, 1960-1989

1. The initial operational capability (IOC) dates vary in different U.S. government sources. Initial deployment dates are from *Soviet Military Power*, 1985, p. 41.
2. Single reentry vehicle. Mod 3 is the Fractional orbital bombardment system (FOBS).
3. Up to three warheads on multiple reentry vehicle (MRV). The MRV was a precursor to the MIRV, where the warheads could not be independently targetable. Because the area in which the warheads can be targeted is limited many tables count the multiple RVs as one warhead. For purposes of estimating warhead production they should be counted separately.
4. Single reentry vehicle. Mod 1 retired first to compensate for SS-25. All retired by end of 1987. Mod 2 uses penetration aids.
5. Up to three warheads on multiple reentry vehicle (MRV). Assumes 180 Mod 2 and 180 Mod 3. Mod 2 is assumed to be next in line to be retired to compensate for SS-25 deployments.
6. Up to four warheads on multiple independently targetable reentry vehicle (MIRV).
7. Single reentry vehicle.
8. Up to four warheads on multiple independently targetable reentry vehicle (MIRV).
9. Single reentry vehicle.
10. Up to eight warheads on multiple independently targetable reentry vehicle (MIRV).
11. Up to ten warheads on multiple independently targetable reentry vehicle (MIRV).
12. Up to six warheads on multiple independently targetable reentry vehicle (MIRV).
13. Single reentry vehicle.
14. Up to six warheads on multiple independently targetable reentry vehicle (MIRV).
15. Up to ten warheads on multiple independently targetable reentry vehicle (MIRV).
16. Single reentry vehicle.

Table 5
U.S. Ballistic Missile Submarine Forces, 1960-1989

	End-1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
SSBNs																														
Polaris [1]	2	5	9	10	20	24	35	41	41	41	41	34	29	21	19	18	13	12	10	10	6	1	0							
Poseidon [2]												7	12	20	22	23	28	29	31	31	31	31	31	31	31	30	28	28	26	25
Trident [3]																						1	2	3	5	7	8	8	8	8
TOTAL	2	5	9	10	20	24	35	41	41	41	41	41	41	41	41	41	41	41	41	41	37	33	33	34	36	37	36	36	34	33
SLBM Launchers																														
Polaris A1 [4]	32	80	80	80	80	0																								
Polaris A2 [5]			64	80	208	208	208	208	208	208	208	144	96	48	0															
Polaris A3 [6]					32	176	352	448	448	448	448	400	368	288	304	288	208	192	160	160	96	16	0							
Poseidon C3												112	192	320	352	368	448	464	496	480	416	400	320	304	304	288	256	256	224	208
Trident C4 [7]																				16	80	120	224	264	312	360	384	384	384	384
TOTAL	32	80	144	160	320	384	560	656	656	656	656	656	656	656	656	656	656	656	656	656	592	536	544	568	616	648	640	640	608	592
SLBM Warheads																														
W47Y1 (A-1)[8]	32	80	80	80	80	0																								
W47Y1 (A-2)			64	64	64	64	32	0																						
W47Y2 (A-2)				16	144	144	176	208	208	208	208	144	96	48	0															
W58 (A-3) [9]					32	176	352	448	448	448	448	400	368	288	304	288	208	192	160	160	96	16	0							
W68 (C-3) [10]												1120	1920	3200	3520	3680	4480	4640	4960	4800	4160	4000	3200	3040	3040	2880	2560	2560	2240	2080
W76 (C-4) [11]																				128	640	960	1792	2112	2496	2880	3072	3072	3072	3072
TOTAL (MRV=1	32	80	144	160	320	384	560	656	656	656	656	1664	2384	3536	3824	3968	4688	4832	5120	5088	4896	4976	4992	5152	5536	5760	5632	5632	5312	5152
TOTAL (MRV=3	32	80	144	160	384	736	1264	1552	1552	1552	1552	2464	3120	4112	4432	3968	4688	4832	5120	5088	4896	4976	4992	5152	5536	5760	5632	5632	5312	5152

Table 5
U.S. Ballistic Missile Submarine Forces, 1960-1989

1. USS George Washington (SSBN 598) first deployed with POLARIS A-1 SLBMs on 15 November 1960.
2. USS James Madison (SSBN 627) first deployed with POSEIDON C-3 SLBMs on 31 March 1971. On 10 June 1985, the White House announced that the US would dismantle a ballistic missile submarine to remain within the SALT II ceiling on MIRVed missiles. The USS Sam Rayburn (SSBN 635) was subsequently deactivated on 16 September 1985. It was converted to a moored training ship to train personnel in the Naval Nuclear Propulsion Program. The first training class began in early 1990. On 27 May 1986, the White House announced that the US would dismantle two more SSBNs. These were the USS Nathan Hale (SSBN 623) and the USS Nathaniel Greene (SSBN 636), retired on 3 November 1986 and 16 December 1986. The FY 1988 DOD Authorization Act specified that no money be authorized to overhaul USS Andrew Jackson (SSBN 619). It was retired on 1 April 1988. Two additional SSBNs have been deactivated; the USS John Adams (SSBN 620) on 1 October 1989 and the USS James Monroe (SSBN 622) on 14 October 1989.
3. USS Ohio (SSBN 726) first deployed with TRIDENT I C-4 SLBMs on 1 October 1982.
4. The POLARIS A-1 was on active duty from 15 November 1960 to 14 October 1965.
5. The POLARIS A-2 was on active duty from 26 June 1962 to 9 June 1974.
6. The POLARIS A-3 was on active duty from 28 September 1964 to 25 February 1982.
7. On 20 October 1979, the USS Francis Scott Key (SSBN 657) deployed with TRIDENT I C-4 SLBMs. The twelfth and last Lafayette/Franklin class SSBN to be retrofitted with TRIDENT I C-4s, the USS Casimir Pulaski (SSBN 633) deployed on 3 June 1983.
8. Single Mk-1 (Navy) reentry vehicle. The nuclear warhead entered Phase 5 (First Production Unit, FPU) in June 1960, the date the first warhead was produced by the Atomic Energy Commission. The Mk-1 (Navy) was also on the POLARIS A-2.
9. Up to three warheads on the Mk-2 (Navy) multiple reentry vehicle (MRV). The MRV was a precursor to the MIRV, where the warheads could not be independently targetable. Because the area in which the warheads can be targeted is limited many tables count the multiple RVs as one warhead. For purposes of estimating warhead production they should be counted separately.
10. Up to ten warheads on the Mk-3 multiple independently targetable reentry vehicle (MIRV). The maximum number of reentry vehicles that have been flight-tested on the Poseidon C-3 SLBM is 14. Loadings per missile prior to withdrawal of ten POLARIS SSBNs probably averaged nine warheads; see testimony by Paul H. Nitze, Senate Armed Services Committee, SALT Hearings, Part 3, p. 897. After withdrawal POSEIDON SLBMs were selectively uploaded: see House Armed Service Committee (HASC), FY 1982 DOD, Part 3, p. 156; House Appropriations Committee, FY 1982 DOD, Part 7, p.544; HASC, FY 1983 DOD, Part 4, p. 118. The nuclear warhead entered Phase 5 (FPU) in May 1970, the date the first warhead was produced by the Atomic Energy Commission.
11. Up to eight warheads on the Mk-4 multiple independently targetable reentry vehicle (MIRV). The maximum number of reentry vehicles that have been flight tested for the TRIDENT I C-4 SLBM is seven. The figure of seven reentry vehicles for the TRIDENT I C-4 is based on the maximum number of reentry vehicles actually released during flight-tests of the missile as of 1 May 1979. If simulated releases of reentry vehicles had been counted as flight-tests of reentry vehicles, as is the case for simulations occurring after 1 May 1979, the figure for the TRIDENT I C-4 would have been eight, which is the largest number of reentry vehicles for which the missile is designed and with which it will be deployed; see Annex to Letter from Secretary of State Cyrus Vance to the President Transmitting the SALT Treaty, June 21, 1979 in ACDA, *Documents on Disarmament* 1979, p. 263. The nuclear warhead entered Phase 5 (FPU) in June 1978, the date the first warhead was produced by the Department of Energy.

Table 6

USSR Ballistic Missile Submarine Forces, 1958-1989

	End-1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
SSBNs																																
Golf I SSB	2	4	10	19	22	22	22	22	22	18	16	15	14	7	7	7	7	7	5	4	3	1	0									
Golf II					1	1	1	1	1	5	6	7	8	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	12	6	
Golf III																				1	1	1	1	1	1	1	1	1	1	0		
Golf IV																			1	1	1	1	1	0								
Golf V																					1	1	1	1	1	1	1	1	1	1	1	1
Hotel I/II SSBN		7	0	0	1	1	1	2	3	6	8	7	7	7	7	7	7	7	7	7	7	6	6	6	6	2	2	0				
Hotel III												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Yankee I SSBN											3	8	14	20	26	30	32	33	34	33	31	30	29	28	24	24	23	21	18	17	15	12
Yankee II																				1	1	1	1	1	1	1	1	1	1	1	1	1
Delta I SSBN																1	4	9	13	18	18	18	18	18	18	18	18	18	18	18	18	18
Delta II																1	2	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Delta III																				4	8	9	10	13	14	14	14	14	14	14	14	14
Delta IV																												1	2	3	4	6
Typhoon																								1	1	1	2	3	3	4	5	6
TOTAL	**2**	**11**	**10**	**19**	**24**	**24**	**24**	**25**	**26**	**29**	**33**	**38**	**44**	**48**	**54**	**60**	**66**	**73**	**78**	**87**	**89**	**86**	**85**	**87**	**84**	**80**	**80**	**78**	**76**	**76**	**75**	**69**
SLBM Launchers [1]																																
Golf I [2]	6	12	30	57	66	66	66	66	66	54	48	45	42	21	21	21	21	21	15	12	9	3	0									
Golf II [3]					3	3	3	3	3	15	18	21	24	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	36	18	
Golf III [4]																				6	6	6	6	6	6	6	6	6	6	0		
Golf IV [5]																			4	4	4	4	4	0								
Golf V [6]																					1	1	1	1	1	1	1	1	1	1	1	1
Hotel I/II [7]		21	0	0	3	3	3	6	9	18	24	21	21	21	21	21	21	21	21	21	21	18	18	18	18	6	6	0				
Hotel III [8]												6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Yankee I [9]											48	128	224	320	416	480	512	528	544	528	496	480	464	448	384	384	368	336	288	272	240	192
Yankee II [10]																				12	12	12	12	12	12	12	12	12	12	12	12	12
Delta I [11]																12	48	108	156	216	216	216	216	216	216	216	216	216	216	216	216	216
Delta II [12]																16	32	48	64	64	64	64	64	64	64	64	64	64	64	64	64	64
Delta III [13]																				64	128	144	160	208	224	224	224	224	224	224	224	224
Delta IV [14]																												16	32	48	64	96
Typhoon [15]																								20	20	20	40	60	60	80	100	120
TOTAL	**6**	**33**	**30**	**57**	**72**	**72**	**72**	**75**	**78**	**87**	**138**	**221**	**317**	**407**	**503**	**595**	**679**	**771**	**849**	**972**	**1002**	**993**	**990**	**1038**	**990**	**978**	**982**	**980**	**948**	**962**	**963**	**949**
SLBM Warheads																																
SS-N-4	6	33	30	57	66	66	66	66	66	54	48	45	42	21	21	21	21	21	15	12	9	3	0									
SS-N-5 Sark					6	6	6	9	12	33	42	42	45	60	60	60	60	60	60	60	60	57	57	57	57	45	45	39	39	39	36	18
SS-N-6 Serb [16]											48	128	224	320	416	480	512	528	548	532	500	484	468	448	384	384	368	336	288	272	240	192
SS-N-8 Sawfly																34	86	162	226	286	292	292	292	292	292	292	292	292	292	286	286	286
SS-N-17 Snipe																				12	12	12	12	12	12	12	12	12	12	12	12	12
SS-N-18 Stingray [17]																				448	896	1008	1120	1456	1568	1568	1568	1568	1568	1568	1568	1568
SS-N-20 Sturgeon [18]																								200	200	200	400	600	600	800	1000	1200
SS-N-23 Skiff [19]																												64	128	192	256	384
TOTAL (MRV=1)	**6**	**33**	**30**	**57**	**69**	**69**	**69**	**72**	**75**	**72**	**120**	**194**	**287**	**362**	**458**	**556**	**640**	**732**	**810**	**1311**	**1730**	**1817**	**1910**	**2426**	**2474**	**2462**	**2646**	**2872**	**2888**	**3130**	**3362**	**3642**
TOTAL (MRV=2) [20]	**6**	**33**	**30**	**57**	**69**	**69**	**69**	**72**	**75**	**72**	**120**	**194**	**287**	**362**	**458**	**556**	**688**	**828**	**954**	**1503**	**1970**	**2105**	**2198**	**2714**	**2762**	**2750**	**2934**	**3160**	**3176**	**3402**	**3602**	**3834**

Table 6
USSR Ballistic Missile Submarine Forces, 1958-1989

1. The initial operational capability (IOC) dates vary in different U.S. government documents. Initial deployment dates are from Soviet Military Power 1985, p. 40.
2. Carries 3 SS-N-4 SLBMs.
3. Carries 3 SS-N-5 SLBMs. These boats were originally GOLF Is with SS-N-4 SLBMs.
4. Carries 6 SS-N-8 SLBMs. This was a one-of-a-kind conversion from GOLF I with SS-N-4 SLBMs to carry the SS-N-8 SLBMs for test purposes.
5. Carries 4 SS-N-6 SLBMs. This is a test platform for the SS-N-6.
6. Carries 1 SS-N-20 SLBM. This is a test platform for the SS-N-20.
7. Carries 3 SS-N-5 SLBMs. It is unclear whether the seven HOTEL Is (each carrying three SS-N-4) were actually operational. There were originally nine Hotels Is. one was converted to a Hotel III and one sank. They were removed from service in 1960-61 while being converted to HOTEL II so as to carry three SS-N-5. In addition one new HOTEL II was built as well.
8. Carries 6 SS-N-8 SLBMs. This boat was originally a HOTEL II, and was converted as a test platform for the SS-N-8 SLBM.
9. Carries 16 SS-N-6 SLBMs.
10. Carries 12 SS-N-17 SLBMs.
11. Carries 12 SS-N-8 SLBMs.
12. Carries 16 SS-N-8 SLBMs. The DELTA II is a lengthened version of the DELTA I submarine.
13. Carries 16 SS-N-18 SLBMs.
14. Carries 16 SS-N-23 SLBMs.
15. Carries 20 SS-N-20 SLBMs.
16. Some missiles have two warheads on multiple reentry vehicle (MRV). The MRV was a precursor to the MIRV, where the warheads could not be independently targetable. Because the area in which the warheads can be targeted is limited many tables count the multiple RVs as one warhead. For purposes of estimating warhead production they should be counted separately.
17. The SS-N-18 Mod 1 carries up to three warheads on multiple independently retargetable reentry vehicles (MIRV); the SS-N-18 Mod 2 carries a single reentry vehicle; the SS-N-18 Mod 3 carries up to seven warheads on MIRV. Counting assumption is seven warheads.
18. Carries up to 10 warheads on multiple independently targetable reentry vehicle (MIRV).
19. Carries up to four warheads on multiple independently targetable reentry vehicles (MIRV).
20. Assumes the SS-N-6 Mod 3 with two warheads on multiple reentry vehicle (MRV) introduced in 1974 and gradually put on 18 Yankee I submarines.

Table 7
U.S. Strategic Bomber Forces, 1946-1989

	End-1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Bombers (Total Inventory) [1]																				
B-29 Superfortress	148	319	486	390	286	340	417	110	0											
B-36 Peacemaker			35	36	38	98	154	185	209	338	247	127	22	0						
B-50 Superfortress			35	99	196	219	224	138	90	0										
B-47 Stratojet						12	62	329	795	1086	1306	1285	1367	1366	1178	889	880	613	391	114
B-58 Hustler															19	66	76	86	94	93
B-52 Stratofortress										18	97	243	380	488	538	571	639	636	626	600
FB-111A																				
B-1B																				
TOTAL	**148**	**319**	**556**	**525**	**520**	**669**	**857**	**762**	**1094**	**1442**	**1650**	**1655**	**1769**	**1854**	**1735**	**1526**	**1595**	**1335**	**1111**	**807**
Bombers (PAA) [2]																				
B-29 [3]	125	270	420	330	230	290	360	90	0											
B-36 [4]			18	18	36	60	100	180	180	270	210	120	0							
B-50 [6]			35	99	196	219	200	135	90	0										
B-47							0	315	765	990	1215	1260	1260	1200	1065	855	675	450	180	45
B-58															0	40	76	80	80	80
B-52										0	45	225	360	345	450	500	555	525	525	525
FB-111A																				
B-1B																				
TOTAL	**125**	**270**	**473**	**447**	**462**	**569**	**660**	**720**	**1035**	**1260**	**1470**	**1605**	**1620**	**1545**	**1515**	**1395**	**1306**	**1055**	**785**	**650**
Bomber Weapons (Force Loadings)																				
Bombs [8]	9	13	50	200	400	569	660	878	1418	1755	2123	2460	2610	2490	3083	2973	2920	2855	2953	3013
Hounddog [9]																43	184	438	474	453
SRAM [10]																				
ALCM [11]																				
TOTAL	**9**	**13**	**50**	**200**	**400**	**569**	**660**	**878**	**1418**	**1755**	**2123**	**2460**	**2610**	**2490**	**3083**	**3016**	**3104**	**3293**	**3427**	**3465**
Bomber Weapons (Total Inventory)																				
Bombs	9	13	50	200	400	600	850	1150	1500	2200	3000	4200	5700	7000	6900	6500	6300	5710	5905	6025
Hounddog (AGM-28B)															54	230	547	593	566	542
SRAM (AGM-69A)																				
ALCM (AGM-86B)																				
TOTAL	**9**	**13**	**50**	**200**	**400**	**600**	**850**	**1150**	**1500**	**2200**	**3000**	**4200**	**5700**	**7000**	**6954**	**6730**	**6847**	**6303**	**6471**	**6567**

Table 7 (Cont.)
U.S. Strategic Bomber Forces, 1946-1989

	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Bombers (Total Inventory) [1]																								
B-29 Superfortress																								
B-36 Peacemaker																								
B-50 Superfortress																								
B-47 Stratojet	0																							
B-58 Hustler	83	81	76	41	0																			
B-52 Stratofortress	591	588	579	505	459	412	402	422	422	420	419	417	344	343	343	344	300	263	263	263	263	263	193	193
FB-111A				3	42	30	60	71	72	69	68	66	66	65	63	62	62	61	60	60	60	60	59	58
B-1B																					18	76	97	97
TOTAL	**674**	**669**	**655**	**549**	**501**	**442**	**462**	**493**	**494**	**489**	**487**	**483**	**410**	**408**	**406**	**406**	**362**	**324**	**323**	**323**	**341**	**399**	**349**	**348**
Bombers (PAA) [2]																								
B-29 [3]																								
B-36 [4]																								
B-50 [6]																								
B-47	0																							
B-58	80	78	76	39	0																			
B-52	495	480	405	360	360	347	397	357	330	330	316	316	316	316	316	316	272	241	241	241	241	241	180	173
FB-111A				0	30	30	60	66	66	66	66	66	60	60	60	60	56	56	56	56	56	56	48	48
B-1B																					15	64	90	90
TOTAL	**575**	**558**	**481**	**399**	**390**	**377**	**457**	**423**	**396**	**396**	**382**	**382**	**376**	**376**	**376**	**376**	**328**	**297**	**297**	**297**	**312**	**361**	**318**	**311**
Bomber Weapons (Force Loadings																								
Bombs [8]	3043	3192	3139	3036	3060	2956	3398	3005	2656	2576	2464	2464	2428	2428	2428	2428	2052	1804	1804	1804	1924	2487	2228	2185
Hounddog [9]	434	438	382	250	279	276	272	270	263	262	246	230	199											
SRAM [10]							175	500	900	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1100
ALCM [11]																0	192	576	900	1160	1525	1614	1614	1600
TOTAL	**3476**	**3630**	**3521**	**3286**	**3339**	**3232**	**3845**	**3776**	**3819**	**3978**	**3850**	**3834**	**3767**	**3568**	**3568**	**3568**	**3384**	**3520**	**3844**	**4104**	**4589**	**5241**	**4982**	**4885**
Bomber Weapons (Total Inventory																								
Bombs	6085	6384	6278	6072	6120	5912	6795	6011	5312	5152	4928	4928	4856	4856	4856	4856	4200	3600	3600	3600	3600	3600	3600	3600
Hounddog (AGM-28B)	548	477	312	349	345	340	338	329	327	308	288	249	0											
SRAM (AGM-69A)							227	651	1149	1451	1431	1415	1408	1396	1383	1374	1332	1327	1309	1309	1309	1309	1309	1250
ALCM (AGM-86B)																14	288	736	1209	1271	1584	1715	1715	1715
TOTAL	**6633**	**6861**	**6590**	**6421**	**6465**	**6252**	**7360**	**6991**	**6788**	**6911**	**6647**	**6592**	**6264**	**6252**	**6239**	**6244**	**5820**	**5663**	**6118**	**6180**	**6493**	**6624**	**6624**	**6565**

Table 7
U.S. Strategic Bomber Forces, 1946-1989

1. Includes the total number of bombers in the Strategic Air Command active inventory ("assigned resources," not bombers in inactive storage) as of the end of the year (December).
2. Primary Authorized Aircraft (PAA). Previously, the term Unit Equipment (UE) was used. Both terms specify the number of aircraft assigned to operational units in combat ready condition.
3. Not all B-29 bombers were modified to carry nuclear weapons. On 31 December 1946 there were 23 nuclear modified B-29 bombers; on 1 March 1947 there were 35; on 1 December 1948 there were 38; in mid-January 1949 there were 66; and on 1 January 1950 there were 95. See David Alan Rosenberg, "U.S. Nuclear Stockpile, 1945 to 1950," *Bulletin of the Atomic Scientists*, May 1982, p. 30.
4. Not all B-36 bombers were modified to carry nuclear weapons. On 1 December 1948 there were four nuclear modified B-36 bombers; by mid-January 1949 there were 17; and by 1 January 1950 there were 34. *Ibid.*
5. Effective 1 October 1955, SAC's four heavy Strategic Reconnaissance Wings were redesignated heavy Bombardment Wings in recognition of the conversion of the RB-36 from a reconnaissance airplane to a bomber.
6. Not all B-50 bombers were modified to carry nuclear weapons. On 1 December 1948 there were 18 nuclear modified B-50 bombers; by mid-January 1949 there were 38; and by 1 January 1950 there were 96. *Ibid.*
7. On 1 July 1950 there were a total of 264 nuclear modified B-29, B-36 and B-50 bombers.
8. There is no easy or accurate method for estimating the actual number of weapons the bomber forces carry. How each bomber is loaded is determined by its Single Integrated Operational Plan (SIOP) mission. The SIOP is the central nuclear war plan of the U.S. It is developed by the Joint Strategic Target Planning Staff at the Strategic Air Command in Omaha, Nebraska. It is incredibly complex matching over 10,000 nuclear warheads with their targets taking into account factors of reliability, timing, target hardness, collateral damage, etc. The U.S. bomber's role in the overall plan must be integrated with ballistic missile salvos from SSBNs and land based forces in the U.S. and Europe. Bombers are on alert at each SAC base but those in the northern parts of the U.S. have the least distance to fly over the north pole and would be the first to reach the Soviet Union. Therefore it is likely that those bombers have a full complement of SRAMs intended for defense suppression and making corridors through which following bombers would fly. The counting assumptions for bomber loadings of nuclear weapons are as follows:

* 1) 1946-48: Actual number of bombs in the stockpile as of June 30; Rosenberg, *op. cit.*

* 2) 1949-50: Rosenberg, *op. cit.* reports 240 mechanical assemblies as of June 30, 1949 and "at least 292" nuclear components and 688 mechanical assemblies as of 30 June 1950. We assume that there were 200 bombs by the end of 1949 and 400 by the end of 1950.

* 3) 1951-52: Prior to the deployment of the B-47 bomber, the assumption is that there is a sufficient number of bombs for each PAA aircraft.

* 4) 1953-55: B-29, B-36 and B-50 bombers continue to carry one bomb per aircraft. The assumption for the B-47 bomber from 1953 to 1965 is that there were an average of 1.5 bombs per aircraft; based on Department of Defense, OSD, "Memorandum for the President, Recommended FY 1965-FY 1969 Strategic Retaliatory Forces," 6 December 1963, p. 1-2 (partially declassified).

* 5) 1956-59: B-36 and B-47 bombers carry one and 1.5 bombs, respectively (see above). B-52 average loading is two bombs per bomber.

* 6) 1960: With the introduction of the versatile B28 bomb in quantity the B-52 bomber force loading goes up to 3.3 bombs per plane; see Department of Defense, OSD, "Memorandum for the President, Recommended FY 1965-FY 1969 Strategic Retaliatory Forces," 6 December 1963, p.1-2 (partially declassified).

* 7) 1961-62: The B-58 bomber carries one bomb until 1964. B-47 and B-52 bomber force loadings continue as above.

* 8) 1963: The average bomb force loading per B-52 bomber increases to four.

* 9) 1964-69: The B-58 is modified to carry four bombs. B-52 bomber force loadings gradually increase from 4.5 to 8 bombs per plane. The average bomb loadings are assumed to be: 4.5 in 1964, 5 in 1965, 5.5 in 1966, 6 in 1967, 7 in 1968, and 8 in 1969.

*10) 1970-71: The average bomb loadings for the B-52 and FB-111A bombers are eight and six respectively.

*11) 1972-86: Twenty FB-111A bombers carry six SRAMs each and no bombs. The remaining FB-111A bombers carry six bombs each. The remaining SRAMs are carried on B-52 bombers. B-52 bombers loaded with SRAMs carry 12 SRAMs and four bombs. The remaining B-52 bombers carry an average of eight bombs. B-1B bombers beginning in 1986 carry eight bombs.

9. Eighty percent of the total inventory of nuclear armed Hound Dog (AGM-28B) air-to-surface missiles are force loadings.

10. Counting assumptions for nuclear-armed Short Range Attack Missiles (SRAM) (AGM-69A). The total number of operational SRAMs is 1140 from 1975-1986; HAC, FY 1982 DOD, Part 2, p. 101. The SRAM inventory peaked in 1975 at 1471. During the 1972-74 period, SRAM operational missiles were assumed to be the same ratio of operational/total inventory as in 1975.
11. Counting assumptions for nuclear armed Air-Launched Cruise Missiles (ALCM) (AGM-86B). The number of ALCMs is assumed to be 12 per modified and deployed B-52G/H bomber.

Table 8
USSR Strategic Bomber Forces, 1956-1989

	End-1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Bombers (PAA) [1]																																		
TU-95 Bear A	2	5	10	25	48	62	75	80	85	60	45	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	20	0
Bear B/C								12	30	45	60	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	65	55	45	30	30	20
Bear G																													10	20	30	40	45	45
Tu-142 Bear H																												10	10	25	40	55	65	80
MYA-4 Bison	20	23	40	50	56	58	58	58	58	58	54	54	54	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	45	30	15	0		
Tu-160 Blackjack																																	10	17
TOTAL	**22**	**28**	**50**	**75**	**104**	**120**	**133**	**150**	**173**	**163**	**159**	**159**	**159**	**157**	**157**	**157**	**157**	**157**	**157**	**157**	**157**	**157**	**157**	**157**	**157**	**157**	**157**	**167**	**160**	**160**	**160**	**155**	**170**	**162**
Bomber Weapons (Force Loadings) [2]																																		
TU-95 Bear A [3]	4	10	20	50	96	124	150	160	170	120	90	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	40	0
Bear B/C [4]								48	120	180	240	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	260	220	180	120	120	80
Bear G [5]																													60	120	180	240	270	270
Tu-142 Bear H [6]																														200	320	440	520	640
MYA-4 Bison [7]	80	92	160	200	224	232	232	232	232	232	216	216	216	208	208	208	208	208	208	208	208	208	208	208	208	208	208	208	180	120	60	0		
Tu-160 Blackjack [8]																																	100	238
TOTAL	**84**	**102**	**180**	**250**	**320**	**356**	**382**	**440**	**522**	**532**	**546**	**576**	**576**	**568**	**568**	**568**	**568**	**568**	**568**	**568**	**568**	**568**	**568**	**568**	**568**	**568**	**568**	**568**	**560**	**720**	**800**	**860**	**1050**	**1228**

Table 8
USSR Strategic Bomber Forces, 1956-1989

1. The number of bombers is assumed to be the equivalent of U.S. Primary Authorized Aircraft (PAA). This does not include aircraft in storage or inactive aircraft.
2. Force loadings from 1956-1959 are authors estimates of bombs available for combat; from 1960-1988, the force loadings are authors estimates based on the counting rules below.
3. Bear A bombers carry two bombs each, and no air-to-surface missiles.
4. Bear B/C bombers carry four bombs or a single AS-3 air-to-surface missile.
5. Bear G bombers carry four bombs and two AS-4 air-to-surface missiles per plane. Bear B/C bombers are currently being converted to Bear G models.
6. In 1984, newly produced Bear H bombers began to be deployed. These bombers are counted as carrying eight AS-15 air-launched cruise missiles.
7. Bison bombers carried four bomber weapons each.
8. Blackjack bombers initially carried 10 weapons (six AS-15s and four bombs). With introduction of AS-16 four additional weapons are carried.

Figure 1

US-USSR Strategic Offensive Warheads

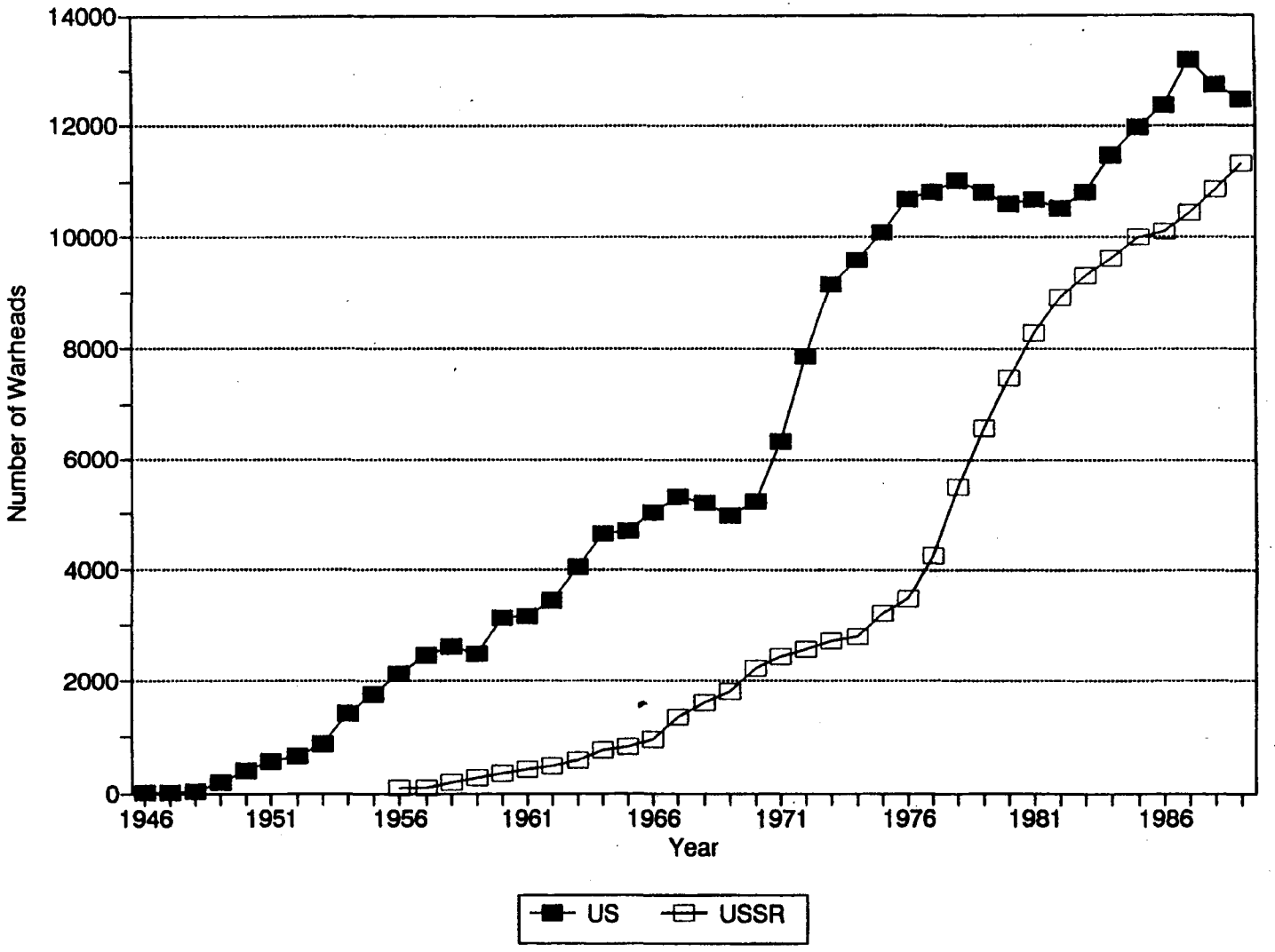


Figure 2

US-USSR ICBM Launchers

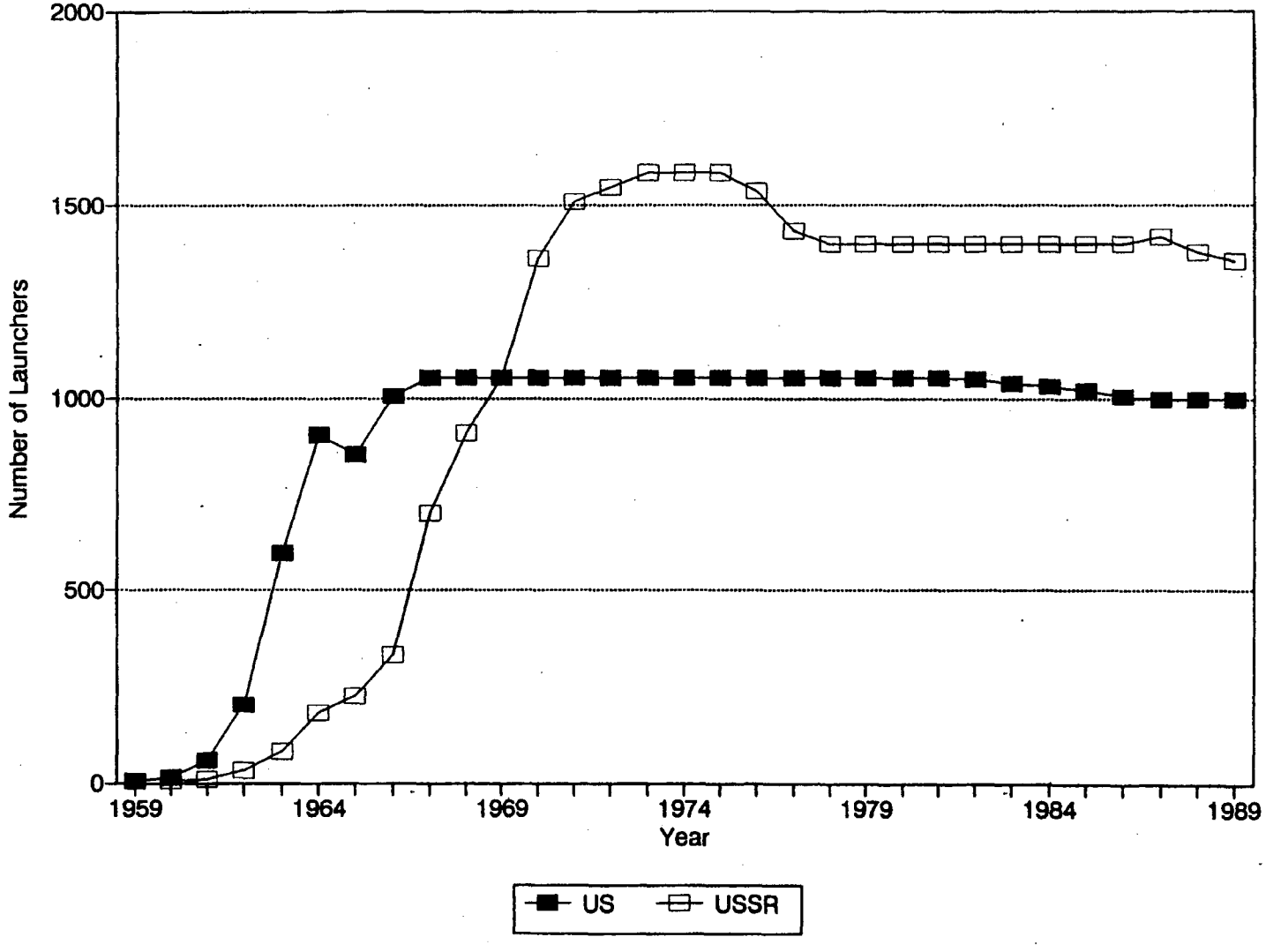


Figure 3

US-USSR ICBM Warheads/RVs

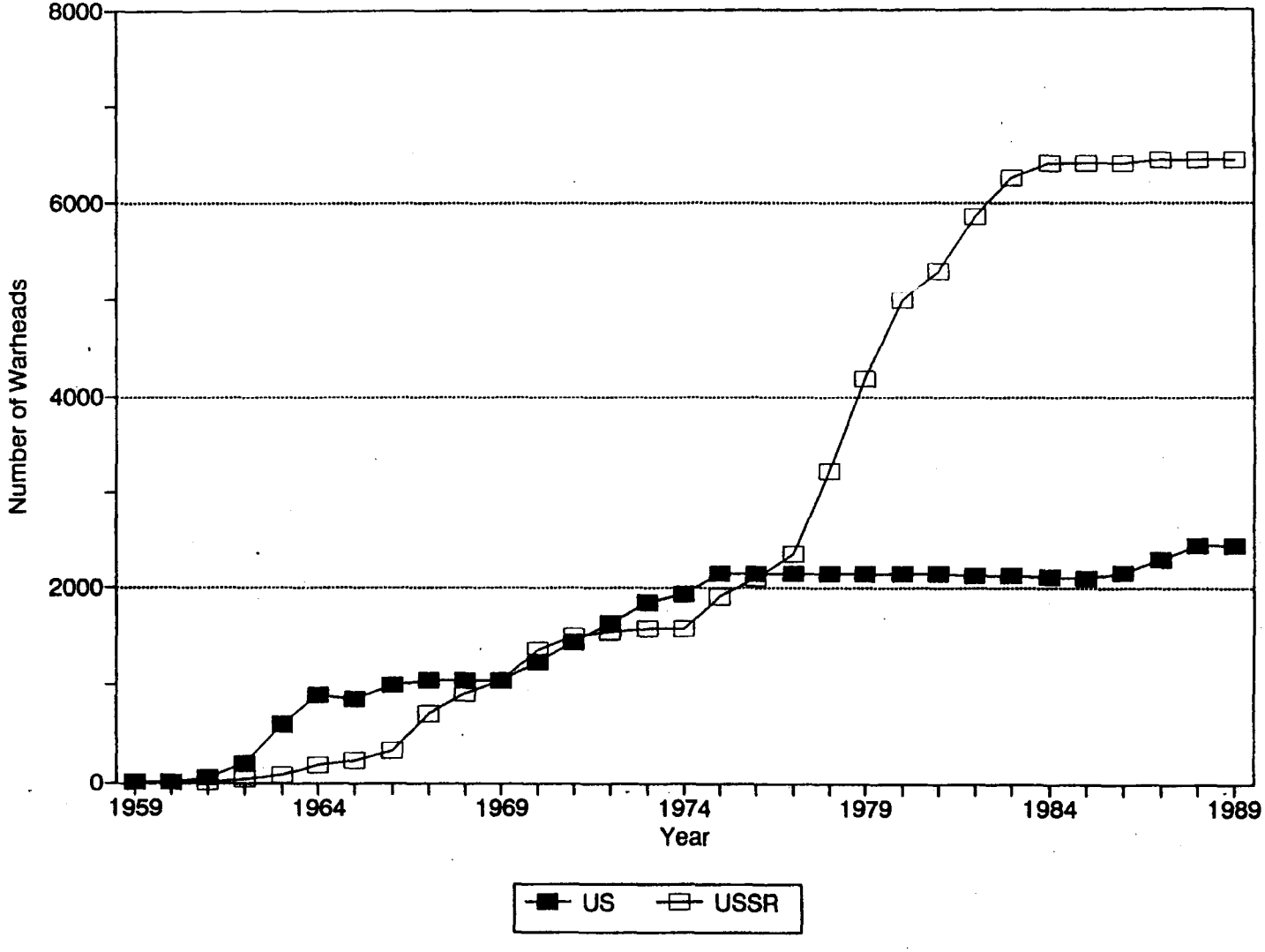


Figure 4

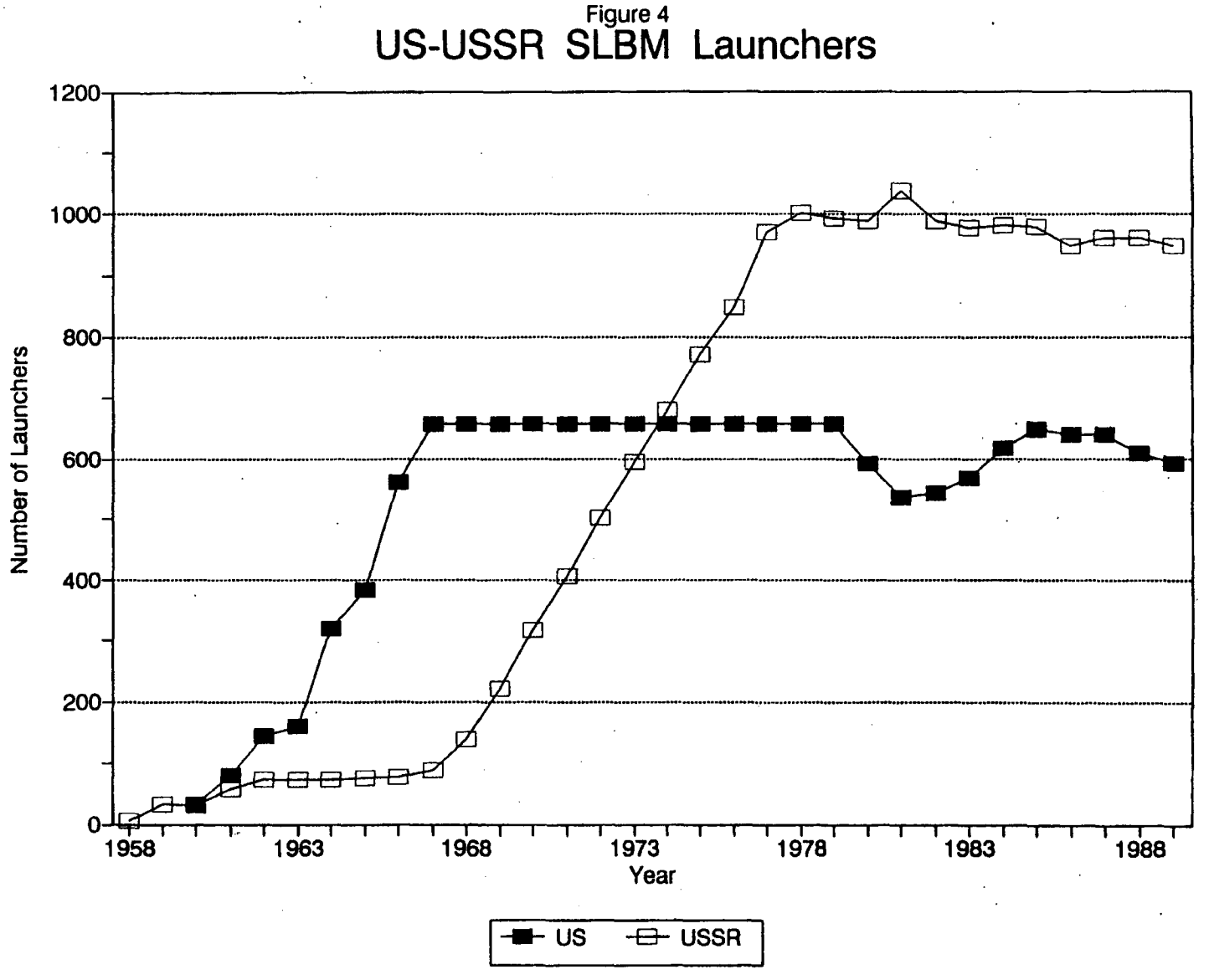

US-USSR SLBM Launchers
1200
1000
800
600
400
200
0
Number of Launchers
1958
1963
1968
1973
1978
1983
1988
Year
US
USSR

Figure 5

US-USSR SLBM Warheads/RVs

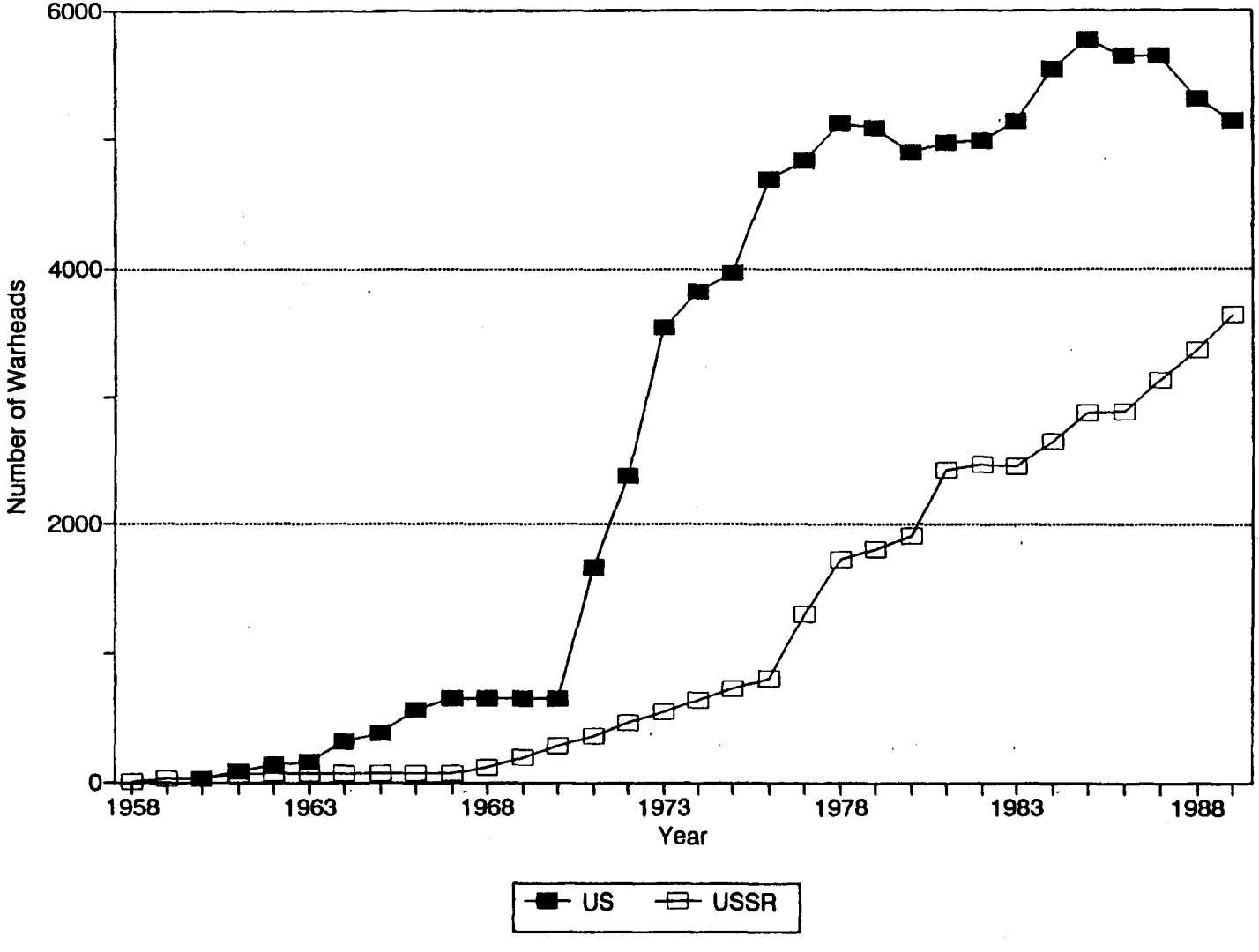


Figure 6

US-USSR Strategic Bombers

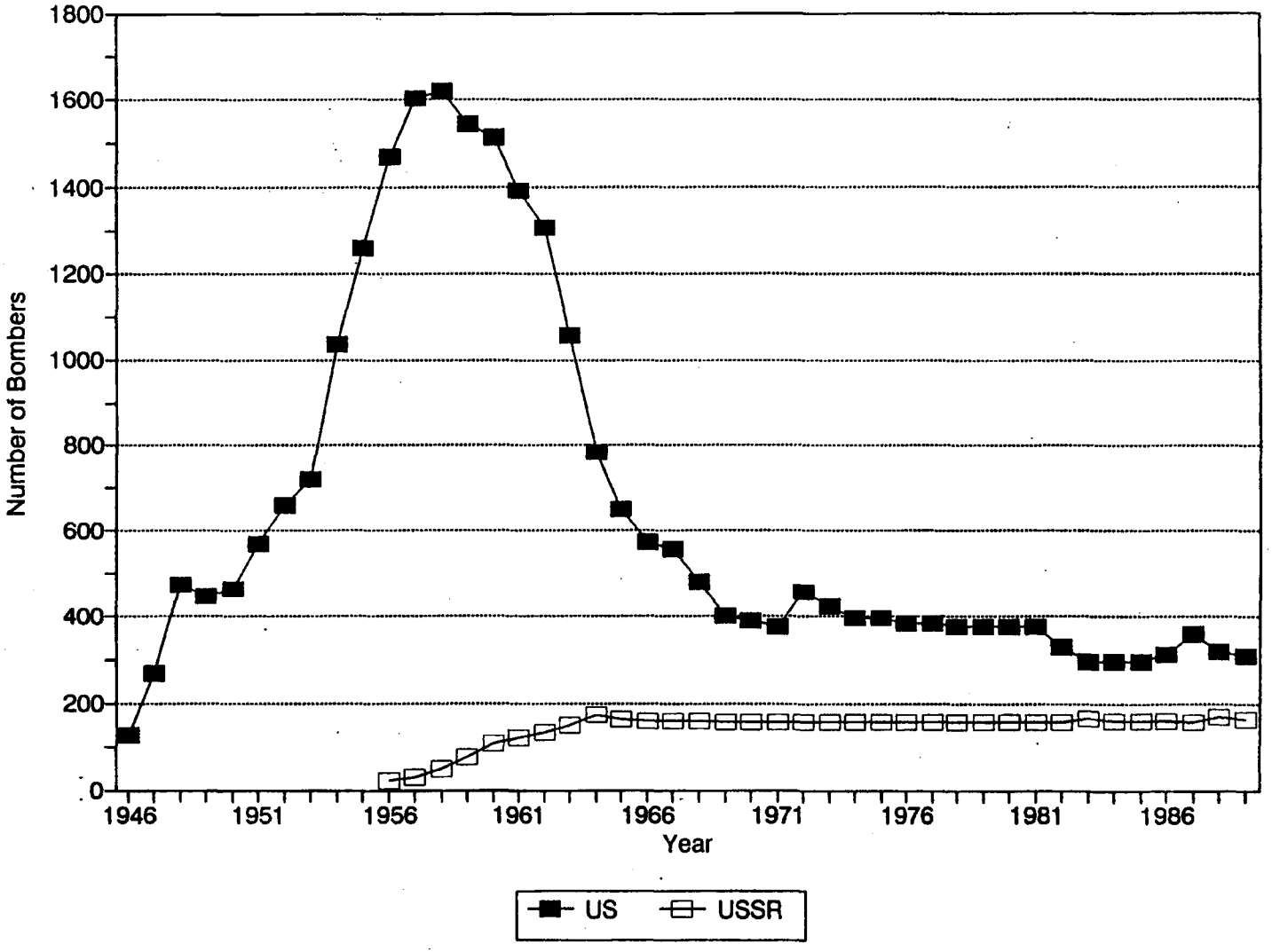
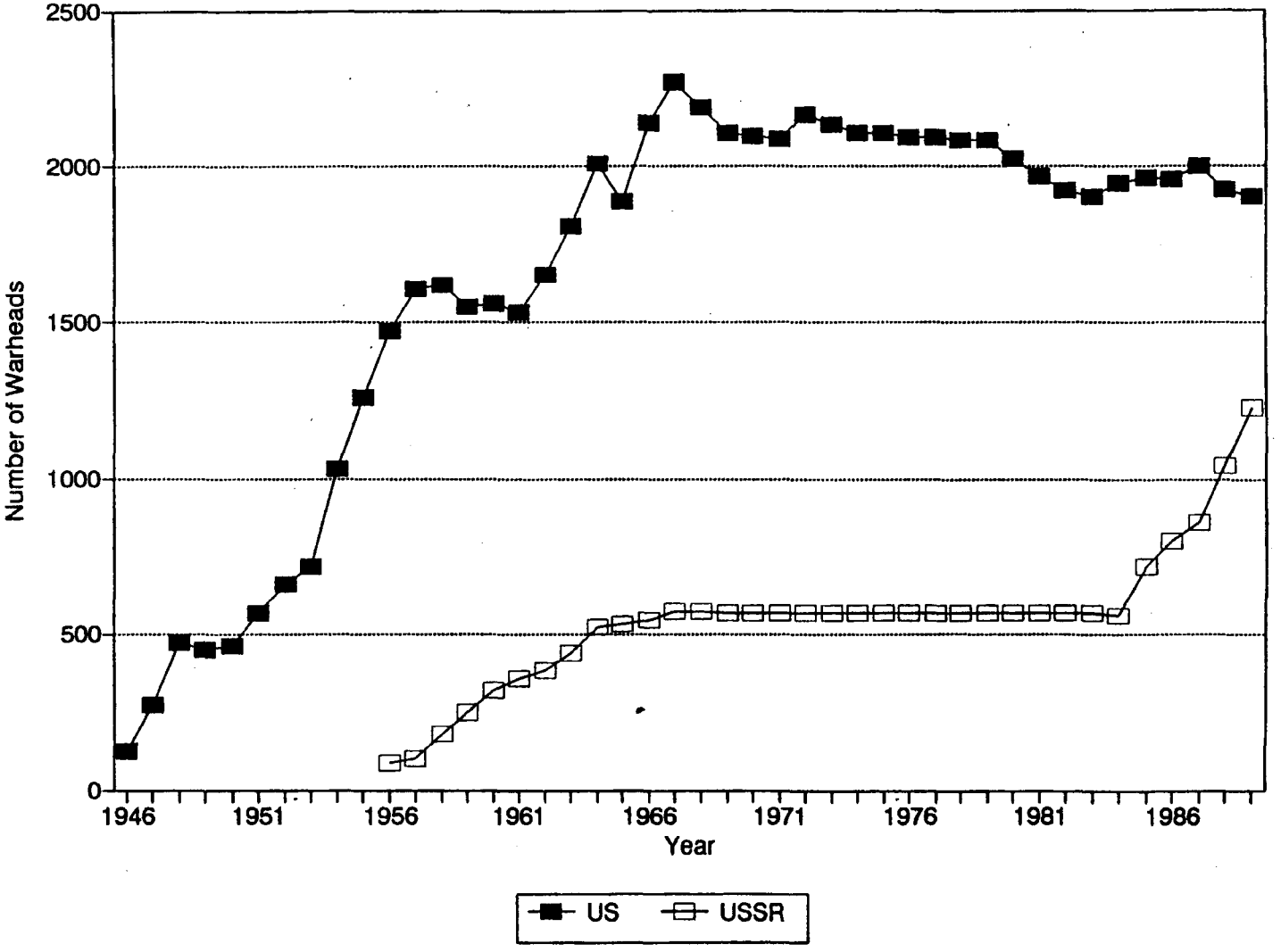


Figure 7

US-USSR Strategic Bomber Weapons



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The NRDC Nuclear Weapons Data Center

Since 1980 the Natural Resources Defense Council has sponsored the **Nuclear Weapons Data Center**. The purpose of the Center is to compile and disseminate accurate information on the world's nuclear forces in order to promote a more informed debate on nuclear weapons and arms control issues. The Center has published four volumes of its *Databook* series describing the U.S. and Soviet nuclear arsenals, and the U.S. nuclear weapons production complex. Currently in preparation is another volume, on other nuclear weapons powers and proliferation. Since May 1987, the Center staff has contributed a monthly column to *The Bulletin of the Atomic Scientists*, entitled Nuclear Notebook.

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Nuclear Weapons Databook
Working Paper 90-1

Making A Virtue of Necessity: START and Strategic Modernization

Robert Standish Norris
and
Thomas B. Cochran

May 15, 1990

Natural Resources Defense Council
1350 New York Avenue, NW
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TABLE OF CONTENTS

After nearly eight years the United States and the Soviet Union are close to concluding a START treaty. Though it will not be finished in time for the May 30-June 3 Washington summit, it is sufficiently defined to analyze its central military, technological, political and economic implications. This report discusses some of those implications and comments on the treaty's shortcomings. Among the paper's major findings and recommendations are:

FINDINGS

* The START treaty has the character of making a virtue of necessity. As with many past treaties this will be arms control without pain or sacrifice. To a public that believes the problem of the nuclear arms race is being addressed the recognition of the true nature of the treaty with its limited cuts, "fine print" and "loopholes" could lead to disillusionment and anger.

* Actual reductions of U.S. and Soviet strategic offensive nuclear warheads will be about one-third rather than the 50 percent often advertised. The reduction will be from combined warhead levels of 23,300 warheads in 1990 to 16,000 in 1998. The U.S. portion (9000) is approximately the number of strategic weapons it had in 1973. The Soviet portion (7000) is approximately the number it had in 1980.

* Almost two dozen U.S. and Soviet strategic nuclear weapon systems would be permitted under the terms of the current proposals, though perhaps not in as large numbers as originally planned.

* Retirements will be of systems scheduled to be retired in any case. The lower military budgets forecast for the future would not support the current strategic forces for either nation.

* START will result in little economic savings in the short term.

* Under a START treaty the nature of the arms race will further shift from quantitative to qualitative competition.

* The retirement of large numbers of warheads ensures that no additional plutonium or highly enriched uranium (HEU) need be produced for weapons in the U.S. or the Soviet Union. A fissile material cutoff may occur by default.

RECOMMENDATIONS

* START II talks should begin immediately upon entry into force of START I. A START II treaty should aim for deep reductions of launchers and warheads so that arsenals are cut by significant percentages. All weapon types should be counted, including bombs, air-to-surface missiles (ASM), and air-launched cruise missiles (ALCM), with no "discounting."

* Additional measures should be added to START II to strengthen the treaty and curb modernization. These could include bans or limits on future missile types and restrictions on ballistic missile flight testing.

* Success in other arms negotiations, such as a nuclear test ban or naval arms control, would further assist in constraining the arms race.

* A comprehensive arms control and disarmament agenda should be developed along the lines of Soviet President Gorbachev's January 1986 fifteen year plan, to eliminate all types of nuclear weapons.

* The most significant act that the U.S. could take to slow the pace and change the character of the strategic nuclear arms race would be to radically revise its Single Integrated Operational Plan (SIOP). Just as there will be a wide-ranging review of NATO's mission and strategy so too should there be an in depth examination of U.S. strategic nuclear war plans. Deep reductions in U.S. strategic forces will be impossible without major changes in the SIOP.

The conclusions in this report are illustrated by seven Tables. Tables 1 and 2 present estimates of current U.S. and Soviet strategic forces as of mid-1990. Table 3 outlines the current START negotiating proposals, showing common positions and remaining differences. Tables 4 and 5 are projections of nominal U.S. and Soviet strategic forces after a START treaty (circa 1998). Table 6 lists current and future weapon programs that would be allowed in part or in full under START. Table 7 details the retirements that would have to take place to comply with the START limits, assuming the forces presented in Tables 4 and 5.

As a timetable we have assumed that a treaty will be signed by the end of 1990. U.S. Senate and Supreme Soviet hearings could then take place from February-May 1991, with ratification in June and entry into force on July 1, 1991.[1] The two sides have agreed that reductions would occur over seven years, and the treaty would have a duration of 15 years.

The SALT treaties provided a measure of predictability about strategic force trends even while warhead numbers grew significantly. The two sides added over 13,000 warheads to their respective strategic arsenals since SALT I was signed eighteen years ago.[2] Launcher limits were set largely to accommodate future programs and did not radically alter the relationship of the different "legs" of the strategic triads of each nation. During the Reagan Administration (1981-1989) the Soviet Union added 3400 strategic warheads to its arsenal while the U.S. added 2100. A START treaty will not allow such growth in strategic forces. It will essentially reduce U.S. and Soviet nuclear forces back to the numerical levels of the late 1970s, before the recent buildups began, but with more capable weapons.

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[1] The SALT II Treaty was signed on 18 June 1979. The Senate Foreign Relations Committee held 28 days of hearings over a four month period during July-October. Markup was held between October 15 and November 9 with its report issued on November 19. The Senate Armed Services Committee held sixteen days of hearings between July 23 and October 24. The INF Treaty was signed on December 7, 1987. The SFRC held 20 days of hearings between January 25 and March 22, 1988. The SASC held 13 days of hearings between January 25 and February 23. Their reports were issued April 13 and April 1 respectively. On May 15 the INF Treaty was brought to the floor of the Senate. After floor debate the Senate voted 93 to 5 on May 27 to approve the INF Treaty. The treaty entered into force on June 1.

[2] See Robert S. Norris and Thomas B. Cochran, "US-USSR Strategic Offensive Nuclear Forces 1946-1989," Nuclear Weapons Databook Working Paper 90-2, May 1990.

Advertised Versus Real Reductions

The Reagan Administration, the Bush Administration, as well as many in the media, routinely report that the START Treaty "calls for 50% reductions to equal levels in strategic offensive arms."[3] This is a common misperception about what will actually happen under START. In fact 50 percent reductions will not occur in Strategic Nuclear Delivery Vehicles (SNDVs), in total warheads, or in ballistic missiles:

1) The U.S. currently has 1847 SNDVs and the Soviet Union 2448. The agreed limit of 1600 would mean a 15 percent reduction for the U.S. and a 35 percent reduction for the Soviet Union.

2) Comparing warheads before and after an agreement reveals that there would be a reduction of approximately 25 per cent for the U.S. (from 12,000 warheads to some 9000) and a reduction of about 35 per cent for the Soviet Union (from 11,300 warheads to some 7000). The combined strategic arsenals would drop from 23,300 to 16,000, or 30 percent.

3) In ballistic missile warheads the U.S. would reduce from 7500 to 4900, a 35 per cent drop. The only area where there is a 50 per cent reduction is in Soviet ballistic missile warheads. Specifically the number of SS-18s will be halved. Overall Soviet forces would be reduced from approximately 10,100 to 4900 warheads and as a consequence so would the throwweight.

Negotiators on both sides have adopted a variety of tactics, no doubt under pressure from their respective civilian bureaucracies and military services, to exempt, or "discount" certain weapons from counting towards the ceilings or subceilings.

One major way has to do with the way bomber weapons are counted. Modern strategic bombers carry three different types of weapons; gravity bombs, ASMs,[4] and ALCMs. Both sides have agreed, primarily because of alleged verification difficulties, that all bombs and ASMs together on one bomber will count as only one warhead under the 6000 warhead ceiling. Thus a bomber carrying 24 bombs/ASMs will be counted as one warhead, not 24. The actual number of bombs currently deployed with each nation's strategic bomber force is difficult to gauge and will remain so after a START agreement. The U.S. currently has a larger bomber force and would presumably retain a warhead advantage after the treaty is implemented.

A second way to undercount has to do with the counting rules for ALCMs. For the U.S., B-52G and H models will be declared ALCM carriers, initially. For purposes of the warhead ceiling, each B-52 will count as 10 yet they have a maximum capability of carrying

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[3] Though this is beginning to change as more journalists examine the details. See, e.g.: R. Jeffery Smith, "Treaty Would Cut Few U.S. Warheads," Washington Post, April 3, 1990, p. A1; David Evans, "Nuclear Arsenals May Not Shrink Much," Chicago Tribune, February 21, 1990, p. A1.

[4] The U.S. has the Short Range Attack Missile (SRAM) on its strategic bomber force. The Soviet Union has the AS-3, AS-4, and AS-16 air-to-surface missiles on its strategic bomber force.

between 12 and 20. Thus 1000 or so deployed ALCMs will be part of U.S. nuclear forces but will not be counted.

Two particularly egregious examples of "discounting" have been proposed by the U.S. Navy. The Navy has proposed that up to 72 SLBM launchers be excluded from being counted in the aggregate since at any given time several submarines are in overhaul. For the 24 tube Tridents this would mean three submarines would be exempt. The Soviets have reportedly agreed to between 48 and 72, with the exact number yet to be announced. If the number is between 64 and 72 up to four Soviet submarines could be exempt. The second example has to do with changing the warhead counting rule on Trident II SLBMs, agreed to in December 1987, from eight to six.[5] If the Soviets agree it would allow a force of 21 Trident SSBNs to each have 24 launchers with roughly 3000 accountable warheads. If the counting rule remains the same, then the Navy will either have to operate with a smaller fleet of 24-tube SSBNs or fill six launchers per submarine with concrete on the 21 boat fleet (see Table 4).

The recent idea of deep reductions can be traced to George Kennan, who in May 1981 called for "an immediate across-the boards reduction by 50 percent" of all types of nuclear weapons in both nations arsenals.[6] On May 9, 1982 President Reagan called for a one-third cut in each nation's strategic ballistic missile warheads, from about 7500 to 5000. Had these plans been implemented quickly the reduction of the then smaller arsenals might have been significant. As it turned out during the eight years of negotiations each side's arsenals have grown. The principle of "50 percent reductions in nuclear arms" was articulated during the first Reagan-Gorbachev summit in Geneva in November 1985. As the negotiations proceeded the principle has been whittled away. Administration spokesmen no longer bother to use 50 percent reductions as a goal of START, the new buzzword is "stability."[7]

The efforts to exempt certain weapons from counting toward the ceilings have protected certain military programs. But it has also resulted in watered down and ineffective arms control and disarmament. A key goal for a START II treaty must be the inclusion of all types of strategic weapons. Verification difficulties should not be used as an excuse to exempt bomber weapons, or any other types, from deep reductions.

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[5] "U.S. Proposes to Reduce the Number of Trident D-5 Warheads Under START Treaty," Inside the Pentagon, April 27, 1990.

[6] George F. Kennan, The Nuclear Delusion: Soviet-American Relations in the Atomic Age (New York: Pantheon Books, 1983), p. 180.

[7] Richard Burt, "The Strategic Arms Reduction Talks - President Bush Proposes Verification Measures," NATO Review, August 1989, pp. 6-10; Richard R. Burt, "Status of the Strategic Arms Reduction Talks, Department of State Bulletin, October 1989, pp. 17-19; Richard Burt, "The State of START," Arms Control Today, February 1990, pp. 3-8. "In START, our goals are not merely to reduce forces but to reduce the risk of nuclear war and create a more stable nuclear balance"; The White House, National Security Strategy of the United States, March 1990, p. 16.

New Weapons

Under current proposals all U.S. weapon systems now being deployed or in research and development would be allowed to proceed. These include: the SRAM II, the B-2, Trident II Submarine-launched Ballistic Missile (SLBM), and the Advanced Cruise Missile (ACM). Given congressional support for funding, the two mobile ICBM programs, the Small ICBM ("Midgetman") and MX rail garrison would be permitted as well.

Programs now in production and currently being deployed would be allowed in their entirety or only be slightly curtailed. In the latter category fewer numbers of SLBMs would be needed if the Navy chooses to put 18 SLBMs per sub instead of 24 to keep within the warhead ceiling. If the counting rule is changed to six warheads per missile, then the original number could be deployed.

Under the current draft START treaty, virtually all Soviet weapon systems under development or being deployed could proceed. These include: the SS-24 and SS-25 ICBMs, the Typhoon and Delta IV submarines, the SS-N-20 and SS-N-23 SLBMs, the Bear H and Blackjack bombers, the AS-15 ALCM, AS-16 SRAM, AS-X-19 ASM, and new gravity bombs for the bombers.[8]

START allows for open-ended modernization; weapon systems currently in research and development can proceed, and as yet unthought of weapon systems are not prohibited. Allowing open-ended modernization will no doubt assist in gaining support for the treaty from the respective military establishments. Following the SALT II and INF precedents a START II Treaty should ban certain types of new missiles.[9]

One of the presumed purposes for the U.S. and the Soviet Union to engage in arms control or disarmament is to alleviate some of the economic burden of the arms race. The enormous U.S. deficit has accrued partially as a result of large military budgets, and Soviet President Gorbachev has repeatedly stated that more resources must be directed to the civilian economy. It is difficult at this time to calculate exactly what effect these reductions would have on the military budgets of both countries. As a rule of thumb strategic nuclear forces constitute about 15 to 20 percent of the annual U.S. military budget. While reductions in the conventional forces, that make up 80 to 85 percent of the budget, can save the most money cutting nuclear weapons programs can marginally reduce the military budget. But allowing a host of very expensive weapon systems to proceed, albeit on a somewhat reduced scale, will probably cost about the same or more than is being spent today.[10] The reductions will no

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[8] The U.S. has proposed a ban on production, flight testing or modernization of new or existing heavy missiles, which the Soviets have rejected. Since the U.S. neither has or intends to develop a "heavy" missile this only applies to the Soviet SS-18 or its follow on. The Soviet have reportedly stopped their Typhoon submarine program at six.

[9] The SALT II Treaty banned flight testing and deployment of new types of ICBMs except for one new type of light ICBM. The INF Treaty specifies the elimination of all current types of U.S. and Soviet land-based ballistic missiles between 500 and 5500 kilometers and prohibits future development or deployment.

[10] A Congressional Budget Office report estimates that, depending upon the options chosen for new systems, the annual long-run cost savings range between $3 and $12 billion; CBO, "Budgetary and Military Effects of the Strategic Arms Reduction Talks

(continued...)

doubt stimulate a natural military reaction to compensate with more capable weapons to replace those just removed, and to try to solve a host of new military problems created by limitations in the number of warheads allowed in strategic forces.

Retirements

Under a START Treaty, retirements on both sides would be substantial, but the vast majority of what would be withdrawn is old and obsolete and was scheduled for retirement anyway.

For the U.S. retirements would include:

- 350 Minuteman II ICBMs and silos[11]
- 350 W56 warheads for the Minuteman II
- 200 W62 warheads for the Minuteman III
- 300 W78 warheads for the Minuteman III
- 23 Lafayette/Franklin class SSBNs
- 368 Poseidon and Trident I SLBMs
- 3300 W68 and W76 SLBM warheads
- 98 B-52G bombers

For the Soviet Union retirements would include:

- 914 SS-11, SS-13, SS-17, SS-18, and SS-19 ICBMs
- 708 SS-N-6, SS-N-8, SS-N-17, and SS-N-18 SLBMs
- 6500 ballistic missile warheads
- 45-51 Hotel, Yankee, and Delta class SSBNs
- 20 Bear B/C bombers

Retirements could begin with the entry into force of the Treaty, (possibly July 1991), and would be accomplished in a phased manner (U.S. position) or in two phases (Soviet position) during the seven year period, until mid-1998. A review of the status of each weapon intended for retirement shows that, in most cases, it was scheduled for retirement anyway.

U.S. Retirements

* The Minuteman II force was deployed between 1966 and 1969. Assuming a thirty-year life span, retirement by 1998 would be exactly on time.

* The Minuteman III force was deployed between 1970 and 1975. Three hundred missiles were fitted with new reentry vehicles between late 1979 and early 1983. Removing one warhead (of three) from each of 500 missiles would not interfere with retirement plans. It has undergone numerous upgrades over the years. Presumably, the Minuteman III will be in

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[10](...continued)
(START) Treaty," Staff Memorandum, February 1990. See also Stephen Alexis Cain, The START Agreement: Strategic Options and Budgetary Savings, Defense Budget Project, July 1988.

[11] If the SICBM program is funded it could be deployed in current Minuteman II silos.

service until about 2005 or later. No missiles need be retired in the force structure assumed in Table 4.

* The remaining 23 (of the original 31) Lafayette/Franklin class SSBNs were commissioned between 1963 and 1967. Eight have been withdrawn from service between 1985 and 1990. Under current plans all were scheduled for decommissioning between 1994 and 1999 as Ohio class submarines are deployed.[12]

* Poseidon (C3) SLBMs were deployed between 1971 and 1978 and Trident I (C4) SLBMs (aboard 12 Lafayette/Franklin class SSBNs) were deployed between 1979 and 1983. Retirement of Trident I missiles on the 12 Lafayette/Franklin submarines by the end of 1998 would be about 10-15 years early for the missiles. Trident I SLBMs are also deployed on the first eight Ohio class SSBNs. Those missiles will be removed at the rate of about one SSBN per year during the period 1993-2000 and replaced with Trident II SLBMs.

* The B-52G bombers were built from 1958 to 1960 and the B-52 H models between 1960 and 1962. Earlier B-52 A/B/C/D/E and F models have already been retired. The original air force plan was to retire B-52s as B-2s were introduced. Now apparently the two programs are not so intertwined. The B-2 may be cancelled or bought in much reduced numbers for budgetary reasons. And some, or all of the remaining B-52Hs may be retained well into the twenty-first century. The U.S. position is to allow 115 B-52 for conventional missions.

* ALCM deployments began in 1982 and were completed in 1987 at B-52 bases. Because of the way that ALCMs are being counted all 1600 operational ALCMs (AGM-86B) may be retained with only 95 bombers counting toward the SNDV limit and only 950 counting toward the warhead limit.

* The Advanced Cruise Missile (AGM-129A) program has experienced considerable difficulty during its development, but in mid-1990 it looks as though it will soon begin limited production. Shrouded in secrecy, it has been difficult to determine what the Air Force's plans are for this weapon. Before the START constraints on cruise missiles the Air Force had planned to deploy approximately 3000 of both types on B-52s and B-1Bs. This would mean about 1400 operational ACM. Since the original plans of the early 1980s many changes have occurred. The B-1B is not now slated to be a cruise missile carrier. Over 30 B-52Gs have been retired. Several dozen other B-52Gs have been transferred to conventional missions with more likely to follow. With this smaller force and with the START "penalty" for cruise missile bombers there are not enough spaces on the B-52H force to accommodate 3000 cruise missiles. The upper limit is approximately 1900 cruise missiles. One report indicates a planned ACM purchase of 1461 missiles.[13] What are the Air Force's plans for the ACM?

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[12] "The Poseidon SSBN fleet constructed in the 1960s will reach the end of its 30 year life by the late 1990s. Because these submarines require costly overhauls to continue in service, five of the original 31 Poseidon submarines have been, or will soon be, retired. The remaining 26 Poseidons will leave service between 1994 and 1999. Independent of a START agreement, the Navy will need to retire the Poseidon force, although START could potentially accelerate the pace depending upon when the Treaty enters into force and the resulting draw-down schedule. In short, START would be entirely consistent with our plans for the Poseidon force"; HASC, FY 1990 DOD, No. 101-9, p. 874.

[13] "Full-Rate Production of ACM to Begin in 1992," Aviation Week & Space Technology, 29 January 1990, p. 32.

Also deserving consideration is the impact at the local level that retirements may have on possible base closures or cutbacks in support functions and manpower levels.

If funding is maintained for the mobile SICBM then possibly 350 Minuteman II missiles would have to be withdrawn and their silos destroyed at three bases in South Dakota, Montana, and Missouri. If funding is not maintained then only 100 Minuteman IIs may be withdrawn at one or more of the three bases. A third possibility is that the SICBM may be purchased and put in Minuteman II silos, reducing the high cost of the program. What ever happens the bases do perform other functions. Whiteman AFB, MO is scheduled to be the first base for the B-2 bomber. Ellsworth AFB, SD has a B-1B wing, and Malmstrom AFB, MT has Minuteman IIIs.

Two SAC bases are being closed as a result of the Base Realignment and Closure Commission and others may close as a result of reduced budgets. If the rail garrison program moves forward the fifty MX missiles removed from F.E. Warren AFB would operate from Warren and from six other SAC bases. The plan for the SICBM is to use existing SAC bases as well. In sum, a portion of the ICBM silo infrastructure, some old (MMII), some new (MX), which cost billions to create, would be dismantled and replaced by a new mobile infrastructure.

The retirement of the remaining 23 SSBNs would have an impact on the ports of Charleston, South Carolina, Groton, Connecticut and Holy Loch, Scotland.[14] While attack submarines would continue to be based at Charleston and Groton there may be decreases in the number of personnel and support services at each base. The first eight Trident submarines operate out of Bangor, Washington. Beginning with the ninth Trident, the *USS Tennessee*, which first deployed at the end of March, the base at Kings Bay, Georgia will be used.

Soviet Retirements

The Soviet Union would have to retire greater numbers of weapons and greater numbers of newer weapons than the U.S.

* SS-11 ICBMs were first operational in 1966. At the peak in 1973 there were over 1000. They have been steadily reduced to the current number of 360.

* The SS-13s date from 1969. Only 60 were ever deployed.

* The three other Soviet ICBMs that would have to be retired, in part or in whole, the SS-17, SS-18 and SS-19, were deployed between 1975 and 1980 and have been undergoing modification and upgrading programs until very recently. SS-17s have been withdrawn to keep within SALT ceilings. SS-19s are being withdrawn as new SS-24s are deployed, and SS-11s are withdrawn as SS-25s are deployed.

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[14] Sixteen SSBNs use Charleston, SC and Kings Bay, GA as bases. The other seven use Groton, CT as a homeport though the submarines deploy from Holy Loch, Scotland. The crews fly to and from Scotland before and after their patrols. Charleston is also the central support point for all of the Navy's Poseidon submarines.

* Somewhere between 45 and 51 SSBNs would have to be retired. These include Yankee submarines deployed in the early 1970s and Delta I, II, and III submarines which date from 1973 to 1978.

* Older Bear A/B/C bombers date from the mid-1950s. Many will surely be retired or converted into tankers or reconnaissance aircraft.

Implications of START for Fissile Material Production

With the retirement of thousands of warheads associated with the above weapons, neither the U.S. nor the Soviet Union would need to produce any further plutonium or highly enriched uranium (HEU) for weapons.

For the U.S., approximately 4200 ballistic missile warheads may be retired. Assuming four kilograms of plutonium per warhead this would result in 17 metric tons available for new warheads. This is estimated to be almost 20 percent of the stockpile of plutonium. At recent peak production during 1984-1985 the U.S. was producing about 2.5 metric tons of plutonium per year. Combined with the already large stocks that exist from many other retirements this amount should ensure that no new plutonium need ever be produced.

Assuming 20 kilograms of HEU per warhead, the retirement of 4200 warheads would result in about 85 metric tons of HEU. This represents about 17 percent of the estimated U.S. stockpile of 500 metric tons of HEU for weapons. No newly produced HEU would be required for weapons.

For the Soviet Union over 6000 ballistic missile warheads may be retired. Using similar calculations to those for the U.S. about amounts of plutonium and HEU per warhead the Soviets would have at least as much of both materials and probably a great deal more. It would seem unlikely that they would need to continue to produce either material in the future. A fissile material cutoff may occur by default.

The Continuing Technological Arms Race

While one of the stated purposes of START is to reduce the number of strategic weapons, the treaty does not address the qualitative competition for technological breakthroughs in future weapons systems. This important feature of the arms race will continue, probably at an accelerated pace, if nothing is done to constrain it. Four key areas are at the forefront of the technological arms race with regard to strategic weapons: Zero or near zero Circular Error Probable (CEP)[15] weapons, Maneuvering reentry vehicles (MaRVs), Earth penetrator warheads, and "third generation" warheads. A START treaty may encourage accelerated research into all of these areas.

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[15] The standard way in which missile accuracy is measured. CEP is the radius of a circle within which half of the missile's reentry vehicles are expected to fall.

Nuclear war planners normally allocate two warheads for certain kinds of targets to be sure it is destroyed. With fewer warheads to allocate under START, it would become more important to nuclear planners to achieve high single-shot kill probabilities.[16]

* *Zero/Near zero CEP RVs* - The most important trend over the past two decades in strategic weapons has been increasingly accurate ballistic missiles. Early ballistic missiles had CEPs of 3000 to 5000 feet or more. The recently deployed MX has a CEP in the 300 to 400 foot range and the Trident II 400 to 500 feet. It is theoretically possible to design a guidance system that would approach or attain a zero CEP, and U.S. and Soviet scientists and engineers are busily at work on terminal guidance and sensor systems for ever greater accuracy. We can expect that any future ballistic missile deployed will be more accurate than the one it replaces or supplements.

* *MaRVs* - Unlike normal reentry vehicles which follow a ballistic trajectory to their targets after being released from the "bus," a MaRV can change its direction in flight. This would be useful to evade and dodge a ballistic missile defense system, improve accuracy, or with the proper sensors track and attack mobile targets. Currently neither the U.S. nor the Soviet Union has MaRVs on their strategic ballistic missiles. The U.S. has conducted successful ballistic missile flight tests using MaRVs and has an ongoing research program. It is likely the Soviets have done the same.

* *Earth penetrator warheads* - In response to the widespread hardening of Soviet missile silos and the building of deep underground command posts, U.S. warhead designers are busily at work trying to perfect a strategic warhead that would burrow underground before exploding. Another use for such a warhead is to penetrate the Arctic icecap to destroy Soviet SSBNs. The warhead could be on ballistic missile reentry vehicles or cruise missiles. Reentry vehicles travel at enormous speeds. While the higher the speed the greater the penetration, if it travels too fast the force of impact will break apart the warhead before it can penetrate. Subsonic cruise missiles may not attain sufficient speed for warhead penetration, but future supersonic versions could be likely candidates.

Research into combining MaRV and penetrator technologies is underway as well. Air Force Ballistic Missile Office contracts to General Electric and Lockheed call for developing operational prototypes of earth-penetrating maneuverable re-entry vehicles. After dodging interceptor missiles the warhead would penetrate into the earth and explode presumably to destroy hardened underground missile silos or command bunkers.

* *Third Generation Concepts* - The U.S. is attempting to develop a new class of nuclear-driven directed-energy weapons as part of its Strategic Defense Initiative program and for other applications. Three basic concepts are being investigated though none appear promising at this stage.

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[16] Single shot kill probability (SSKP) is expressed as a mathematical formula (made up of the variables of yield, CEP and hardness) which war planners use to attempt to measure the probability that a single reliable warhead can be expected to destroy a given target.

The x-ray laser program has received the most attention. Here laser rods are energized by the radiation of a nuclear explosion. The strong burst of x-ray laser energy would be aimed in a certain direction to destroy a target. The technical difficulties in achieving a nuclear pumped x-ray laser weapon now appear insurmountable and funding for this program has been reduced.[17]

A second concept is a hypervelocity pellet weapon, a kind of "nuclear shotgun," where thousands or perhaps millions of pellets channeled and driven by a nuclear explosion would presumably destroy incoming reentry vehicles or other targets. Still farther down the technological road are optical frequency lasers intended for similar application. All of these third generation weapons could have missions to attack mobile missiles. Under a START treaty attempts to perfect them would be encouraged.

Effects of START on Strategic Stability

According to the Bush Administration a primary goal of START is to improve stability, that is, to lessen the temptation to strike first out of fear that if weapons are not launched they will be destroyed. A situation where each side's forces are less vulnerable to the other is highly desirable; it would increase stability and should be reflected in START. Ideally, strategists on both sides could construct a stable and invulnerable nuclear force of many missiles which each carry few warheads and are therefore more survivable.

Because of the seven-year implementation period, the U.S. and Soviet Union will only be able to field the nuclear weapons that are currently in the pipeline. Many of these weapons have been designed to maximize their warhead carrying capability, that is, to place as many launch tubes on submarines or as many warheads on ballistic missiles as is possible. Under START numerical limits, nuclear planners will want to spread the number of launch tubes on submarines and reduce the number of warheads on missiles as much as possible, rather than having them concentrated in a few delivery vehicles. Unfortunately the goal of redesigning nuclear forces to make them more stable will not be possible in a seven year period, and may not be possible in the long-term given economic constraints on military spending.

In other ways, START does not improve stability to any significant degree. The current ratio of Soviet "heavy" ICBMs (SS-18 Mod 4/5/6) to U.S. missile silos is 3:1, seemingly the most worrisome situation to the Bush Administration. With an eventual Soviet force of 1540 heavy ICBM warheads, plus more accurate versions of other types of missiles, all aimed at what will likely be a slightly fewer number of U.S. fixed land-based silos the ratio does not improve very much. Judging then on what is touted as the treaty's chief virtue START does not succeed very well.

The "vulnerability" of land-based forces would change markedly with addition of mobile missiles. The U.S. position on this matter is schizophrenic. Repeatedly the U.S. has stated that the essence of deterrence is the U.S. ability to hold Soviet targets at risk while its own targets

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[17] William J. Broad, "Crown Jewel of 'Star Wars' Has Lost Its Luster," New York Times, 13 February 1990, p. C1.

remain invulnerable. This is partially its justification for highly accurate missiles like the MX and the Trident II. The best situation for the U.S. under this "logic" is to have fixed Soviet targets to aim at and invulnerable U.S. targets, but this is a difficult negotiating proposal. To allow mobile Soviet missiles means that it would be more difficult to "hold them at risk." Since certain bomber weapons are not constrained in START, the shift to mobile missiles will set off the development of new bomber weapons to target mobile missiles. At one point the need for the B-2 bomber was justified as being able to accomplish this. More recent statements have downplayed this difficult task.

Transforming the SIOP

The single most important act the U.S. could take to slow the pace and change the character of the strategic arms race would be to radically revise its employment plan for nuclear war. This plan is known as the Single Integrated Operational Plan (SIOP). The SIOP is enormously complex. It matches thousands of targets with thousands of weapons, all with proper timing and sequence of execution. If real disarmament is ever to take place then the problem of the nature of the war plan must be addressed.

The current version, SIOP 6F, sets extraordinary demands and goals.[18] Large numbers of highly accurate and capable weapons are required. It is this dynamic that generates continuing Air Force and Navy requirements for more capable and sophisticated weapons. The commanders responsible for executing the SIOP continue to demand new and better weapons to accomplish their duties.

The United States has decided that the sine qua non of deterrence shall be the precise targeting of the Soviet leadership. To accomplish this requires highly accurate weapons, which are now being deployed in large numbers. A circularity is evident between technological advances and nuclear war plans. Technological advances in accuracy need a strategic rationale. What follows is the issuance of Presidential guidance which eventually becomes an employment plan for nuclear war. Conversely, targeters always "need" better weapons to do their jobs. Manipulating the target base can also generate a "need" for new weapons.[19]

What constitutes deterrence? The definition is an arbitrary one. The U.S. could decide that much less ambitious requirements will suffice to deter the Soviet Union from launching a nuclear attack. The U. S. has had these lesser definitions of deterrence over the past four decades and they have worked quite well. It is time to return to those simpler plans and set much less ambitious definitions of deterrence. This is no more arbitrary than the way we go about the process today. A less ambitious war plan, based on a less exacting definition of deterrence will then alleviate the need for the more capable weapon systems. In short, we can

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[18] According to a recent article the major revision incorporated into SIOP 6F has been to attempt to hit the Soviet leadership promptly; Desmond Ball and Robert C. Toth, "Revising the SIOP: Taking War-Fighting to Dangerous Extremes," International Security, Spring 1990, pp. 65-92.

[19] David Lynch, "Nitty-Gritty Of Nuclear Targeting Draws Scrutiny," Defense Week, April 16, 1990, p. 1; John Barry, "Attention, SAC: The War's Over," Newsweek, March 12, 1990, pp. 29-30.

get by with less, a lot less. There is ample evidence that deterrence requirements have diminished and future warplans should reflect it.[20]

Conclusions

A close analysis reveals that the once high hopes for a meaningful and effective START treaty have been dashed. Bureaucracies and the military establishments on both sides have, through persistence, rivalry, and self interest, desiccated the treaty. The public has not yet awakened to this fact, and when it does disillusionment and anger may follow. The INF Treaty had the effect, as did SALT I in the era of detente, of tranquillizing the fears of worried and concerned publics. It appeared to most observers after the INF signing that now the problem of the nuclear arms race was being taken care of. The true disappointment of START is that there has never been a more opportune time to address these problems. The treaty that will soon result only formalizes what was scheduled to happen in any event. All new programs are permitted and all the retirements would have occurred anyway. Real disarmament and arms control must involve fundamental change to be effective. It cannot be business as usual. Severe dislocations must jolt the bloated military establishments. The institutional infrastructure of the Cold War and the arms race is still basically intact and will continue to operate merely at a reduced scale under a START regime. The infrastructure must not only be reduced but ways must be found to dismantle it. If that task is to be accomplished a more ambitious set of initiatives and goals must be proposed.

At the very least START II negotiations should get under way immediately upon entry into force of START I. Deep reductions and outright bans of certain weapon types should be among the goals. All weapons should be included with no discounts. START is a relic of the Cold War and the 1980s. What is needed is a treaty for the 1990s that looks toward the twenty-first century reflecting altered world developments. A comprehensive approach that constrains all types of nuclear weapons will be most effective. In January 1986 President Gorbachev proposed a plan to eliminate nuclear weapons in three phases over a 15 year period. It is time that that plan, or one like it, be resuscitated.

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[20] Thomas L. Friedman, "NATO Adopts Plan to Revamp Itself For German Unity," New York Times, 4 May 1990, p. A1; R. Jeffrey Smith, "Powell Days Defense Need Massive Review," Washington Post, 7 May 1990, p. A1.

TABLE 1

U.S. STRATEGIC NUCLEAR FORCES (mid-1990)

Type	Name	Number/ SSBN	Year Deployed	Warheads x Yield (Mt)	Total Warheads	Total Mt
ICBMs						
LGM-30F	Minuteman II	450	1966	1 x 1.2	450	540
LGM-30G	Minuteman III	500			1500	404
	Mk-12	(200)	1970	3 x .170 (MIRV)	(600)	(102)
	Mk-12A	(300)	1979	3 x .335 (MIRV)	(900)	(302)
LGM-118A	MX	50	1986	10 x .300 (MIRV)	500	150
Total		**1000**[1] **(53%)**			**2450 (20%)**	**1094 (38%)**
SLBMs						
UGM-73A	Poseidon	176/11	1971	10 x .050 (MIRV)	1760	88
UGM-96A	Trident I	384/20	1979	8 x .100 (MIRV)	3072	307
UGM-133A	Trident II	24/1	1990	8 x .475 (MIRV)	192	91
Total		**560/32**[2] **(31%)**			**5024 (42%)**	**486 (17%)**
Bombers/weapons						
B-1B		90	1986	ALCM .05 -.150	1600	240
B-52G/H		173	1958/61	SRAM .170	1100	187
FB-111A[3]		48	1969	Bombs .500 (avg.)	1800	900
Total		**311 (16%)**			**4500 (38%)**	**1327** (45%)
Grand Total		**1871**			**11,974**	**2907**

[1] ICBM throwweight is approximately 2.3 million pounds: Minuteman II (1600 lbs), Minuteman III (2400 lbs), MX (7900 lbs).

[2] SLBM throwweight is approximately 1.8 million pounds: Poseidon C-3 (3300 lbs), Trident I C-4 (2900 lbs), Trident II D-5 (5040 lbs).

[3] FB-111As will not be counted as SNDVs. In 1990 and 1991 they will be transferred to the Tactical Air Command.

TABLE 2

SOVIET STRATEGIC NUCLEAR FORCES (mid-1990)

Type	Name	Number(SSBN)	Year Deployed	Warhead x Yield (Mt)	Total Warheads	Total Mt
ICBMs						
SS-11	Sego					
M2		150	1973	1 x 1.1	150	165
M3		210	1973	3 x 350 (MRV)	210*	221
SS-13 M2	Savage	60	1973	1 x .750	60	45
SS-17 M3	Spanker	100	1979	4 x .750 (MIRV)	400	300
SS-18 M4/M5	Satan	296/12	1979	10 x .550/.750 (MIRV)	3080	1637
SS-19 M3	Stiletto	300	1979	6 x .550 (MIRV)	1800	990
SS-24 M1/M2	Scalpel	18/40	1987	10 x .550 (MIRV)	580	319
SS-25	Sickle	170	1985	1 x .550	170	94
Total		**1356[1] (55%)**			**6450 (57%)**	**3770 (61%)**
SLBMs						
SS-N-6 M3	Serb	192 (12)	1973	2 x 1 (MRV)	192*	384
SS-N-8 M1/M2	Sawfly	286 (23)	1973	1 x 1.5	286	429
SS-N-17	Snipe	12 (1)	1980	1 x 1	12	12
SS-N-18 M1-3	Stingray	224 (14)	1978	7 x .500 (MIRV)	1568	784
SS-N-20	Sturgeon	120 (6)	1983	10 x .200 (MIRV)	1200	240
SS-N-23	Skiff	96 (6)	1986	4 x .100 (MIRV)	384	39
Total		**930[2] (38%)**			**3642 (32%)**	**1888 (30%)**
Bombers/weapons						
Tu-95	Bear B/C	20	1962	4 bombs or 1 AS-3	80	100
Tu-95	Bear G	45	1984	4 bombs and 2 AS-4	270	184
Tu-142	Bear H	80	1984	8 AS-15 or bombs	640	160
Tu-160	Blackjack	17	1988	6 AS-15 ALCMs, and 4 AS-16 SRAMs, and 4 bombs	238	119
Total		**162 (7%)**			**1228 (11%)**	**563 (9%)**
Grand total		**2448**			**11,320**	**6220**

*SS-11 Mod 3 and SS-N-6 Mod 3 MRV warheads are counted as one.

[1] ICBM throwweight is approximately 9.9 million pounds: SS-11 (2500 lbs), SS-13 (1100 lbs), SS-17 (6300 lbs), SS-18 (16,700 lbs), SS-19 (8000 lbs), SS-24 (5000 lbs), SS-25 (2600 lbs).

[2] SLBM throwweight is approximately 2.3 million pounds: SS-N-6 (1500 lbs), SS-N-8 (1500 lbs), SS-N-17 (2500 lbs), SS-N-18 (2900 lbs), SS-N-20 (5000 lbs), SS-N-23 (3000 lbs).

TABLE 3
START NEGOTIATING PROPOSALS (April 1990)

	UNITED STATES	SOVIET UNION
General Approach:	Reduction to equal levels in strategic offensive arms, carried out in a phased manner achieving equal intermediate ceilings by agreed dates over seven years from the date the treaty comes into force.	Reduction to equal levels in strategic offensive arms, carried out in two phases over seven years from the date the treaty enters into force, with equal ceilings after phase 1.
	Completion of Start not contingent upon the resolution of Defense and Space issues.	Conclusion of Start agreement not contingent upon reaching a Defense and Space agreement. However, Soviets indicate that they claim a right to withdraw from START if they determine that the U.S. has gone beyond the Anti-Ballistic Missile (ABM) Treaty as they define it.
	No further strategic arms control treaties can be concluded with the Soviet Union until it corrects its violation of the Anti-Ballistic Missile (ABM) Treaty involving Krasnoyarsk radar in a verifiable manner that meets U.S. criteria. The U.S. has expressed satisfaction with the Soviet announcement that it will completely eliminate the Krasnoyarsk radar station.	The Soviets have states that they will completely eliminate the Krasnoyarsk radar station.
Delivery Vehicles:	1,600 ceiling on the number of strategic nuclear delivery vehicles (SNDVs) which comprise deployed (ICBMs) and their associated launchers, deployed submarine-launched ballistic missiles (SLBMs) and their associated launchers, and heavy bombers.	Same at the U.S. position.
Warheads:	6,000 warhead ceiling, to include the accountable number of deployed ICBM and SLBM warheads and long-range, nuclear-armed ALCMs (air-launched cruise missiles) (see ALCMs), and with each heavy bomber equipped only for nuclear-armed gravity bombs and short-range attack missiles (SRAMs) counting as one warhead.	Same at the U.S. position.
Warhead Sublimits:	Sublimits of 4,900 ballistic missile warheads and 3,000-3,300 ICBM warheads.	Sublimit of 4,900 ballistic missile warheads; if 3,300 sublimit on ICBMs, then must also be 3,300 sublimit on SLBMs. Sublimit on 1,100 on deployed heavy bomber-carried warheads.
Heavy ICBMs:	A limit of 1,540 warheads on 154 deployed heavy ballistic missiles. Ban on production, flight testing or modernization of new or existing types of heavy ICBMs.	A limit of 1,540 warheads on 154 deployed heavy ICBMs. Production, flight testing or modernization of existing types of heavy ICBMs permitted. Development, testing and deployment of new types of heavy ICBMs banned.
Throwweight:	The aggregate throwweight of Soviet ICBMs and SLBMs will be reduced to 50 percent below their throwweight level as of December 31, 1986. Neither side will exceed this level for the duration of this treaty.	Same as the U.S. position in principle, but differences remain on how to determine accountable throwweight. Reductions will be from the throwweight level existing at treaty signature.
Ballistic Missile Warheads:	Each ballistic missile warhead counts as one warhead under the 6,000 warhead ceiling. For existing types, a quota of on-site inspections to verify that deployed missiles contain no more than the number of warheads declared and agreed for each type at the Washington Summit.	Same as U.S. position for existing types.

	For future types, as well as changes in the number of warheads on existing types, procedures remain to be agreed.	
Mobile ICBMs:	The U.S. has lifted ban on mobile ICBMs. START negotiators must work out the appropriate details of limits to be applied to mobile ICBMs and effective verification measures.	Permitted, with numerical limits on launchers and warheads.
Non-deployed Missiles:	There will be numerical limits (exact numerical limit still to be agreed) on non-deployed ballistic missiles and the warheads attributable to them for all ICBMs of a type that has been flight-tested from a mobile launcher. Other non-deployed ballistic missiles will not be subject to numerical limits, but there will be restrictions on their location and movement. The sides have also agreed there will be no restrictions on non-deployed cruise missiles and non-deployed heavy bomber weapons.	Same at the U.S. position.
Heavy Bombers:	Each heavy bomber counts as one strategic nuclear delivery vehicle (SNDV). Each heavy bomber equipped only for gravity bombs and short-range attack missiles (SRAMs) would count as one warhead under the 6,000 limit. An agreed number of heavy bombers could be removed from accountability under the 1,600 SNDV limit by conversion to a conventional-only capability.	Same as the U.S. position, except that Soviet agreement on conversion of heavy bombers to a conventional-only capability is contingent on U.S. acceptance of Soviet position on ALCM range.
ALCMs:	ALCMs defined as air-launched, nuclear armed cruise missiles with a range in excess of 1,000 kilometers. An agreed number of ALCMs shall be attributed to each type of heavy bomber equipped for ALCMs (10 for U.S. heavy bombers, 8 for existing Soviet heavy bombers and 10 for future Soviet heavy bombers), for the purpose of counting against the 6,000 warhead limit. U.S. heavy bombers could actually be equipped for up to 20 ALCMs, while existing Soviet heavy bombers could actually be equipped for up to 12 ALCMS, and future Soviet heavy bombers could actually be equipped for up to 20 ALCMs.	Same as the U.S. position, except ALCMs defined as air-launched cruise missiles with a range in excess of 600 kilometers.
SLCMs:	SLCMs defined as sea-launched, nuclear-armed cruise missiles with a range in excess of 3000 kilometers. For the duration of the treaty, the sides will make parallel, politically binding declarations of the maximum number of SLCMs they plan to deploy. The initial declaration of each side will include the maximum number to be deployed for each of the first five years of the treaty; each following year a maximum number will be declared for the next succeeding year beyond the original five-year period. The declared SLCMs will not come under any of the START provisions, e.g., the 6000 warhead and 1,600 strategic nuclear delivery vehicle (SNDV) limits.	Same as the U.S. position, except SLCMs defined as sea-launched, nuclear-armed and conventionally-armed cruise missiles with a range in excess of 600 kilometers.

Verification of Compliance	Provisions, at a minimum, to include: exchange of data both before and after the reductions take place; on-site inspection to verify data and to observe elimination of weapons; continuous onsite monitoring of the perimeter and portals of critical production facilities; and short-notice inspection of sites where treaty-limited systems are located both during and after the reduction period. Inspections requested at sites where a party considers that covert production, storage, repair or deployment may be occurring.	The Soviets have accepted much of the U.S. verification position, although many details remain to be resolved, especially in the area of mobile ICBM verification.
	Right to short-notice inspections at certain types of "suspect sites." Right to request inspection at other "suspect sites." If challenged party refuses inspection, it must make good faith effort to resolve concerns.	
	The U.S. has proposed that the two sides accelerate efforts to agree on, and begin implementing as soon as possible, verification and stability measures to acquire practical experience and speed up resolution of verification issues. Proposed measures include: early establishment of on-site perimeter/portal monitoring of certain missile production facilities, exchange of data on each side's strategic nuclear forces, and addressing the problem of short-time-of-flight SLBMs.	The Soviets have accepted the principle of verification and stability measures, have made some proposals of their own, and have been discussing U.S. proposals in detail in Geneva.
	Agreement reached with the Soviets on: 1) advance notification of one major strategic exercise involving heavy bomber aircraft per calendar year; 2) exhibitions of one type of heavy bomber on each side to demonstrate verification procedures for distinguishing ALCM heavy bombers from non-ALCM heavy bombers; and, 3) demonstration of each side's proposed procedures for on-site inspection of reentry vehicles for each side's ballistic missiles. The sides have also exchanged information on missile tagging technologies. The sides agree on major elements of a regime to ensure the non-denial of telemetry data during test flights of START-accountable ballistic missiles. These provisions will be included in the START treaty, but will be implemented early, at the time of treaty signature, through an exchange of letters.	Agreement reached with U.S. on: 1) advance notification of one major strategic exercise involving heavy bomber aircraft per calendar year; 2) exhibitions of one type of heavy bomber on each side to demonstrate verification procedures for distinguishing ALCM heavy bombers from non-ALCM heavy bombers; and, 3) demonstration of each side's proposed procedures for on-site inspection of reentry vehicles for each side's ballistic missiles. The sides also exchanged information on missile tagging technologies. The sides agree on major elements of a regime to ensure the non-denial of telemetry data during test flights of START-accountable ballistic missiles. These provisions will be included in the START Treaty, but will be implemented early through an exchange of letters.

Source: U.S. ACDA, Issues Brief, Nuclear and Space Talks: U.S. and Soviet Proposals, April 4, 1990.

TABLE 4

NOMINAL U.S. STRATEGIC FORCES AFTER START (1998)

	SNDVs	Nuclear Warheads Accountable	Actual
ICBMs			
MX (silo or rail-garrison-based)	50	500	500
Minuteman III (MIRV x 2)	500	1000	1000
Minuteman II	100	100	100
Small ICBM)[1] (silo and/or mobile)	200	200	200
subtotal	**850 (58%)**	**1800 (30%)**	**1800 (20%)**
SLBMs			
Trident II D5[2]	378	3024	3024
subtotal	**378 (26%)**	**3024 (51%)**	**3024 (34%)**
Ballistic missile warheads	--	4824	4824
Bombers			
B-52H/10 ALCM/ACM	95	950	1900[3]
B-1B/16 bombs or ASMs	97	97	1550
B-2/18 bombs or ASMs	36[4]	36	648
subtotal	**228 (15%)**	**1083 (19%)**	**4098 (46%)**
TOTAL	**1456**	**5907**	**8922**

[1] If the SICBM is never deployed then an additional 200 Minuteman IIs could be retained.

[2] On 21 Trident (Ohio class) submarines with 18 missile tubes each, MIRV x 8. The same number of warheads could reached with 21 submarines, using all 24 tubes, with MIRV x 6. This would raise the launcher number to 504. Sixteen 24 tube SSBNs with MIRV x 8 provides an equivalent number of warheads (3072). The table does not include the exempted 72 launchers or warheads.

[3] The counting rule is 10 though the bomber is capable of carrying 20. Any future ALCM carrying bomber will be counted as 10.

[4] The original program called for 132 operational bombers. Secretary of Defense Cheney announced that the program was reduced to 75 on April 26, 1990. Sixteen aircraft have been authorized through FY 1990. Fiscal constraints may limit the program further. The table assumes one wing of 28-30 B-2s with the rest for training and maintenance.

TABLE 5

NOMINAL SOVIET STRATEGIC FORCES AFTER START (1998)

	SNDVs	Nuclear Warheads Accountable	Actual
ICBMs			
SS-18 Mod 4/5/6 (silo)	154	1540	1540
SS-24 Mod 1/2 (mobile/silo)	75	750	750
SS-19 (silo)	60	360	360
SS-25 (mobile)	400	400	400
subtotal	**689 (59%)**	**3050 (51%)**	**3050 (45%)**
SLBMs			
Typhoon/SS-N-20	108[1]	1080	1080
Delta III or IV/SS-N-23	192[2]	768	768
subtotal	**300 (26%)**	**1848[3] (31%)**	**1848 (27%)**
Ballistic missile warheads	--	4898	4898
Bombers			
Blackjack/10 ALCMs[4]	32	320	640
Bear G/2 ASMs and 4 bombs	45	45	270
Bear H/8 ALCMs[5]	90	720	1080
subtotal	**167 (15%)**	**1085 (16%)**	**1990 (28%)**
TOTAL	**1156**	**5983**	**6888**

[1] On six Typhoon class submarines detubed to 18 missile tubes each with ten warheads per SS-N-20 SLBM.

[2] On 12 Delta III/IV class submarines with 16 missile tubes for SS-N-23 SLBMs. Assumes four warheads on each SS-N-23 SLBM.

[3] Throwweight is 5.6 million pounds, less than 50 percent of 1990 forces. See Table 2.

[4] Assumes modest force of Blackjack bombers with future ALCM capability. It was agreed that all future ALCM-carrying bombers would count as ten warheads with a maximum of 20.

[5] In February 1990 it was agreed that current Soviet ALCM carrying bombers would count as eight with a maximum capability of 12. Future Soviet heavy bombers would count as ten with a maximum of 20.

TABLE 6

CURRENT AND FUTURE WEAPON PROGRAMS

UNITED STATES	SOVIET UNION
Small ICBM (MGM-134A)	SS-24 (mobile/silo)
MX/rail garrison	SS-25 (mobile/silo ?)
Trident II SLBM (21 SSBNs)	SS-18 follow-on ?
Trident SSBN (21-24)	Typhoon SSBN (up to 6)
B-2 Bomber	Delta IV SSBN (up to 12)
Advanced Cruise Missile (AGM-129A)	SS-N-20 SLBM (for 6 SSBNs)
SRAM II (AGM-131A)	SS-N-23 SLBM (12 SSBNs)
Gravity bombs (B83/B61)	Bear H bomber
Warhead/Reentry Vehicle programs	Blackjack A bomber
Zero/near Zero CEP RVs	AS-15 Kent ALCM
MaRV	AS-16 Kickback SRAM
Earth penetrator warhead	Gravity Bombs
Third generation warhead concepts	Warhead/Reentry Vehicle programs
SLCMs	Zero/near zero CEP RVs
	MaRV
	Earth penetrator warhead
	Third generation warhead concepts
	AS-X-19 Koala ALCM
	SLCMs

TABLE 7

U.S. AND SOVIET WEAPON RETIREMENTS UNDER START

	UNITED STATES	SOVIET UNION
ICBMs	350 MM IIs & 350 W56 warheads[1] 200 Minuteman III W62 warheads 300 Minuteman III W78 warheads	360 SS-11 with 780 warheads 60 SS-13 with 60 warheads 100 SS-17 with 400 warheads 154 SS-18 with 1540 warheads 240 SS-19 with 1440 warheads
Total	**350 ICBMs with 850 warheads**	**914 ICBMs with 4220 warheads**
SLBMs/SSBNs	192 Trident I C4[2] & 1536 W76 warheads 176 Poseidon C3 & 1760 W68 warheads 23 SSBNs	192 SS-N-6 with 384 warheads 12 SS-N-17 with 12 warheads 280 SS-N-8 with 280 warheads 224 SS-N-18 with 1568 warheads 42-48 SSBNs[3]
Total	**23 SSBNs** **368 SLBMs** **3296 warheads**	**45-51 SSBNs** **708 SLBMs** **2244 warheads**
Bombers	98 B-52G	20 Bear B/C
Total	**98 bombers**	**20 bombers**

[1] If the SICBM is not deployed then only 150 Minuteman II missiles would be retired.

[2] Another 192 Trident I SLBMs are deployed with the first eight Ohio class SSBNs. Most will be removed during the START implementation period and retired, but not for treaty compliance reasons. The first eight Ohio class SSBNs are scheduled to receive the Trident II SLBM during their first major overhaul. Approximately 1500 W76 warheads (from the Trident I missiles) will be used on the Trident IIs.

[3] Retirements include 12 Yankee I, one Yankee II, one Hotel III, 18 Delta I, 4 Delta II, 6-12 Delta III. If 12 Delta IVs are not built the SS-N-23 SLBM could be backfitted into as many as six Delta IIIs.

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THE NRDC NUCLEAR WEAPONS DATA CENTER

Since 1980 the Natural Resources Defense Council has sponsored the **Nuclear Weapons Data Center.** The purpose of the Center is to compile and disseminate accurate information on the world's nuclear forces in order to promote a more informed debate on nuclear weapons and arms control issues. The Center has published four volumes of its *Databook* series describing the U.S. and Soviet nuclear arsenals, and the U.S. nuclear weapons production complex. Currently in preparation is another volume, on other nuclear weapons powers and proliferation. Since May 1987, the Center staff has contributed a monthly column to *The Bulletin of the Atomic Scientists*, entitled Nuclear Notebook.

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